

# **MGST 451**

## **Corporate Governance and Ethical Decision-Making**

**Lecture 8 – Winter 2019 L01-L03**

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1. Options in general and Exchange-Traded Stock Options
2. Call options
  - Purposes of (naked) call options and Profit and losses of call options
  - Holding period return of call options
  - Examples of a call option and of a call option versus buying the stock
3. Put options
  - Purposes of (naked) put options and Profit and losses of put options
  - Holding period return of put options
  - Examples of a put option and of a put option vs shorting the stock
4. Price of Exchange-Traded Stock Options
5. On-line tutorial for options
6. Further examples

- An option is a contract giving the buyer (holder) the right, but not the obligation, to buy (for a 'call option'; to sell in the case of a 'put option') a given quantity of an underlying asset at a pre-determined 'strike price' **up to or on a specified date**.
- At the inception of the contract, the seller (writer) is compensated by receiving from the buyer the price of the option (the 'premium'), but has to comply with the terms of the option when the buyer 'exercise' the option:
  - For a call option, deliver the underlying asset in the given quantity at the strike price (receives strike price);
  - For a put option, take delivery of the underlying asset in the given quantity at the strike price (pays strike price).
  - It is a **zero-sum game** between the buyer and the writer.

## At-the-money

- Current market price of underlying is **equal** to the strike price.

## Out-of-the-money

- Current market price of underlying is **less** than the strike price for a call (**more** for a put), so there is no profit to exercise.

## In-the-money

- Current market price of underlying is **more** than the strike price for a call (**less** for a put), so it is profitable to exercise.

## Deep-in-the-money (and vice-versa for **Deep-out-of-the-money**)

- Current market price of underlying is **much higher** than the strike price for a call (**much lower** for a put), so it would be very profitable to exercise (making the option very valuable).

## A **naked option** (or a naked position)

- The writer (seller) of the option does not have a position in the underlying asset.

## A **covered option** (or a covered position)

- The writer (seller) of the option has a position in the underlying asset.
- If the position in the underlying asset offsets the option, then the risk-return of that position and the option taken altogether is likely very different from writing a naked option.
- The investment objectives sought through writing a covered option are likely different (and more complicated) than through writing a naked option.

## Exchange-traded options

- Traded on an exchange (i.e. prices and quantities are quoted).
- Can buy or sell any options (new and existing) any trading day.
- Quantities of underlying and strike prices are standardized.
- Expiry dates are as per a schedule (TMX: 3<sup>rd</sup> Friday is the last trading day while the option expire the following Sunday).
- A 'compensation chamber' insures that the buyer is made whole in case of a default by the seller.

## American options

- Options that may be exercised at any time on or before expiry.

## European options

- Options that may be exercised only on the day they expire.

- The quantity of shares (a '**board lot**') that is implied per option is as per below table.

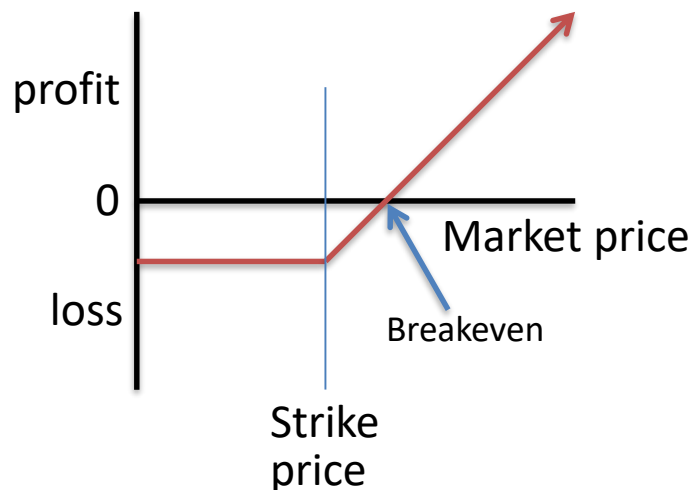
Canadian Markets	
Price of the share	# shares in a board lot
Under \$0.10	1,000
\$0.10 to under a \$1.00	500
\$1.00 and over	100
USA Markets	
All Stocks	100

- A **bullish** investor expects the market to rise, a **bearish** investor expects the market to fall, and a '**crabbish**' investor expects the market to go sideways (i.e. remains the same).
- A bullish investor having bought call options will make a higher return than buying the underlying stock, if the stock price rises enough
  - at the risk of losing the cost of the options if the stock price goes sideways (stays the same or doesn't rise much);
  - but avoiding the risk of losses if the stock price falls.
- A crabbish (or bearish) investor could sell call options and make a return assuming the stock price remains the same (or falls) and the options expire worthless (i.e. out-of-the-money).



