

Risk Management
in
Option Trading

1. What is risk?

2. What are essential strategies for managing it?

Call and Put Options

A **put** is a contract giving the owner the right (not the obligation) to **sell** shares of an underlying security.

A **call** gives the owner the right (not the obligation) to **buy**.

Calls and puts can be bought or sold.

Option buyers become long. Option sellers become short.

	Buyer		Seller
Call	Buys	←→	Sells
Put	Buys	←→	Sells

Option Greeks

Delta

The change in option price with a change in the underlying price. For a \$1.00 increase in the underlying price, the value of the *delta* is added to the value of the option. Conversely, for each \$1.00 decrease in the price of the underlying, the value of *delta* is subtracted from the value of the option.

The *delta* of call options is always positive (0 to 100) and the *delta* of put options is always negative (0 to -100).

The *delta* of an at-the-money option is approximately .50 (calls) or -.50 (puts).

The *delta* of an option at expiration is either 0 or 100 (-100 for puts).

Theta

The change in option price per day resulting from time decay.

Vega

The change in option price with changes in implied volatility (IV, see following slide).

Gamma

The change in delta with changes in price of the underlying security.

Implied volatility (IV)

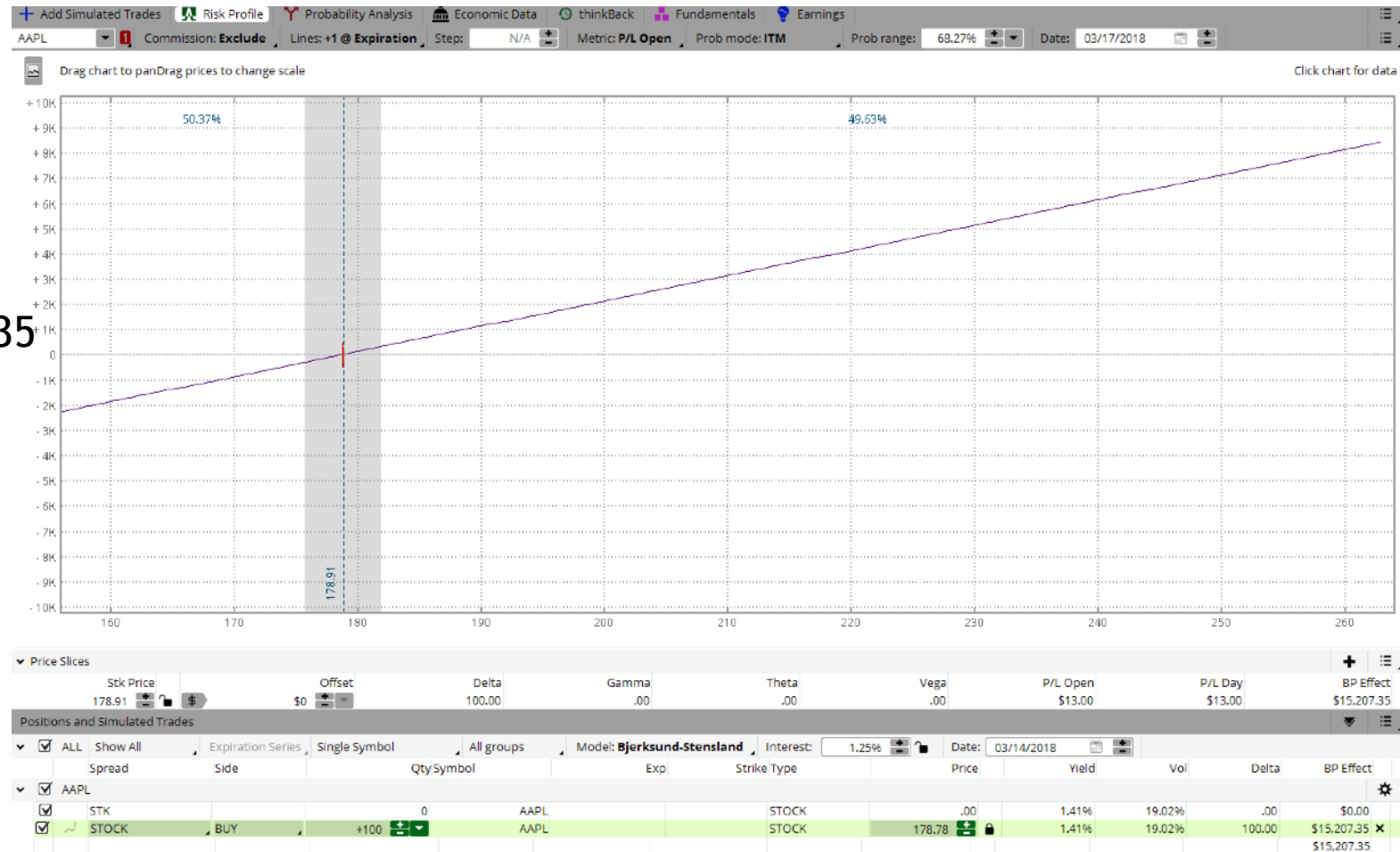
Volatility is a measure of price uncertainty expressed as a percentage. IV is derived from a statistical formula that determines a one standard deviation annual price distribution.

Example: If we have a stock trading at \$100 with an IV of 25 percent, the options are implying that the stock will be higher or lower by 25 percent within one standard deviation. (One standard deviation equals 68 percent in a normal distribution.) So the stock has a 68 percent probability of being between \$75 and \$125.



