JAN 19 2021 MATH 134B

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1. Terminologies

Options: Options are financial instruments that are derivatives based on the value of underlying securities such as stocks. An options contract offers the buyer the opportunity to buy or sell—depending on the type of contract they hold—the underlying asset. Unlike futures, the option buyer is not required to buy or sell the asset if they choose not to.

- Call options: Call options allow the holder to buy the asset at a stated price within a specific timeframe.
- Put options: Put options allow the holder to sell the asset at a stated price within a specific timeframe.

Premium: Premium can mean a number of things in finance, here, premium is the cost to buy an option.

Expiration: An expiration date in derivatives is the last day that derivative contracts, such as options or futures, are valid. Before an option expires, the option buyer can choose to exercise the option, close the position to realize their profit or loss. If an option expires, depending on your broker, for some brokers if it expires in the money by at least $0.01, it will be automatically exercised.

Strike price: A strike price is the set price at which a derivative contract can be bought or sold when it is exercised. For call options, the strike price is where the security can be bought by the option holder; for put options, the strike price is the price at which the security can be sold.

Remark (A few things to keep in mind regarding expiring options)**.**

If you are long expiring option(s)... *Any long option that expires in the money by at least $0.01 will be automatically exercised. Any long option that does not expire in the money by at least $0.01 will not be automatically exercised.*

If you are short expiring option(s)... *It is up to the long side to decide whether or not an option is exercised. This means:*

-If a short option expires at the money or out of the money, it is likely that it will not be assigned, but it is possible that it will be assigned.

-If a short option expires in the money, it is likely that it will be assigned, but it is possible that it will not be assigned.

Exercise and/or Assignment May Result in Stock/ETF Positions *If you do not have sufficient buying power to hold the stock position(s) that would result from exercise and/or assignment, the broker may close your position(s) or take other measures to reduce or eliminate potential stock exposure.*

2. Examples and Questions

Example (Examples of options)**.** *Take Apple's options for example, we have*

Figure 1. Expiration dates

Figure 2. Jan 22's strike prices

Figure 3. Mar 19's strike prices

Figure 4. Sell put option

Figure 5. Buy put option

Figure 6. Buy call option

Question. *If an option seller's profit is limited and the loss might be infinity, who would want to be a seller?*

Answer:
-Control of Delta: Delta is the ratio that compares the change in the price of an asset to the corresponding change in the price of its derivative. Although they are not the same, but another useful way to think about delta: the probability an option will end up in-the-money at expiration.
-PoP (Probability of Profit): Based on some studies [2], some option strategies were profitable most of the time (PoP) when held to expiration.
-Theta decay: Theta is the amount the price of calls and puts will decrease (at least in theory) for a one-day change in the time to expiration. You can imagine that if the stock price remains unchanged, as the day becomes closer and closer to the expiration date, the contract becomes more and more worthless.
-IV (Implied Volatility): Implied volatility represents the expected volatility of a stock over the life of the option. As expectations change, option premiums react appropriately. Implied volatility is directly influenced by the supply and demand of the underlying options and by the market's expectation of the share price's direction.
-Time to be correct: Normally, options will not be exercised before expiration. So if the stock price goes in the money and you have a loss on your position, it is possible that you can still be profitable before expiration. □

Example (An example of how option-sellers earn money)**.**
Invitae Down After Preliminary Results, 2021 Forecast

Time	Symbol	Type	Description	Commi...	Fees	Amount
Jan 14, 2021 12:22a	NVTA..PUT	Trade	BOUGHT 1 Feb 19, 2021 40 Put @ 1.05	0.00	-0.14	-105.00
Jan 11, 2021 11:39p	NVTA..PUT	Trade	SOLD 1 Feb 19, 2021 40 Put @ 2.28	-1.00	-0.152	228.00

Regardless of commissions and fees, the maximum profit for this option-seller will be the premium \$228. *This seller closes the short put option by buying a put option back with the premium* \$105. *So the profit (regardless of commissions and fees) will be* \$228 − \$105 = \$123, *which is roughly* 54% *of the maximum profit within 3 days.*

Notice that the expiration date is February 19, which is roughly 40 days from the date the position is opened. So it is a clever move for this option-seller to close the position and take the profit. After all, for option-sellers, managing winners is important!

Question (2.5)**.**

a. *Suppose you enter into a short 6-month forward position at a forward price of* $50*. What is the payoff in 6 months for prices of* $40*,* $45*,* $50*,* $55*, and* $60*?*

b. *Suppose you buy a 6-month put option with a strike price of* $50*. What is the payoff in 6 months at the same prices for the underlying asset?*

c. *Comparing the payoffs of parts (a) and (b), which contract should be more expensive (i.e., the long put or short forward)? Why?*

Solution.

a. The payoff for different prices will be the following table

Short 6-month forward position payoffs					
Price	$40	$45	$50	$55	$60
Payoff	$10	$5	$0	−$5	−$10

b. The payoff for different prices will be the following table

Buy 6-month put option payoffs					
Price	$40	$45	$50	$55	$60
Payoff	$10	$5	$0	$0	$0

c. Since the payoff of buying a put option is always greater than or equal to zero, so you limit your risk. The put option contract should be more expensive and that is the price you pay.

□

References

[1] Investopedia, *Options*.
https://www.investopedia.com/terms/o/option.asp

[2] R. Richards, *Trade Options with an Edge*.

[3] Futubull, *Invitae Down After Preliminary Results, 2021 Forecast*.
https://news.futunn.com/en/post/8465722?src=3&report_type=stock&report_id=16252814&seo_redirect=1

[4] Tastytrade, *Managing Winners*.
https://www.tastytrade.com/definitions/managing-winners