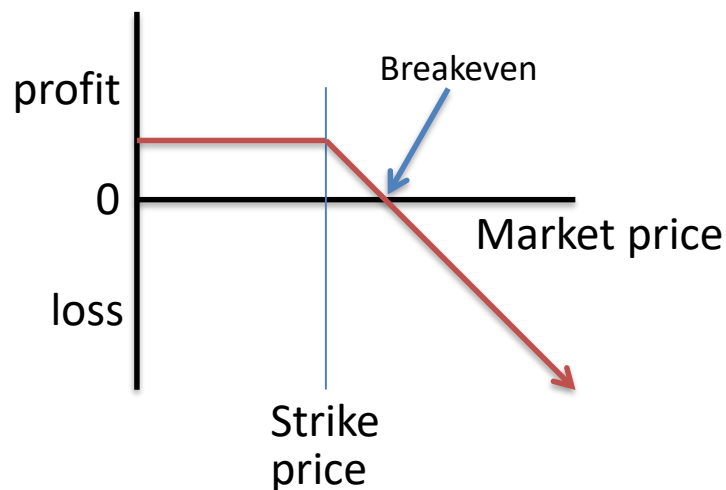
- If, upon expiry, the market price of the underlying is below the strike price, there is no profit for the holder of the call option (i.e. the option is 'out-of-the-money') and the holder loses 100% of its investment (the purchase price of the option).
- If, just before upon expiry, the market price of the underlying is above the strike price, the holder of the call option exercise it (i.e. the option is 'in-the-money') and the net payoff is the quantity multiplied by the difference between the market price of the underlying and the strike, less the purchase price.
- The profit and losses of the writer of a call is the mirror image of the above in the case of a 'naked call' (i.e. the writer does not already own the underlying). In the case of a 'covered call', the writer can forego a gain but not register a loss.

**Call buyer  
(long a call)**



- $\text{Market} < \text{Strike} \rightarrow \text{loss}$
- $\text{Market} < \text{Strike} + \text{cost} \rightarrow \text{loss}$
- $\text{Market} = \text{Strike} + \text{cost} \rightarrow \text{breakeven}$
- $\text{Market} > \text{Strike} + \text{cost} \rightarrow \text{profit}$
- No 'action' on the downside

**Call writer  
(short a call)**



- $\text{Market} < \text{Strike} \rightarrow \text{profit}$
- $\text{Market} < \text{Strike} + \text{cost} \rightarrow \text{profit}$
- $\text{Market} = \text{Strike} + \text{cost} \rightarrow \text{breakeven}$
- $\text{Market} > \text{Strike} + \text{cost} \rightarrow \text{loss}$
- No 'action' on the downside

Holding period return for the holder of the call

- The return is the profit (i.e. positive payoff minus cost) divided the cost of establishing the position (in %, multiply by 100).

- $$\text{Return} = \frac{(\text{market price} - \text{strike price})^+ - \text{cost of option}}{\text{cost of option}} \times 100$$

- $$\text{Return} = \frac{(\$70/\text{share} - \$55/\text{share}) - \$10/\text{share}}{\$10/\text{share}} \times 100 = 50\%$$

Holding period return for the seller of the call

- Since the investment in the position is negative (i.e. price received in consideration of granting an unilateral right to the buyer), there is no concept of 'return'.
- However, the outcome of the transaction could be expressed as a percentage of the premium received initially.