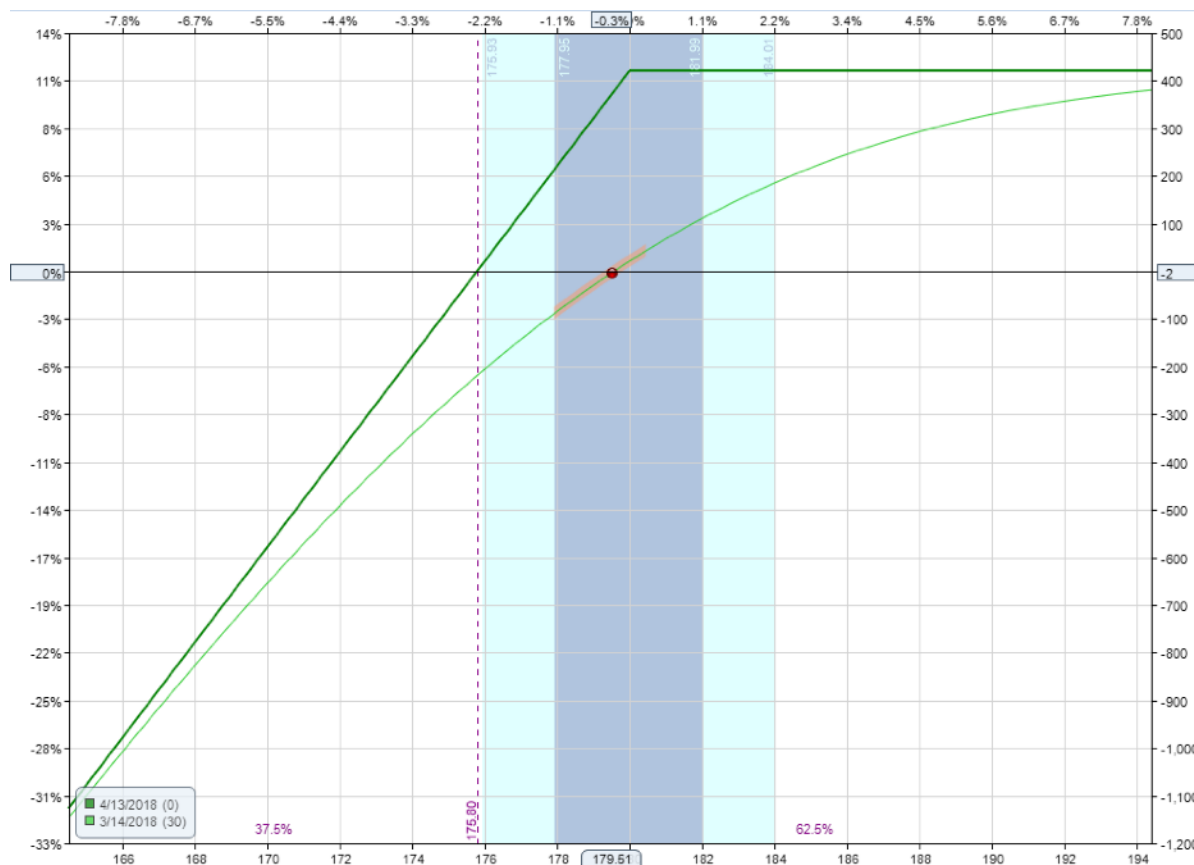
The risk of buying 100 shares of Apple

Share price: \$178.91
Delta = 100
Margin req: \$15,207.35
Max loss: \$17,891
Max gain: infinite



The risk of selling a naked put in Apple

1, 13 APR, 179.5 put
 Credit: \$421
 Delta = 50.78
 Margin req: \$3591.30
 Max loss: \$17,891
 Max gain: \$421



