**Option Markets**

* Basics
	+ Derivative: financial contract whose value “derives” from a traditional security (stock or bond), an asset (commodity), or a market index
	+ Financial option: contract that gives its owner the right but not the obligation, to purchase or sell an asset at a fixed price at some future date
		- Call option: the right to buy
		- Put option: the right to sell
	+ The option premium is the purchase price of the option
* Option contract
	+ Exercising an option: when the holder of an option enforces the agreement and buys or sells a share of stock at the agreed-upon price
	+ Strike price: price at which they buy or sell
		- Also called exercise price
	+ Expiration date: the last date on which an option holder has the right to exercise
* Option types
	+ American option
		- Can be exercised on or before its expiration
		- Options on individual stocks are typically American
	+ European option
		- Can be exercised only at its expiration
		- Options on indices (e.g. S&P 500) are typically European
* Option contract terms
	+ Option buyer (holder)
		- Holds the right to exercise the option
		- Has a long position in the contract
	+ Option seller (writer)
		- Sells the option
		- Has a short position in the contract
		- Because the long side has the option to exercise, the short side has an obligation to fulfill the contract if exercised
* Option trading
	+ Most options are on organized exchanges
	+ Each contract provides for the right to buy or sell 100 shares of stock
	+ Open interest
		- Total number of contracts of a particular option that have been written
* Trading options—what actually happens
	+ Individual stock options
		- Typically physically settled
		- You actually use your right to buy or sell and trade the underlying security
		- In order to receive the value, you would then need to make a second trade
	+ Index options
		- Typically cash settled
		- Rather than actually exercising the right to buy or sell the underlying (which is an entire index), you simply receive the value of the option in cash
* Option expiration
	+ Traditionally, all traded options expire on the Saturday following the third Friday of the month
		- As of 2/1/2015, all option products on the CBOE expire on Friday
	+ More than that has changed
		- Other short-term expirations (“weeklys”) may be available
		- These offerings will differ based on the underlying asset
	+ Expirations still tend to be fairly short, typically only a few months
* Option expirations—general guidelines
	+ Individual stock options
		- ≤ 2 months: every Friday
		- ≥ 2 months: every third Friday
	+ Index options
		- ≤ 1 month: every Monday, Wednesday, and Friday at the end of the month
		- 2-3 months: every Friday and the end of the month
		- 4 months-1 year: third Friday and the end of the month
		- > 1 year: third Friday
	+ Note: the calendar dates are just for reference. The exchange generally allows for a min and max number of maturities for each type of option to be traded at a time, which generally fills these time windows
* “Moneyness”
	+ Near the money
		- Option whose exercise price is close to the current stock price
	+ At the money
		- Option whose exercise price equals the current stock price (S=X)
	+ In the money
		- Option whose value would be positive if exercised immediately
			* Call: S>X
			* Put: S<X
	+ Out of the money
		- Option whose value would be negative if exercised immediately
			* Call: S<X
			* Put: S>X
* Why options?
	+ To hedge
		- Reduce risk by holding options whose payoffs are negatively correlated with some risk exposure
		- Ex. A famer might use options to guarantee a minimum price for their crops in a season
		- Ex. A multinational firm might use currency options to avoid adverse exchange rate movements
	+ To speculate
		- Using options to place a bet on the direction the market is likely to move
		- Ex. George Soros “broke the Bank of England” by betting against the pound
		- Note: not necessarily bad🡪how would the hedgers be able to shed risk if no one was willing to take it?
* Option payoffs: long call (we bought)
	+ Use option to buy (-X)
	+ Sell at market price (S)
	+ The value of a call at expiration is:
		- C = max (S-X, $0)
	+ Where:
		- S = stock price at expiration
		- X = exercise price
		- C = value of the call option
* Example: Long Call
	+ You own a call option on Cisco with a strike price of $40. The option will expire in exactly 3 months’ time
		- If the stock is trading at $55 in 3 months, what will be the payoff of the call?
		- If the stock is trading at $35 in 3 months, what will be the payoff of the call?
* Option payoffs: long put (we bought)
	+ Buy at market price (-S)
	+ Use option to sell (X)
	+ The value of a put at expiration is:
		- P = max(X-S, $0)
	+ Where:
		- S = stock price at expiration
		- X = exercise price
		- P = value of put option
* Example: Long put
	+ You own a put option on Ford with a strike price of $10. This option will expire in exactly 6 months’ time
		- If the stock is trading at $8 in 6 months, what will be the payoff of the put?
		- If the stock is trading at $23 in 6 months, what will be the payoff of the put?
