Options: Introduction & Applications

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Agenda

- Calls & Puts
  - House insurance example
- Greeks
  - Delta, Gamma, Theta, Vega
- Application: personal trading
- Application: professional trading
- Application: VIX

Calls & Puts - House Insurance Example

- House worth $U
- 2 states of world
  - Everything's fine ($U value)
  - House burns down ($0 value)
- Risk-averse → want to buy fire insurance
  - In bad state of world, insurance company will give you $X
- Suppose we pay fire insurance premium up front

- What factors influence the cost of this fire insurance?

Calls & Puts - House Insurance Example, cont.

- Current price of house (U)
- Insurance payout (X)
- Time period insurance covers
- Likelihood of bad state of world

Calls & Puts - House Insurance Example, cont.

- Current price of house (U)
- Insurance payout (X)
- Time period insurance covers
- Likelihood of bad state of world

- Put: right (but not obligation) to sell an asset at a certain price within a certain time period
- How do the 4 inputs above apply to a Put?

Calls & Puts - House Insurance Example, cont.

- Current price of house (U) <> Underlying Price
- Insurance payout (X) <> Strike Price
- Time period insurance covers <> Time to Expiry
- Likelihood of bad state of world <> Volatility

- Stuff that doesn’t matter as much:
  - Risk-free rate
  - Dividend Yield

Calls & Puts - House Insurance Example, cont.

What happens to the insurance premium if...

- Current price of house (U) increases?
- Time period insurance covers increases?
- Likelihood of bad state of world increases?

Calls & Puts - House Insurance Example, cont.

What happens to the insurance premium if...

- Current price of house (U) increases? → decrease
- Time period insurance covers increases? → increase
- Likelihood of bad state of world increases? → increase

Options Greeks

- How much do they increase/decrease?
- These relationships are denoted by the Greeks

Greeks: Delta

- As the price of the house increases, the insurance premium decreases
  - Similarly, as U increases, P decreases
- How much does P decrease?

Greeks: Delta

- As the price of the house increases, the insurance premium decreases
  - Similarly, as U increases, P decreases
- How much does P decrease? → defined marginally by $\delta P/\delta U$ (Delta)
- ATM: 50Δ
  - ATM, OTM, ITM
- Roughly approximates moneyness

Greeks: Delta

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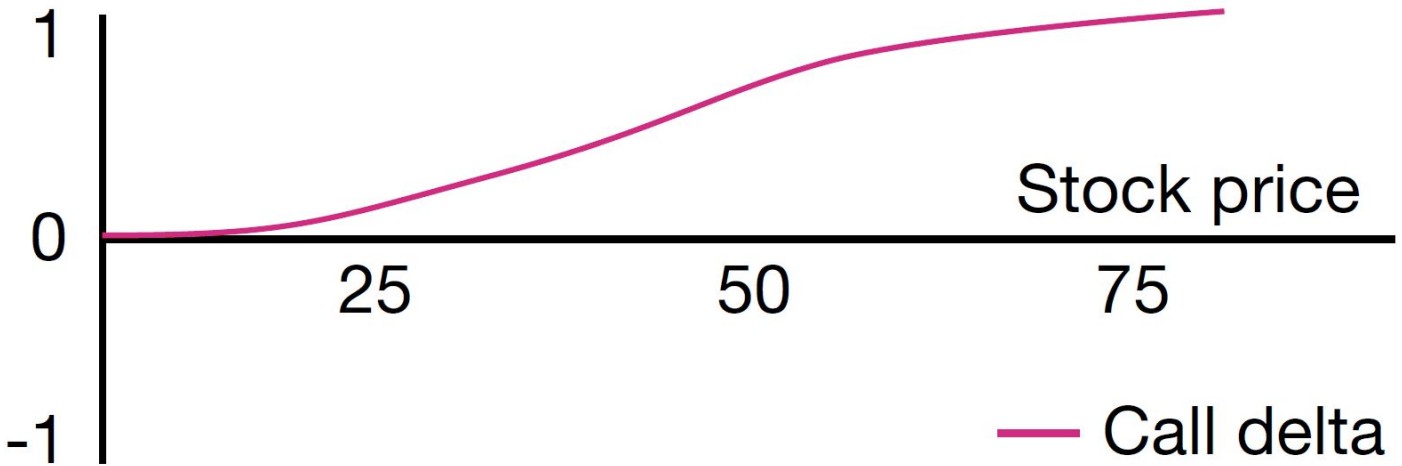
  - Similarly, as U increases, P decreases
- How much does P decrease? → defined marginally by δP/δU (Delta)

Figure 1: Call delta vs underlying



Source: http://www.optiontradingtips.com/greeks/delta.html

Greeks: Gamma

- But Δ only describes δP/δU at the margin -- how does Δ itself change?
- Gamma: δΔ/δU = δ^2P/δU^2
- Normal curve
  - Note: B/S assumes stock returns normally distributed

Greeks: Theta

- Time period insurance covers increases → premium increases
- As time passes (time period decreases) → premium decreases
- But how much does it decrease?