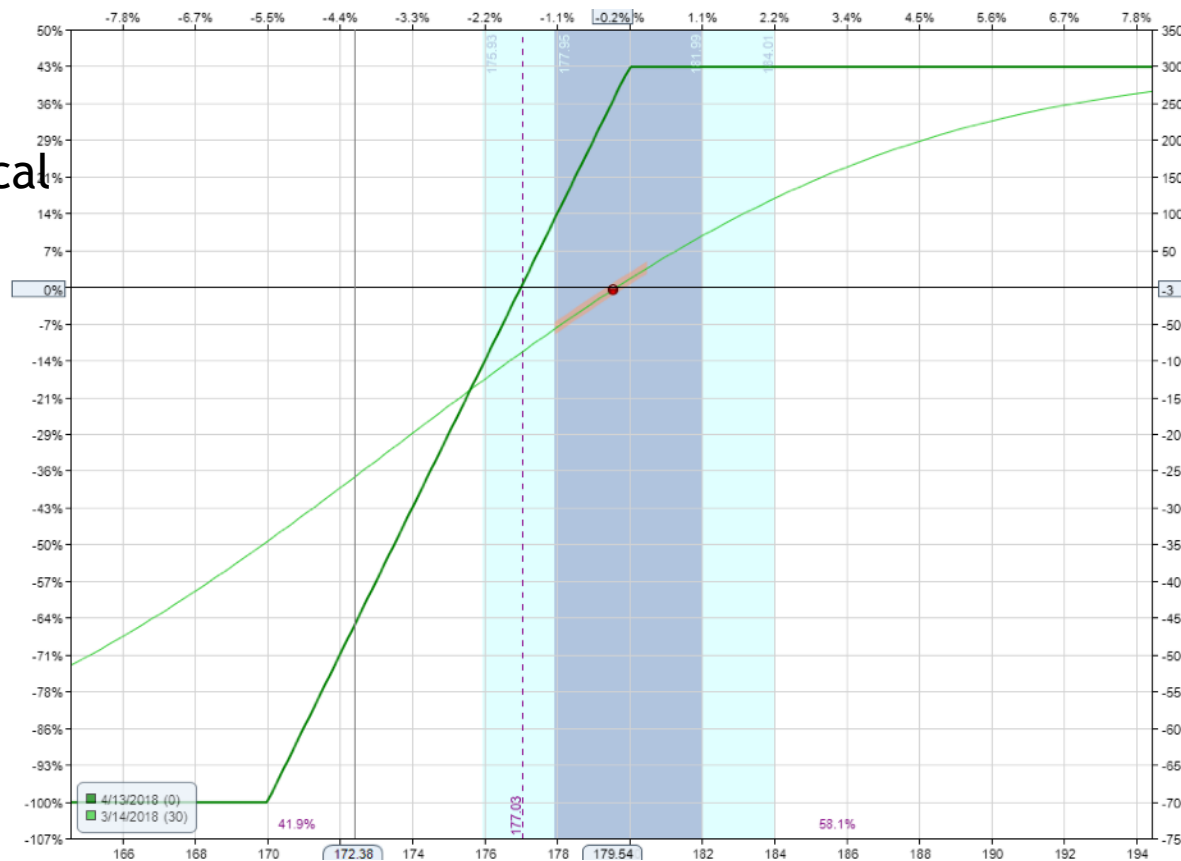
13 APR PUT

Mid	IV	Delta	Model	Pos
21.475	0.00	99.99		
19.025	16.10	-98.76		
16.575	16.41	-97.27		
14.125	15.65	-95.73		
11.825	16.50	-91.04		
9.55	16.14	-85.94		
7.55	16.68	-77.36		
5.75	16.98	-67.27		
4.25	17.44	-55.91		-1
3.075	18.09	-44.52		
2.175	18.77	-34.18		
1.52	19.55	-25.49		
1.055	20.41	-18.61		
0.74	21.40	-13.49		
0.515	22.37	-9.66		
0.38	23.67	-7.13		
0.285	25.02	-5.32		
0.215	26.35	-3.98		
0.16	27.58	-2.96		

Isolation Mode		Combine	Auto	Trade Analysis								Ignore
Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega		
Model	3,591.30	421.00	-422.50	1.50	-1.50	-0.04%	50.78	-4.00	6.57	-20.52		

Apple put credit spread (short put vertical)

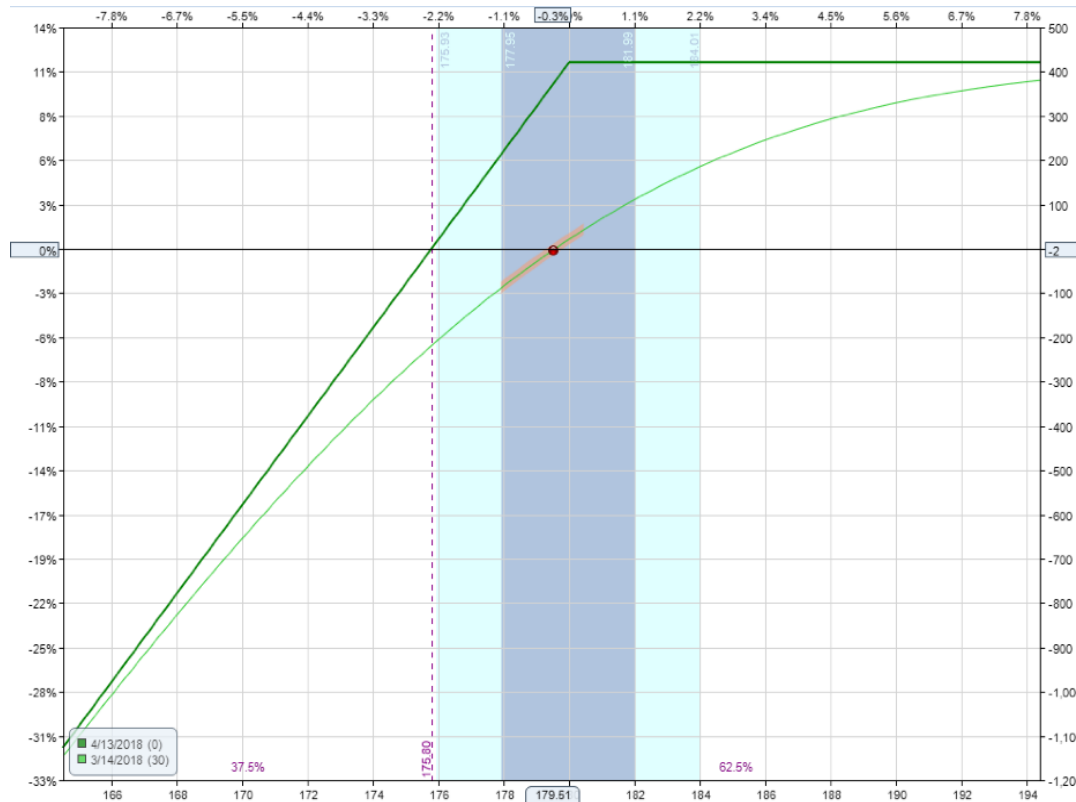
1, 13 APR, 179.5/170 put vertical
 Credit: $\$421 - \$280 = \$298.50$
 Delta = 32.07
 Margin req: $\$701.5$
 Max loss: $\$700$
 Max gain: $\$298.5$