# Example of a call option

	Stock price	Seller (sell a call)		Buyer (buy a call)	
		Cash in account	Position	Cash in account	Position
Start of day #1	\$50	\$5,000	-	\$5,000	-
Writes 1 call option		\$5,000		\$5,000	
Buys 1 call option	\$50	+ \$1,000	-1 option	- \$1,000	+1 option
@ \$10/share; Strike: \$55		= \$6,000	V = -\$1,000	= \$4,000	V = +\$1,000
Start of day #2	\$40	\$6,000		\$4,000	
Market \$40 < Strike \$55			-1 option		+1 option
Option price = \$5/share	\$40	\$6,000	V = -\$500	\$4,000	V = +\$500
Start of day #3	\$70	\$6,000		\$4,000	
Market \$70 > Strike \$55		\$6,000		\$4,000	
Holder exercises option	\$70	- \$1,500	-	+ \$1,500	-
(\$70-\$55)x100=\$1,500		= \$4,500		= \$5,500	
Profit or loss ?		Loss of		Profit of	
\$1,500-\$1,000=\$500		\$500		\$500	
Holding period return		(-50%)		+50%	

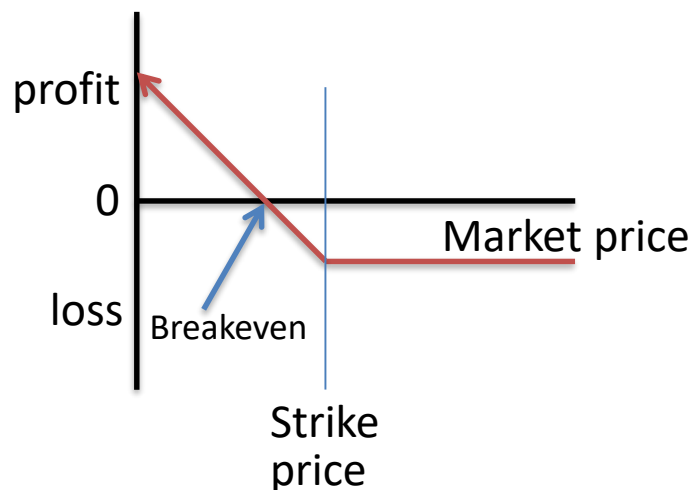
# Example of a call option versus buying the stock

You are bullish!	Stock price	Buy the stock		Buy the call	
		Cash in account	Position	Cash in account	Position
Start of day #1	\$50	\$5,000	-	\$5,000	-
Buy 100 shares @ \$50		\$5,000		\$5,000	
Buy 1 call option @ \$10/share; Strike: \$55	\$50	- \$5,000 = \$ 0	100 shares V = +\$5,000	- \$1,000 = \$4,000	+1 option V = +\$1,000
Start of day #2	\$40	\$ 0		\$4,000	
Market \$40 < Strike \$55 Option price = \$5/share	\$40	\$ 0	100 shares V = +\$4,000	\$4,000	+1 option V = +\$500
Start of day #3	\$70	\$ 0		\$4,000	
Investor sells 100 shares \$70 x 100 sh. = \$7,000 Holder exercises option	\$70	\$ 0 + \$7,000 = \$7,000	-	\$4,000 + \$1,500 = \$5,500	-
Profit or loss ? \$7,000-\$5,000=\$2,000		Profit of \$2,000		Profit of \$500	
Holding period return		+40%		+50%	

- If, upon expiry, the market price of the underlying is above the strike price, there is no profit for the holder of the put option (i.e. the option is 'out-of-the-money') and the holder loses 100% of its investment (the purchase price of the option).
- If, just before upon expiry, the market price of the underlying is below the strike price, the holder of the put option exercise it (i.e. the option is 'in-the-money') and the net payoff is the quantity multiplied by the difference between the market price of the underlying and the strike, less the purchase price.
- The profit and losses of the writer of a put is the mirror image of the above in the case of a 'naked put' (i.e. the writer is not already short the underlying). In the case of a 'covered put', the writer can forego a gain but not register a loss.