* Option payoffs: short call
	+ The value of a short call option at expiration is:
		- C = -max(S-X, $0)
* Example: short call
	+ You wrote a call option on Time Warner with a strike price of $80. The option will expire in exactly one year
		- If the stock is trading at $72 in one year, what will be your payoff from the call?
		- If the stock is trading at $86 in one year, what will be your payoff from the call?
* Option payoffs: short put
	+ The value of a short put option at expiration is:
		- P = -max(X-S, $0)
* Example: short put
	+ You wrote a put option on Spotify with a strike price of $110. The option will expire in exactly 3 months’ time
		- If the stock is trading at $105 in 3 months, what will be your payoff from the put?
		- If the stock is trading at $115 in 3 months, what will be your payoff from the put?
* Option strategies
	+ By combining the puts and calls with various exercise prices, we create an unlimited variety of payoff patterns
	+ Useful for both speculation and hedging
	+ Portfolios of puts and calls
		- By the law of one price, if the cash flows are the same, the prices must be the same
* Straddle
	+ A portfolio that is long a call and a put on the same stock with the same exercise date and strike price
	+ Example: suppose you set up a straddle at $100 on Walmart. What would your payoff be from this position if the underlying stock is trading at $110 at expiration?
* Straddle Illustrated
	+ A straddle will pay off any time the price does not remain constant at the strike price
	+ But, only one option will pay off at a time
		- We still had to pay for both
		- Might require a significant deviation to be profitable
* Strangle
	+ A portfolio that is long a call and a put on the same stock with the same exercise date, but the strike price on the call is higher than the strike price on the put
	+ Example: you are long a call option and a put option on Cisco stock with the same expiration date. The exercise price of the call is $42 and the exercise price of the put is $38
* Straddle vs. Strangle
	+ Strangles have lower payoffs than straddles
		- However, the options that we purchase to create them are less in the money than their straddle counterparts
		- Strangles are cheaper to enter into
* Butterfly Spread
	+ A portfolio that is:
		- Long 1 call option with strike X1
		- Long 1 call option with strike X3
		- Short 2 call options with strike
			* X2 = ½(X1 + X3)
* Example: Butterfly Spread
	+ You enter into a butterfly spread by buying one call with exercise price $100, selling two calls with exercise price $110, and buying one call with exercise price $120. What is the payoff of this position if the underlying stock is trading at $115 at expiration?
* Option Strategies: Endless Combos
	+ Commonly mentioned strategies:
		- Covered call, strips, straps, spreads, collars
* Option strategies: Portfolio insurance
	+ Protective put
		- A long position in a put held on a stock you already own
		- Guarantees a minimum protection equal to the put’s exercise price
	+ Portfolio insurance
		- A protective put written on a portfolio rather than a single stock
		- When the put does not trade itself, it is synthetically created by constructing a replicating portfolio
		- Can also be achieved by purchasing a bond and a call option
	+ To see the payoff to these two strategies, we first need the payoff to a stock a the payoff to a risk free bond
	+ The payoff to the 2 strategies are identical
* Put-Call Parity
	+ Because both versions of portfolio insurance provide exactly the same payoff, by the law of one price, they must have the same price
	+ Relationship is known as put-call parity:
		- S + P = PV(X) + C
	+ Requires us to make 2 assumptions:
		- The options are European
		- The stocks don’t pay dividends
	+ We make these assumptions for simplicity. For example, dividend paying stocks could be reconciled:
		- S – PV(Dividend) + P = PV(X) + C
* Put-Call Parity—input note
	+ In order to be able to use the relationship, 3 things need to be true:
		- The put and call need to be on the same underlying security
		- The put and call need to have the same expiration date
		- The put and call need to have the same exercise price
* Put-Call Parity—computational note
	+ In many cases, we can get away with simple conversions
		- Ex. We could divide the annual rate by 2 to get the 6 month rate
	+ However, we need a more precise calculation:
		- Need to take compounding into account
		- We take the maturity of the option and assume that is the compounding frequency as well
			* $PV\left(X\right)=\frac{X}{(1+rf)^{\frac{option maturity}{1 year}}}$
* Example: Put-Call Parity
	+ In October 2016, a four month call option on Amazon, with an exercise price of $850 sold for $42.50. The stock price at the time was $840. Assume that the risk free rate was 3% (EAR). How much would you be willing to pay for a put on Amazon with the same maturity and exercise price?
* Option-Like Securities
	+ Many securities behave like options:
		- Callable bonds
		- Convertible bonds
		- Warrants
		- Collateralized loans
		- Levered equity and risky debt
	+ These concepts can be applied to corporate investment decisions