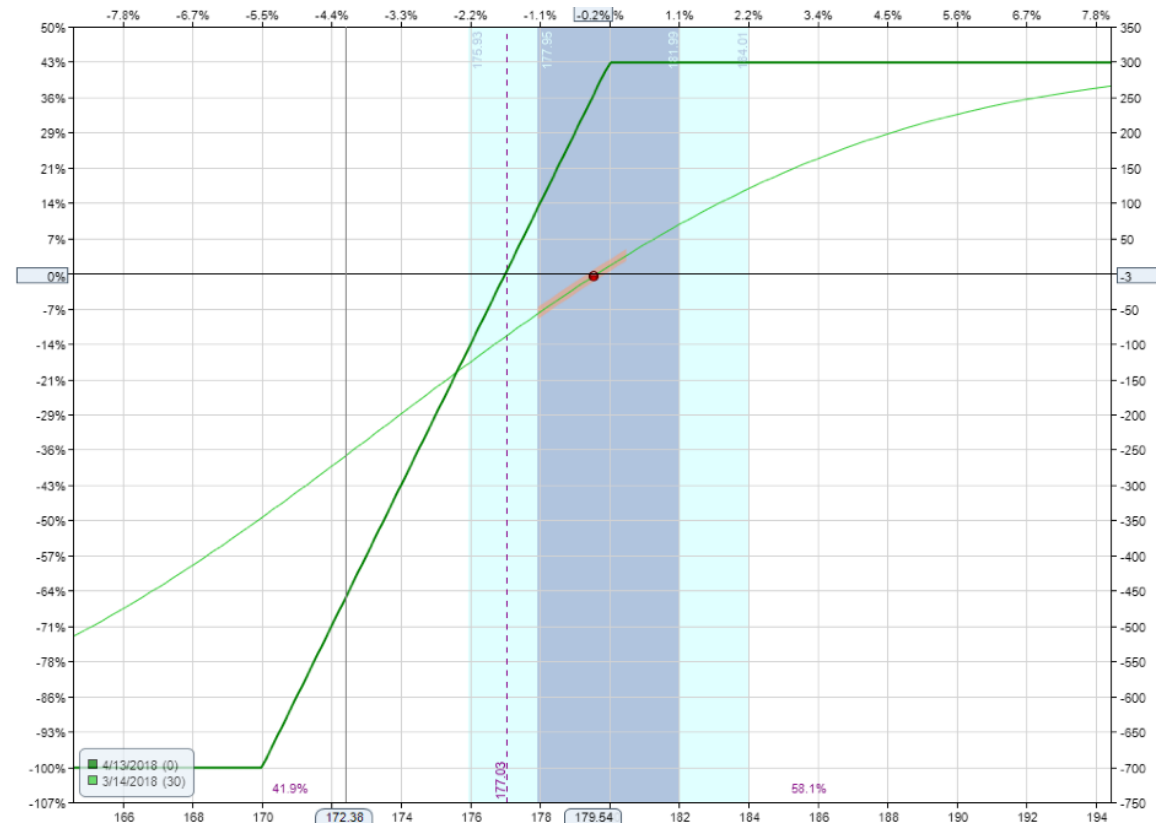
Option Chain				
Weekly	13 Apr 18 (30)			20.18%
Mid	IV	Delta	Model	Pos
0.55	19.77	11.39		
0.855	19.60	16.42		
1.315	19.70	22.95		
2.00	20.06	31.08		
2.925	20.49	40.18		
4.075	20.99	49.42		
5.50	21.54	58.61		
7.20	22.76	66.32		
9.55	24.00	72.88		
11.10	17.85	-86.03		
9.025	17.86	-79.56		
7.15	18.22	-70.88		
5.575	18.99	-60.70		
4.225	19.34	-50.87		-1
3.15	19.99	-41.07		
2.32	20.75	-32.27		
1.68	21.44	-24.81		
1.215	22.23	-18.79		+1
0.88	23.13	-14.08		
0.64	24.09	-10.49		
0.475	25.27	-7.85		
0.36	26.45	-5.97		
0.265	27.47	-4.44		
0.21	28.89	-3.47		
0.16	30.06	-2.64		
0.12	31.15	-1.98		
0.11	31.71	-1.80		
0.10	32.24	-1.63		
0.09	32.70	-1.47		
0.085	33.44	-1.37		
0.075	33.82	-1.21		

Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega	T/D	Plot
Model	701.50	298.50	-301.50	3.00	-3.00	-0.43%	32.07	-1.65	1.46	-6.68	0	<input checked="" type="checkbox"/>

Hedging short options is essential for effective risk management



1, 13 APR, 179.5 put
 Credit: \$421
 Delta = 50.78
 Margin req: \$3591.30
Max loss: \$17,891
 Max gain: \$421



13 APR, 179.5/170 put
 vertical
 Credit: \$298.50
 Delta = 32.07
 Margin req: \$701.5
Max loss: \$700
 Max gain: \$298.5

Risk Management Strategies

1. Risk management begins *before*, not after, you enter a position.
 - Primary Objective: stay out of losers not to pick winners.
2. Risk management begins when looking for which options to sell.
 - Liquidity, underlying vehicle
 - Probability of expiring out of the money (OTM)
3. Determine when to get out before you get in
4. Establish a maximum loss and profit target before starting trade
 - Max loss should be no greater than 2X profit target
5. To increase probability of long term success: maximum risk/trade $\leq 2\%$
total account size

Risk management begins *before* entering a position: which option to sell? Liquidity? OTM probability?