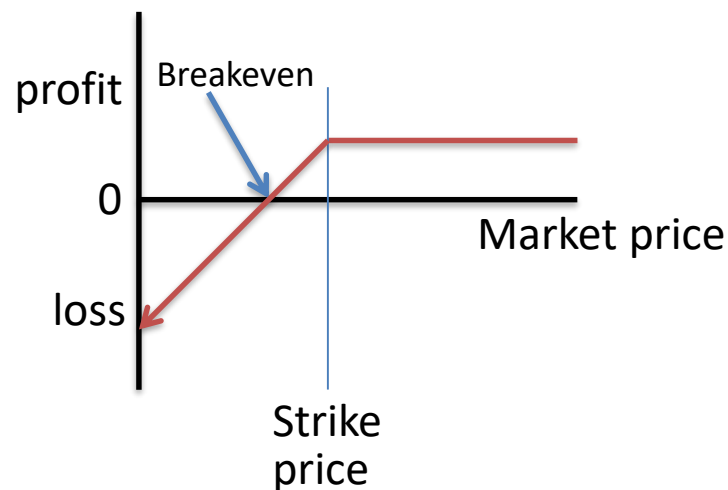
- A **bearish** investor having bought put options will make a higher return than selling short the underlying stock, if the stock price falls enough
  - at the risk of losing the cost of the options if the stock price goes sideways (stays the same or doesn't rise much);
  - but avoiding the risk of losses if the stock price rises.
- A crabbish (or bullish) investor could sell put options and make a return assuming the stock price remains the same (or increases) and the options expire worthless (i.e. out-of-the-money).

**Put buyer  
(long a put)**



- $\text{Market} > \text{Strike} \rightarrow \text{loss}$
- $\text{Market} > \text{Strike} - \text{cost} \rightarrow \text{loss}$
- $\text{Market} = \text{Strike} - \text{cost} \rightarrow \text{breakeven}$
- $\text{Market} < \text{Strike} - \text{cost} \rightarrow \text{profit}$
- No 'action' on the upside

**Put writer  
(short a put)**



- $\text{Market} > \text{Strike} \rightarrow \text{profit}$
- $\text{Market} > \text{Strike} - \text{cost} \rightarrow \text{profit}$
- $\text{Market} = \text{Strike} - \text{cost} \rightarrow \text{breakeven}$
- $\text{Market} < \text{Strike} - \text{cost} \rightarrow \text{loss}$
- No 'action' on the upside



# Holding period return of put options

Holding period return for the holder of the put

- The return is the profit (i.e. positive payoff minus cost) divided the cost of establishing the position (in %, multiply by 100).

- $$\text{Return} = \frac{(\text{strike price} - \text{market price})^+ - \text{cost of option}}{\text{cost of option}} \times 100$$

- $$\text{Return} = \frac{(\$75/\text{share} - \$60/\text{share}) - \$10/\text{share}}{\$10/\text{share}} \times 100 = 50\%$$

Holding period return for the seller of the put

- Since the investment in the position is negative (i.e. price received in consideration of granting an unilateral right to the buyer), there is no concept of 'return'.
- However, the outcome of the transaction could be expressed as a percentage of the premium received initially.

# Example of a put option

	Stock price	Seller (sell a put)		Buyer (buy a put)	
		Cash in account	Position	Cash in account	Position
Start of day #1	\$50	\$2,500	-	\$2,500	-
Writes 1 put option		\$2,500		\$2,500	
Buys 1 put option	\$50	+ \$1,000	-1 option	- \$1,000	+1 option
@ \$10/share; Strike: \$45		= \$3,500	V = -\$1,000	= \$1,500	V = +\$1,000
Start of day #2	\$40	\$3,500		\$1,500	
Market \$40 < Strike \$45	\$40	\$3,500	-1 option	\$1,500	+1 option
Option price = \$15/share			V = -\$1,500		V = +\$1,500
Start of day #3	\$70	\$3,500		\$1,500	
Market \$70 > Strike \$45	\$70	\$3,500	-	\$1,500	-
Option expires worthless					
Profit or loss ?		Profit of		Loss of	
\$0-\$1,000=-\$1,000		\$1,000		\$1,000	
Holding period return		(+100%)		-100%	