Greeks: Theta

- Time period insurance covers increases → premium increases
- As time passes (time period decreases) → premium decreases
- But how much does it decrease?
- Defined by theta: $\delta P/\delta t$
- Also a normal curve

Greeks: Vega

- Likelihood of bad state of world increases → premium increases
- More volatility → premium increases
- But how much does it increase?

Greeks: Vega

- Likelihood of bad state of world increases → premium increases
- More volatility → premium increases
- But how much does it increase?
- Defined by vega: $\delta P/\delta \sigma$
- Also a normal curve

Application: Personal Trading

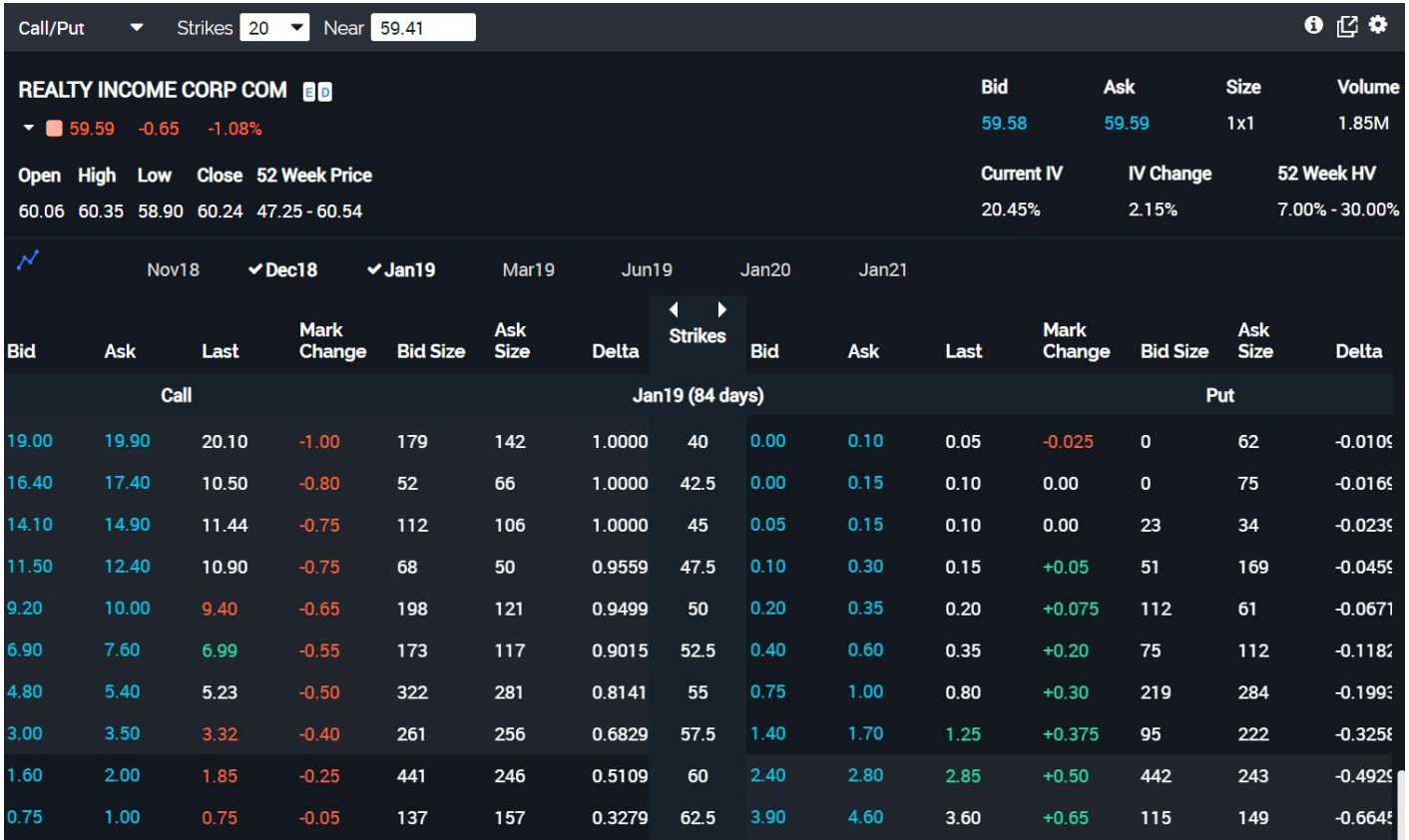
- Covered calls
- Cash-secured puts
- Call/Put Spreads

Covered Calls

- Generally done by “income” investors
- Buy dividend stock + sell upside call
- Pretty good if you were just going to buy + hold anyways