AAPL		APPLE INC COM	179.08	+64 +0.36%	B: 179.08 A: 179.09	ETB	NASDAQ	Company Profile							
Underlying															
	Last X	Net Chng	Bid X	Ask X	Size	Volume	Open	High	Low						
	179.08 P	+64	179.08 Z	179.09 K	1 x 3	18,466,558	178.50	180.24	178.0701						
Option Chain Filter: Off Spread: Single Layout: Delta, Open Interest, Volume, Probabili...															
CALLS					Strikes: 14	PUTS									
	Delta	Open.Int	Volume	Prob.OTM	Bid X	Ask X	Exp	Strike	Bid X	Ask X	Delta	Open.Int	Volume	Prob.OTM	
>	23 MAR 18	(8)	100 (Weekly)											21.04% (±4.656)	
>	29 MAR 18	(14)	100 (Weekly)											21.07% (±6.055)	
>	6 APR 18	(22)	100 (Weekly)											20.58% (±7.348)	
>	13 APR 18	(29)	100 (Weekly)											20.91% (±8.54)	
>	20 APR 18	(36)	100											21.40% (±9.717)	
		.92	1,713	0	7.89%	34.40 H	34.70 M	20 APR 18	145	.10 H	.11 H	-.02	18,564	85	97.97%
		.92	4,112	39	8.66%	29.50 X	29.75 X	20 APR 18	150	.16 N	.17 H	-.03	27,608	154	96.86%
		.91	6,736	62	9.79%	24.60 X	24.80 X	20 APR 18	155	.26 Z	.27 H	-.04	15,147	377	95.04%
		.89	13,940	63	12.50%	19.80 X	20.00 X	20 APR 18	160	.44 Z	.45 H	-.07	30,006	579	91.91%
		.85	12,059	309	17.10%	15.15 X	15.30 Q	20 APR 18	165	.78 Z	.79 Z	-.12	20,412	532	86.47%
		.77	24,256	763	25.60%	10.85 X	11.00 X	20 APR 18	170	1.44 Z	1.45 Z	-.21	37,189	8,028	77.22%
		.64	22,314	1,695	38.30%	7.10 X	7.20 X	20 APR 18	175	2.64 Q	2.66 W	-.34	22,439	7,622	63.21%
		.48	43,524	4,480	54.56%	4.10 N	4.15 N	20 APR 18	180	4.60 X	4.70 X	-.52	15,935	1,936	45.23%
		.31	42,099	3,112	71.41%	2.07 Z	2.09 Z	20 APR 18	185	7.60 N	7.70 X	-.71	3,224	244	26.75%
		.17	29,234	2,093	84.76%	.91 W	.93 Z	20 APR 18	190	11.45 X	11.65 X	-.87	3,207	1	12.27%
		.08	17,735	1,725	92.75%	.38 Z	.39 Z	20 APR 18	195	16.00 X	16.20 X	-.95	1,719	22	4.23%
		.04	22,424	375	96.51%	.17 Z	.18 Z	20 APR 18	200	20.85 X	21.10 X	-.98	1,256	53	1.44%
		.02	5,010	52	98.11%	.09 H	.10 Z	20 APR 18	205	25.80 X	26.10 X	-.99	764	106	0.84%
		.01	5,190	84	98.92%	.05 Z	.06 Z	20 APR 18	210	30.70 M	31.30 Z	-.98	0	0	1.53%
>	27 APR 18	(43)	100 (Weekly)											22.54% (±11.173)	
>	18 MAY 18	(64)	100											25.35% (±15.314)	
>	15 JUN 18	(92)	100											24.87% (±18.007)	
>	20 JUL 18	(127)	100											24.31% (±20.692)	
>	17 AUG 18	(155)	100											25.25% (±23.782)	
>	21 SEP 18	(190)	100											24.97% (±26.074)	
>	19 OCT 18	(218)	100											25.01% (±28.013)	
>	16 NOV 18	(246)	100											25.54% (±30.452)	
>	18 JAN 19	(309)	100											25.70% (±34.47)	
>	21 JUN 19	(463)	100											25.35% (±41.958)	
>	17 JAN 20	(673)	100											26.19% (±53.045)	
>	19 JUN 20	(827)	100											24.94% (±56.26)	

Risk management begins when looking for which options to sell.
Liquidity? Underlying vehicle?

Option Statistics
3-15-18 12:30PT

SPY

Volume of underlying
54,814,528 shares

SPX 1,170,995

ES futures 816,216

ES options 293,333

VIX 825,549

Trade Analysis	Calls		Puts		Total	
Total Volume:	1,316,796		1,461,952		2,778,748	
Traded at BID or below:	498,849		625,498		1,124,347	
...% of total:	37%		42%		40%	
Traded at ASK or above:	510,705		636,426		1,147,131	
...% of total:	38%		43%		41%	
Between the Market:	307,242		200,028		507,270	
...% of total:	23%		13%		18%	
Delta Between *						
0 ... 20	394,363	29%	644,601	44%	1,038,964	37%
21 ... 40	295,190	22%	487,709	33%	782,899	28%
41 ... 60	288,018	21%	284,139	19%	572,157	20%
61 ... 80	125,930	9%	35,914	2%	161,844	5%
81 ... 100	213,295	16%	9,589	0%	222,884	8%

Trade Analysis	Calls		Puts		Total	
Total Volume:	168,470		115,197		283,667	
Traded at BID or below:	62,383		46,881		109,264	
...% of total:	37%		40%		38%	
Traded at ASK or above:	66,132		41,154		107,286	
...% of total:	39%		35%		37%	
Between the Market:	39,955		27,162		67,117	
...% of total:	23%		23%		23%	
Delta Between *						
0 ... 20	53,371	31%	44,255	38%	97,626	34%
21 ... 40	40,363	23%	41,663	36%	82,026	28%
41 ... 60	38,734	22%	18,225	15%	56,959	20%
61 ... 80	24,821	14%	6,603	5%	31,424	11%
81 ... 100	11,181	6%	4,451	3%	15,632	5%