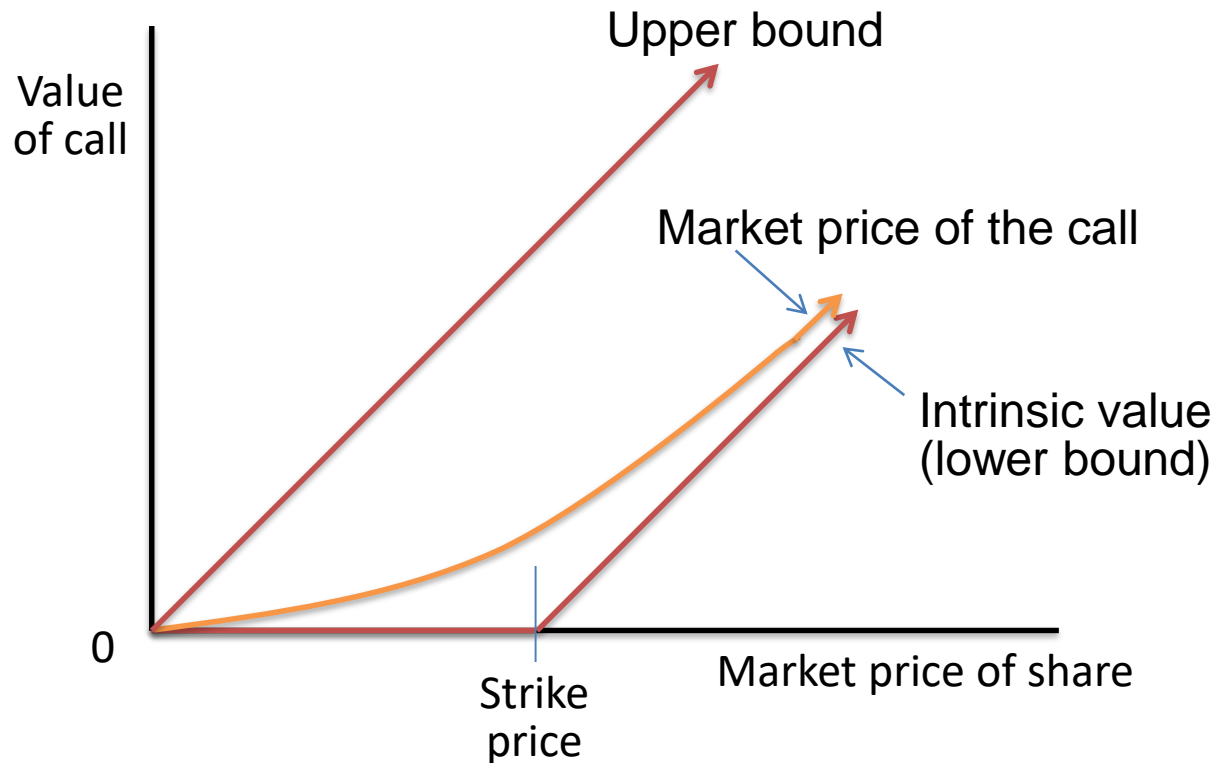
# Example of a put option vs shorting the stock

You are bearish!	Stock price	Short the stock		Buy a put	
		Cash in account	Position	Cash in account	Position
Start of day #1	\$50	\$2,500	-	\$2,500	-
Short 100 shares @ \$50 Buys 1 put option @ \$10/share; Strike: \$45	\$50	\$2,500 + \$5,000 = \$7,500	-100 shares V = -\$5,000	\$2,500 - \$1,000 = \$1,500	+1 option V = +\$1,000
Start of day #2	\$40	\$7,500		\$1,500	
Market \$40 < Strike \$45 Option price = \$15/share	\$40	\$7,500	-100 shares V = -\$4,000	\$1,500	+1 option V = +\$1,500
Start of day #3	\$70	\$7,500		\$1,500	
Buy 100 shares @ \$70 Option expires worthless	\$70	\$ 500	-	\$1,500	-
Profit or loss ? \$5,000-\$7,000=-\$2,000		Loss of \$2,000		Loss of \$1,000	
Holding period return		(-40%)		-100%	

Factors influencing the price (or 'premium') of stock options

- the current market price of the underlying common share;
- the strike (exercise price), in relation to the current market price of the underlying common share;
- the length of time until the option expires (the 'time to expiration') and restrictions, if any, on exercising;
- the expected future volatility of the underlying share's price;
- the cost of holding a position in the underlying stock
  - market interest rates;
  - the expected dividends on the underlying common share.
- **Intrinsic value:** value if exercised immediately (i.e. payoff).
- **Time value:** market value of option minus its intrinsic value.