Covered Call Example

Dividend Yield: 4.39%
Monthly dividend per share: 0.22



Call/Put | Strikes 20 | Near 59.41

REALTY INCOME CORP COM E D

59.59 -0.65 -1.08%

Bid	Ask	Size	Volume
59.58	59.59	1x1	1.85M

Open	High	Low	Close	52 Week Price
60.06	60.35	58.90	60.24	47.25 - 60.54

Current IV	IV Change	52 Week HV
20.45%	2.15%	7.00% - 30.00%

Nov18 | ✔Dec18 | ✔Jan19 | Mar19 | Jun19 | Jan20 | Jan21

Call							Strikes	Put						
Bid	Ask	Last	Mark Change	Bid Size	Ask Size	Delta		Bid	Ask	Last	Mark Change	Bid Size	Ask Size	Delta
Jan19 (84 days)														
19.00	19.90	20.10	-1.00	179	142	1.0000	40	0.00	0.10	0.05	-0.025	0	62	-0.010
16.40	17.40	10.50	-0.80	52	66	1.0000	42.5	0.00	0.15	0.10	0.00	0	75	-0.016
14.10	14.90	11.44	-0.75	112	106	1.0000	45	0.05	0.15	0.10	0.00	23	34	-0.023
11.50	12.40	10.90	-0.75	68	50	0.9559	47.5	0.10	0.30	0.15	+0.05	51	169	-0.045
9.20	10.00	9.40	-0.65	198	121	0.9499	50	0.20	0.35	0.20	+0.075	112	61	-0.067
6.90	7.60	6.99	-0.55	173	117	0.9015	52.5	0.40	0.60	0.35	+0.20	75	112	-0.118
4.80	5.40	5.23	-0.50	322	281	0.8141	55	0.75	1.00	0.80	+0.30	219	284	-0.199
3.00	3.50	3.32	-0.40	261	256	0.6829	57.5	1.40	1.70	1.25	+0.375	95	222	-0.325
1.60	2.00	1.85	-0.25	441	246	0.5109	60	2.40	2.80	2.85	+0.50	442	243	-0.492
0.75	1.00	0.75	-0.05	137	157	0.3279	62.5	3.90	4.60	3.60	+0.65	115	149	-0.664

Covered Call

- σ_{ATM} = 20.45 = 20.45% move in 1 year is within 1 SD
  - $\sigma_{3\ months} = \sigma_{12\ mo} * sqrt(¼)$ = 10.225% move in 3 months is within 1 SD

State of the World	3-month Return	Benchmark (No Call)	Annualized Return
Up	7.42%	11.33%	33.1%
Neutral	2.53%	1.11%	10.5%
Down	-7.69%	-9.12%	-27.4%

Cash-Secured Puts

- Sell downside put
- Actually has the same risk profile as a covered call
  - C = P + 1 delta
  - 1 delta - C = - P

Call Spreads & Put Spreads

- Suppose you think there’s a floor or ceiling to the stock
- How can you make money?
  - Can’t really with equities (or at least, a lot of variance)
  - Sell a CS/PS

PS Example -- TSLA

PS Example -- TSLA

- 9/28/18
- -15% on SEC lawsuit news
- Sell Nov (11/16) 225-200 PS (sell 225 P, buy 200 P)
- $5.41 premium → $1959 margin

- +15% on settling
- Bought back for 2.36
- $305 profit (15.6% return)

Application: Professional Trading

- Delta hedging
- Trading vol/gamma

Delta Hedging

- We don’t know where underlying will move
  - Short-term: equity returns are random walk
  - Similar to pairs trading (hedging beta) -- want to make money b/c we’re right, not b/c overall market (or underlying, for delta hedging) moves
- Constantly re-hedge as underlying moves due to gamma
  - Also: Charm ($\delta\Delta/\delta t$) at expiry, etc

Trading Vol/Gamma

- Long 1 STD (1 C, 1P) → long gamma
- Move a bit and one huge move VS 1 huge move then move a bit -- which better?

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- Long 1 STD (1 C, 1P) → long gamma
- Move a bit and one huge move VS 1 huge move then move a bit -- which better?
- Gamma normal curve property

Application: VIX

The Cboe Volatility Index - more commonly referred to as the "VIX Index" - is an up-to-the-minute market estimate of expected volatility that is calculated by using real-time prices of options on the S&P 500® Index listed on Cboe Exchange, Inc. ("Cboe Options") (Symbol: SPX). The VIX Index is calculated using SPX quotes generated during regular trading hours for SPX options. The VIX Index uses SPX options with more than 23 days and less than 37 days to expiration and then weights them to yield a constant, 30-day measure of the expected volatility of the S&P 500 Index.

Source: CBOE (http://cfe.cboe.com/cfe-products/vx-cboe-volatility-index-vix-futures/contract-specifications)

VIX

- Estimate SPX IV with average tte of 30 days
- Quoted in percentage points for 1 SD annualized move
    - Can calculate for other time periods from annualized figure

Trading VIX

- Can’t directly trade VIX
- VIX futures
- VIX-tracking ETF/ETNs
  - Long: VXX
  - Short: SVXY
  - Construct 30-day VIX future via different weights on actual VIX futures
- Contango, etc