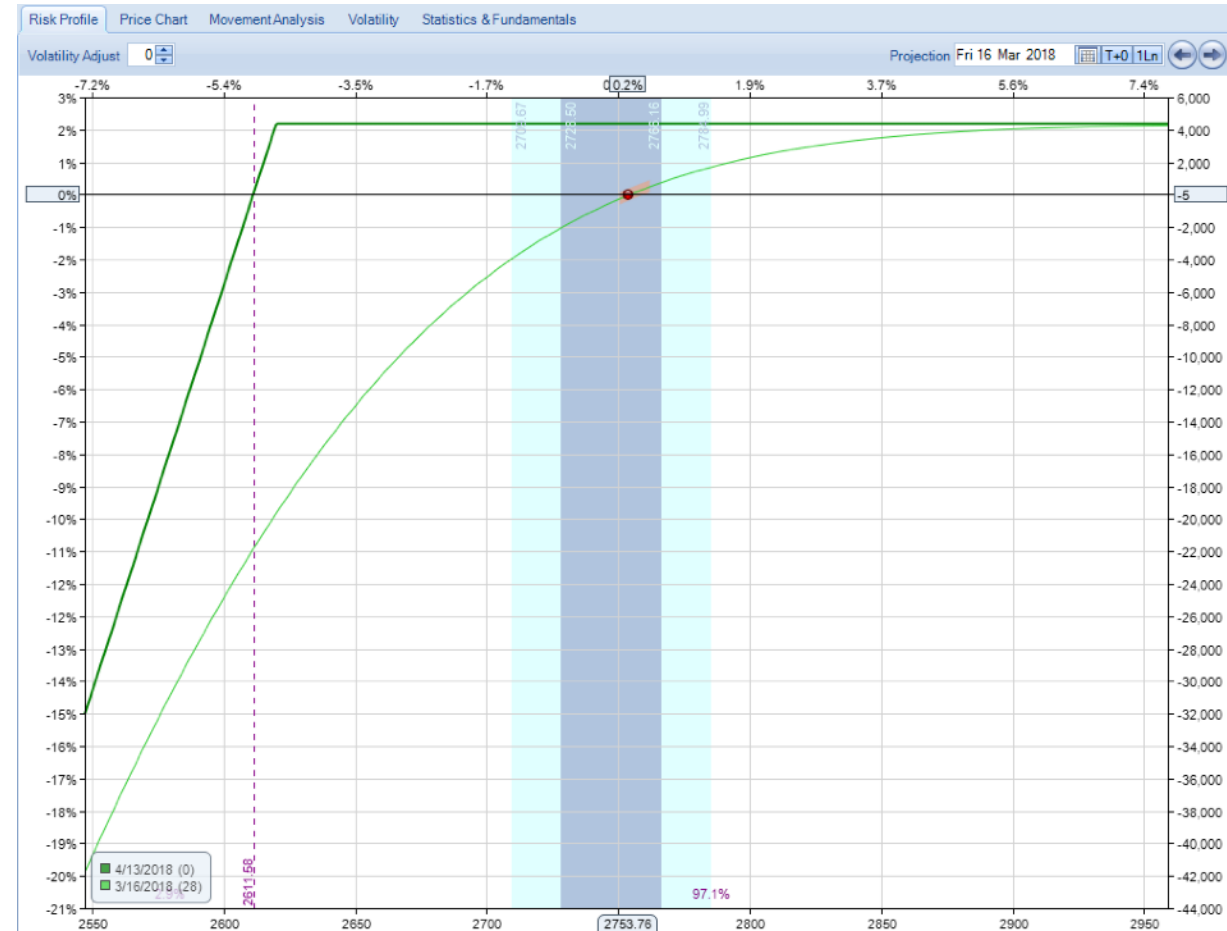
AAPL

Volume of underlying
18,466,558 shares

Naked Put in SPX

PUT	Mid	IV	Delta	Model
2650	11.10	15.23	-17.43	
2645	10.65	15.47	-16.65	
2640	10.20	15.67	-15.93	
2635	9.80	15.93	-15.22	
2630	9.40	16.15	-14.55	
2625	9.00	16.36	-13.90	
2620	8.70	16.60	-13.36	-5
2615	8.40	16.87	-12.81	
2610	8.10	17.11	-12.30	
2605	7.80	17.31	-11.81	
2600	7.50	17.55	-11.30	
2595	7.25	17.81	-10.86	
2590	7.00	18.03	-10.44	
2585	6.80	18.27	-10.08	
2580	6.55	18.52	-9.66	
2575	6.35	18.77	-9.31	
2570	6.15	19.01	-8.96	

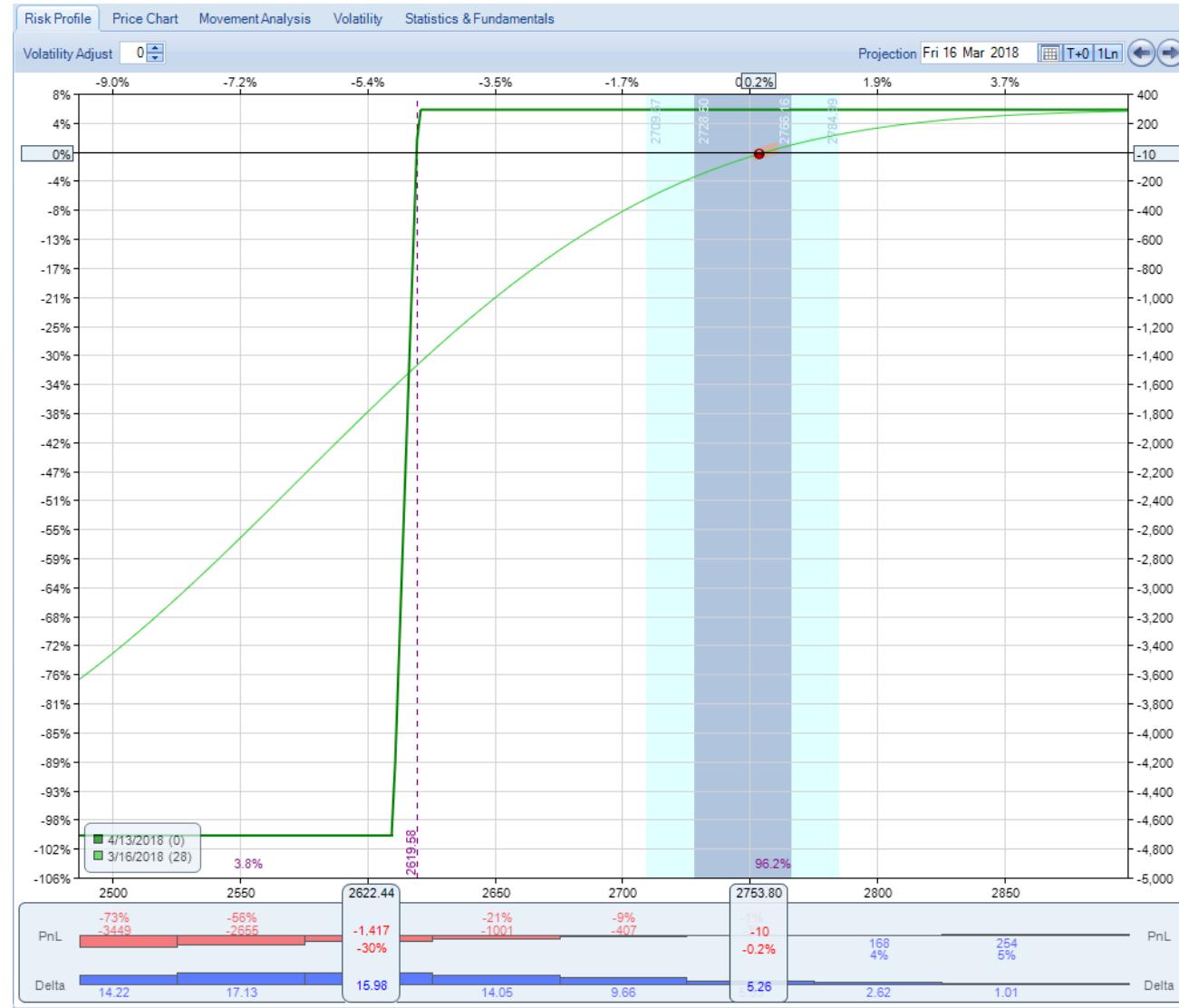
Risk: \$ 208,701.00
 Max profit: \$ 4,395



Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega
Model	208,701.00	4,395.00	-4,400.00	5.00	-5.00	0.00%	67.34	-0.85	244.27	-826.24

Put Credit Spread in SPX

PUT	Mid	IV	Delta	Model
2650	11.20	15.27	-17.52	
2645	10.70	15.48	-16.71	
2640	10.30	15.75	-15.98	
2635	9.90	15.99	-15.30	
2630	9.50	16.21	-14.63	
2625	9.10	16.41	-14.00	
2620	8.80	16.69	-13.43	-5
2615	8.45	16.90	-12.86	
2610	8.15	17.14	-12.34	+5
2605	7.85	17.37	-11.83	
2600	7.60	17.63	-11.38	
2595	7.30	17.82	-10.92	
2590	7.10	18.10	-10.53	
2585	6.80	18.29	-10.07	
2580	6.60	18.57	-9.70	
2575	6.40	18.81	-9.35	
2570	6.20	19.05	-9.01	



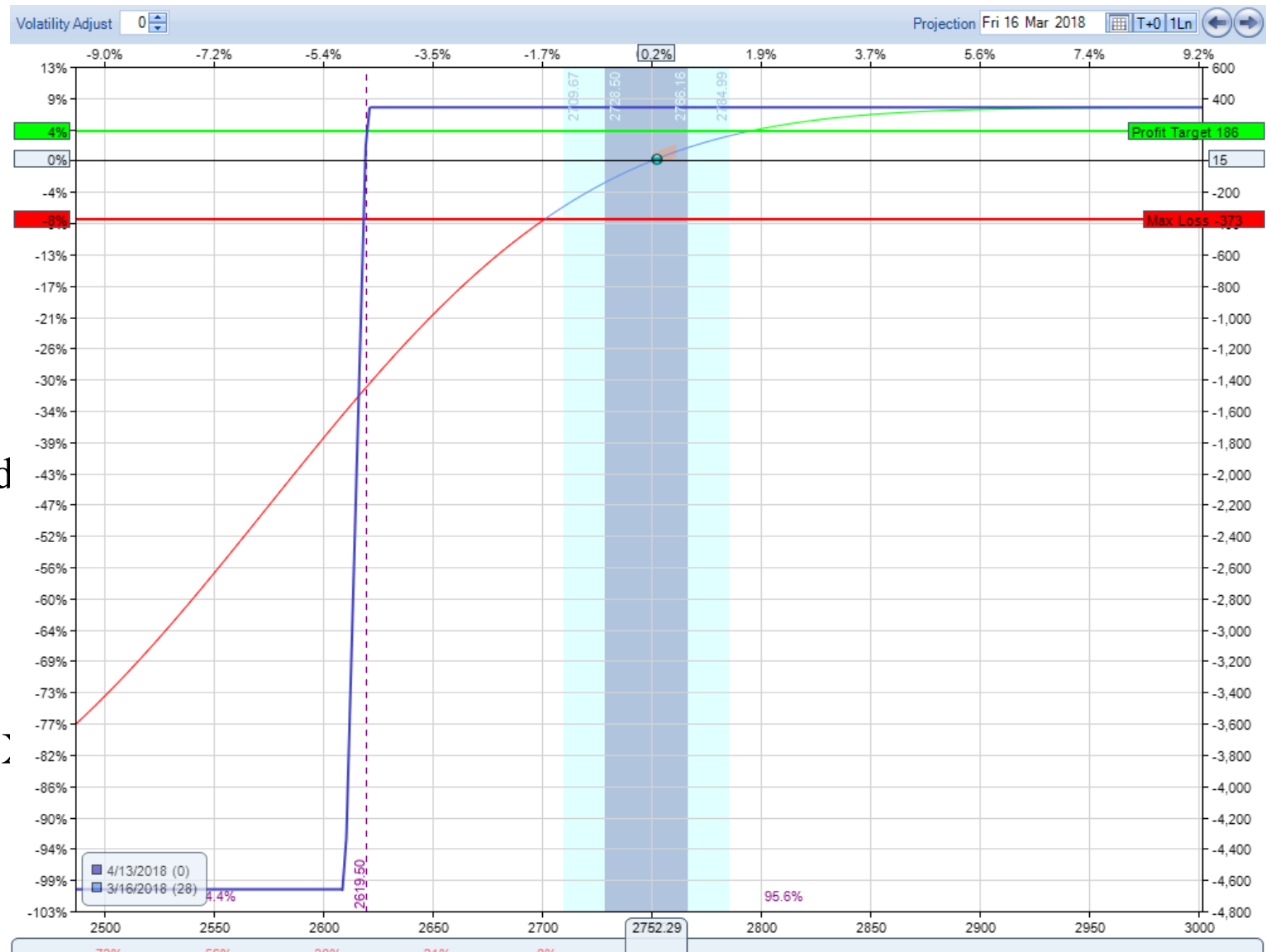
Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega
Model	4,685.00	315.00	-325.00	10.00	-10.00	-0.21%	5.48	-0.07	7.57	-47.26

Risk Management

Determine when to get out of the trade before you get in.