# Price of American Stock Options



- The value of a call cannot be higher than the price of the stock.
- The value of an American call cannot be lower than its intrinsic value.
- The time value is the price of the call minus its intrinsic value
- See <http://www.investopedia.com/terms/o/option-premium.asp>

## On-line videos explaining options

- Kahn Academy has a series of well-made short videos.
- Each video is typically between 3 and 4 minutes.
- Go to [www.khanacademy.org/economics-finance-domain/core-finance/derivative-securities](http://www.khanacademy.org/economics-finance-domain/core-finance/derivative-securities)
- I suggest that you watch videos 1-2-3-6-7-11-12 carefully.

Video	Lecture	Video	Lecture
1. American call options	8	8. Put as insurance	11
2. Basic shorting	7	9. Put-call parity	11
3. American put options	8	10. Long straddle	11
4. Call options as leverage	9	11. Put writer payoff diagram	8
5. Put vs. short and leverage	9	12. Call writer payoff diagram	8
6. Call payoff diagram	8	16. Put-call parity clarification	11
7. Put payoff diagram	8	18. Option expiration & price	9

You **buy** a call option on 100 shares for \$3 per share with a strike price of \$40. The option will expire in exactly three months' time.

- **Breakeven:** Market price = strike price + cost of option = \$40 + \$3 = \$43
- If the stock trades at \$55 at maturity, what is your payoff, your profit, and your holding period return? (in-the-money at maturity)

$$\text{Payoff} = (\text{market price} - \text{strike price})^+ \times 100 = (\$55 - \$40)^+ \times 100 = \$1,500$$

$$\begin{aligned} \text{Profit} &= (\text{market price} - \text{strike price})^+ \times 100 - \text{cost of option} \\ &= (\$55 - \$40)^+ \times 100 - \$3 \times 100 = \$1,500 - \$300 = \$1,200 \end{aligned}$$

$$\text{Return} = \frac{(\text{market price} - \text{strike price})^+ - \text{cost of option}}{\text{cost of option}} = \frac{(\$55 - \$40)^+ - \$3}{\$3} = 4 \text{ (or 400\%)}$$

- If the stock trades at \$35 at maturity, what is your payoff, your profit, and your holding period return? (out-of-the-money at maturity)

$$\text{Payoff} = (\text{market price} - \text{strike price})^+ \times 100 = (\$35 - \$40)^+ \times 100 = \$0$$

$$\begin{aligned} \text{Profit} &= (\text{market price} - \text{strike price})^+ \times 100 - \text{cost of option} \\ &= (\$35 - \$40)^+ \times 100 - \$3 \times 100 = \$0 - \$300 = -\$300 \end{aligned}$$

$$\text{Return} = \frac{(\text{market price} - \text{strike price})^+ - \text{cost of option}}{\text{cost of option}} = \frac{(\$35 - \$40)^+ - \$3}{\$3} = -1 \text{ (or -100\%)}$$

You **sell** a call option on 100 shares for \$3 per share with a strike price of \$40. The option will expire in exactly three months' time.

- If the stock trades at \$55 at maturity, what is your payoff, your profit, and your "holding period return"?

$$\text{Payoff} = -(\text{market price} - \text{strike price})^+ \times 100 = -(\$55 - \$40)^+ \times 100 = -\$1,500$$

$$\begin{aligned} \text{Profit} &= \text{price of option} - (\text{market price} - \text{strike price})^+ \times 100 \\ &= \$3 \times 100 - (\$55 - \$40)^+ \times 100 = \$300 - \$1,500 = -\$1,200 \end{aligned}$$

$$\text{"Return"} = \frac{\text{price of option} - (\text{market price} - \text{strike price})^+}{\text{price of option}} = \frac{\$3 - (\$55 - \$40)^+}{\$3} = -4 \text{ (or -400\%)}$$

- If the stock trades at \$35 at maturity, what is your payoff, your profit, and your "holding period return"?

$$\text{Payoff} = -(\text{market price} - \text{strike price})^+ \times 100 = -(\$35 - \$40)^+ \times 100 = \$0$$

$$\begin{aligned} \text{Profit} &= \text{price of option} - (\text{market price} - \text{strike price})^+ \times 100 \\ &= \$3 \times 100 - (\$35 - \$40)^+ \times 100 = \$300 - \$0 = \$300 \end{aligned}$$

$$\text{"Return"} = \frac{\text{price of option} - (\text{market price} - \text{strike price})^+}{\text{price of option}} = \frac{\$3 - (\$35 - \$40)^+}{\$3} = 1 \text{ (or 100\%)}$$



You **buy** a put option on 100 shares for \$3 per share with a strike price of \$40. The option will expire in exactly three months' time.