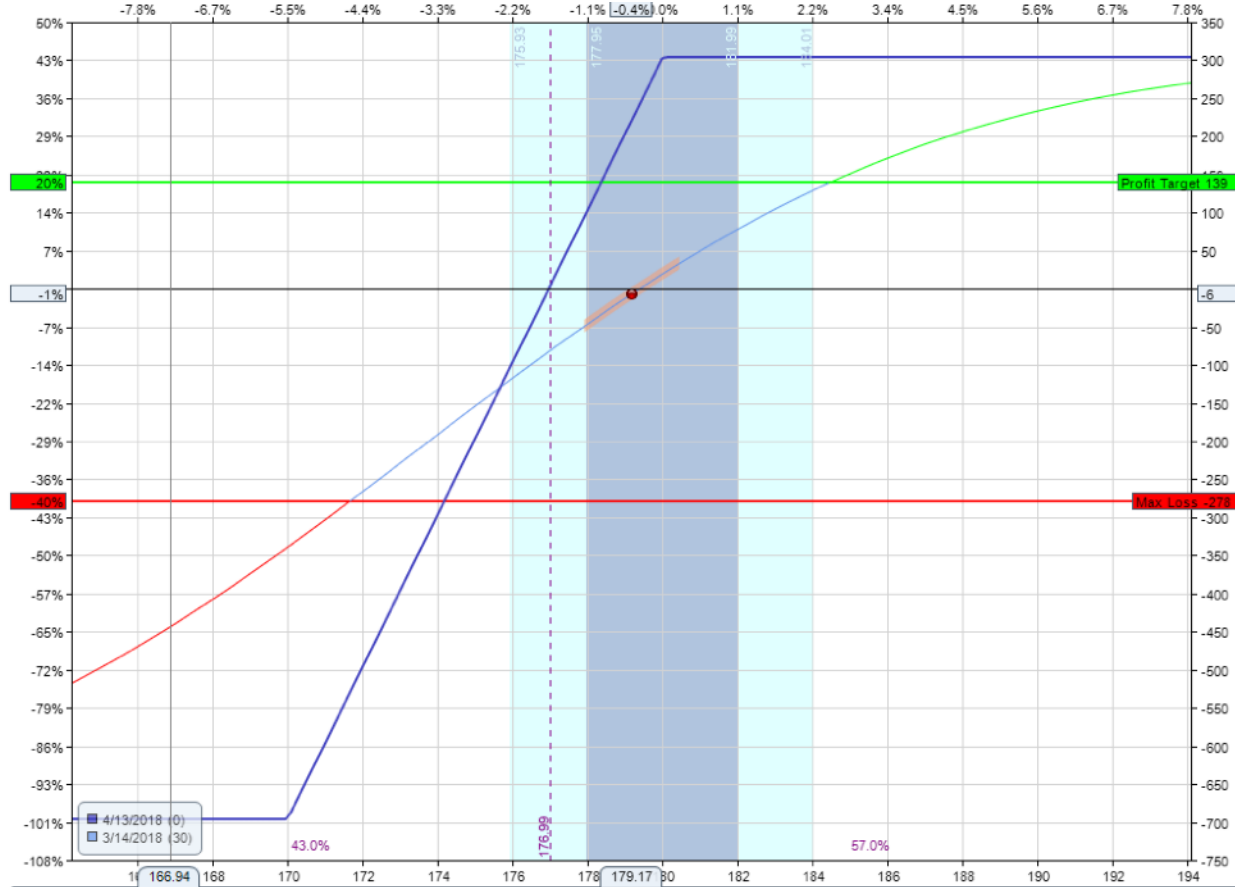
Establish a maximum loss and profit target before starting trade.

Max loss should be no greater than 2x profit target.



Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega
Model	4,685.00	315.00	-325.00	10.00	-10.00	-0.21%	5.48	-0.07	7.57	-47.26

Maximum Gain and Loss are Established at Trade Start



Analysis	OrigMargin	Cost	Curr Cost	Com	Profit/Loss	PnL%	Delta	Gamma	Theta	Vega
Position	696.00	304.00	-310.00	3.00	-6.00	-0.86%	32.70	-1.61	1.26	-6.27

Backups

The Black-Scholes pricing formula for call options.

$$C = SN(d_1) - N(d_2)Ke^{-rt}$$

C = Call premium
S = Current stock price
t = Time until option exercise
K = Option striking price
r = Risk-free interest rate
N = Cumulative standard normal distribution
e = Exponential term

s = St. Deviation
ln = Natural Log

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{s^2}{2}\right)t}{s \cdot \sqrt{t}}$$

$$d_2 = d_1 - s \cdot \sqrt{t}$$

Option Greeks

- **Delta** indicates an option's sensitivity to change in the underlying price. It predicts the change in the option's price with a \$1 change in the underlying price.
- **Theta** indicates an option's time decay, giving us the change in price per day.
- **Vega** is the option's sensitivity to changes in implied volatility. A rise in implied volatility is a rise in option premiums, and so will increase the value of long calls and long puts. Vega increases with each expiration further out in time.

For every 1% volatility increase in the underlying asset, the value of vega is added to the value of the option.

- Conversely, for every 1% volatility decrease, the value of vega is subtracted from the value of the option.
- **Gamma** is the sensitivity of the delta to changes in price of the underlying asset.

The Risk of Selling 1 Covered Call



The Risk of Selling 1 Covered Call