- **Breakeven:** Market price = strike price – cost of option = \$40 – \$3 = \$37
- If the stock trades at \$55 at maturity, what is your payoff, your profit, and your holding period return? (out-of-the-money at maturity)

$$\text{Payoff} = (\text{strike price} - \text{market price})^+ \times 100 = (\$40 - \$55)^+ \times 100 = \$0$$

$$\begin{aligned} \text{Profit} &= (\text{strike price} - \text{market price})^+ \times 100 - \text{cost of option} \\ &= (\$40 - \$55)^+ \times 100 - \$3 \times 100 = 0 - \$300 = -\$300 \end{aligned}$$

$$\text{Return} = \frac{(\text{strike price} - \text{market price})^+ - \text{cost of option}}{\text{cost of option}} = \frac{(\$40 - \$55)^+ - \$3}{\$3} = -1 \text{ (or -100\%)}$$

- If the stock trades at \$35 at maturity, what is your payoff, your profit, and your holding period return? (in-the-money at maturity)

$$\text{Payoff} = (\text{strike price} - \text{market price})^+ \times 100 = (\$40 - \$35)^+ \times 100 = \$500$$

$$\begin{aligned} \text{Profit} &= (\text{strike price} - \text{market price})^+ \times 100 - \text{cost of option} \\ &= (\$40 - \$35)^+ \times 100 - \$3 \times 100 = \$500 - \$300 = \$200 \end{aligned}$$

$$\text{Return} = \frac{(\text{strike price} - \text{market price})^+ - \text{cost of option}}{\text{cost of option}} = \frac{(\$40 - \$35)^+ - \$3}{\$3} = 0.67 \text{ (or 67\%)}$$

You **sell** a put option on 100 shares for \$3 per share with a strike price of \$40. The option will expire in exactly three months' time.

- If the stock trades at \$55 at maturity, what is your payoff, your profit, and your "holding period return"?

$$\text{Payoff} = -(\text{strike price} - \text{market price})^+ \times 100 = -(\$40 - \$55)^+ \times 100 = \$0$$

$$\text{Profit} = \text{price of option} - (\text{strike price} - \text{market price})^+ \times 100$$

$$= \$3 \times 100 - (\$40 - \$55)^+ \times 100 = \$300 - \$0 = \$0$$

$$\text{"Return"} = \frac{\text{price of option} - (\text{strike price} - \text{market price})^+}{\text{price of option}} = \frac{\$3 - (\$40 - \$55)^+}{\$3} = 1 \text{ (or 100\%)}$$

- If the stock trades at \$35 at maturity, what is your payoff, your profit, and your "holding period return"?

$$\text{Payoff} = -(\text{strike price} - \text{market price})^+ \times 100 = -(\$40 - \$35)^+ \times 100 = -\$500$$

$$\text{Profit} = \text{price of option} - (\text{strike price} - \text{market price})^+ \times 100$$

$$= \$3 \times 100 - (\$40 - \$35)^+ \times 100 = \$300 - \$500 = -\$200$$

$$\text{"Return"} = \frac{\text{price of option} - (\text{strike price} - \text{market price})^+}{\text{price of option}} = \frac{\$3 - (\$40 - \$35)^+}{\$3} = -0.67 \text{ (or -67\%)}$$

A call option on 100 shares is priced at \$3 per share with a strike price of \$40 while the current stock price is worth \$41. The option will expire in exactly three months' time.

What is the intrinsic value and the time value of the option

- Intrinsic value =  $(\text{market price} - \text{strike price})^+ = \$41 - \$40 = \$1$
- Time value = price of call – intrinsic value =  $\$3 - \$1 = \$2$

See [https://en.wikipedia.org/wiki/Option\\_time\\_value](https://en.wikipedia.org/wiki/Option_time_value)