Options Deep Dive

Welcome to the first installment of Macro Ops' Deep Dives. It is our mission to provide clients with actionable information which can be easily applied across any skill set and portfolio type. Unless explicitly noted, our deep dives will generally adhere to the following structure:

- Brief overview of the subject
- Explanation of any critical terms necessary to understand the subject matter
- Best practices and applications
- Sharing any related quantitative tools Macro Ops has developed to assist in education or active trading.
- Additional reading and resources

Since demand from the Collective has been high in requesting this subject, we thought we would kick things off covering the ins and outs of options. The overview will be relatively basic, so if you're a veteran options trader feel free to skip straight to the 'Best Practices and Applications' section.

Subject Overview

What is an option?

An option is a type of financial derivative. This is just a fancy way of saying that the value of an option is derived from its underlying stock. Options buyers and sellers enter into contract with each other which gives the buyer of the option contract the right (but not the obligation) to purchase the underlying equity from the seller at the agreed upon "strike" price written in the contract, most commonly on the date of expiry.

In order to own the rights of the underlying option contract, the buyer of an option contract must pay the seller a premium to do so (before expiry). This compensates the seller for taking the risk that their shares may be taken from them, or if they are required to purchase shares at the agreed upon strike price in the event that the conditions set in the option contract become valid. An option contract is typically sized in 100 shares of the underlying stock. There are two main types of option contracts:

Call Option

If an operator has a bullish outlook on the underlying, he should purchase a call option.
Example: An operator has a bullish outlook on TSLA, currently trading at a price of $650/share. He purchases a single call option with a strike price of $800/share. He believes that Tesla will rally significantly in the next 30 days to expiry.

To purchase this call option, he must pay the seller of the call option $9.65/share, or $965 for the right to purchase 100 shares of Tesla at $650/share 30 days in the future. Below, let's see the potential payout of his bet in Table 1:

Share Price at Expiry	Resultant Intrinsic P/L
$800/share	{[($800/s - $650/s) * 100 s/contract] * [1 num. contracts]} - $965 (premium/contract) = $14035 of intrinsic value at expiry
$850/share	{[($850/s - $650/s) * 100 s/contract] * [1 num. contracts]} - $965 (premium/contract) = $19035 of intrinsic value at expiry
$700/share	($965) - no intrinsic value at expiry - The price did not reach the strike price by expiry - The seller collects $965 and the buyer loses $965

Note: An operator can also sell a call contract. In doing so, he is paid a premium for holding his 100 shares (per contract) in the event that the underlying price rises at or above the strike price of the option contract. This will be described in detail later on.

Put Option

If an operator has a bearish outlook on the underlying, he should purchase a put option.
Example: An operator has a bearish outlook on TSLA, currently trading at a price of $650/share. He believes that Tesla will decline in price significantly in the next 30 days to $500/share.

To purchase this put option, he must pay the seller of the put option $2.25/share, or $225/contract for the right to purchase 100 shares of Tesla at $500/share 30 days in the future (at contract expiry). Let's see the potential payout of his bet in Table 2:

Share Price at Expiry	Resultant Intrinsic P/L
$500/share	{[($650/s - $500/s) * 100 s/contract] * [1 num. contracts]} - $225 (premium/contract) = $14775 of intrinsic value at expiry
$450/share	{[($650/s - $450/s) * 100 s/contract] * [1 num. contracts]} - $225 (premium/contract) = $19775 of intrinsic value at expiry
$600/share	($225) - no intrinsic value at expiry - The price did not reach the strike price by expiry. - The seller collects $225 and the buyer loses $225

Note: An operator can also sell a put contract. In doing so, he is paid a premium for allocating the capital necessary required to purchase the 100 shares (per contract) in the event the underlying price falls at or below the strike price of the option contract. This will be described in detail later on.

If the underlying equity is in-the-money (ITM) on the date of the contract, the buyer has the right, but is not obligated to take delivery of the underlying at the strike price. According to the Chicago Board Options Exchange (CBOE), only 10% of options contracts are exercised.

Option Skew:

If you look at the TSLA option chain around the time of this writing, you may be wondering to yourself, “Why is the premium an operator pays to purchase a call option ~4x greater than the premium to purchase a put? After all, the two strikes used in the examples above are very close to the same distance away from the underlying.” This is known as ‘option skew’. All participants of the options market are forecasting that shares of TSLA will appreciate in value within 30 days. Given that outlook, sellers of option contracts at the $800 strike are therefore enticed with more premium (reward) in exchange to take on the associated risk of having their shares called away if the share price reaches or exceeds $800 on the date of expiry.

Option Contract Holding

If an operator purchases a call or put option, he can sell it back at any time leading up to expiry. Additionally, if he sells a call or put, he can buy it back at any time leading up to expiry. He is not obligated to hold onto the contract until expiry, and can exit the position when conditions are profitable. As an analogy, think of buying or selling option contracts as a game of voluntary hot potato between market participants.

Option Greeks

Option Greeks help analyze how dynamic factors such as price, direction, time, and volatility will influence the premium of an option contract. Four major greeks will be described below: **Delta, Gamma, Theta, and Vega.**

Delta (Δ) | Price & Direction

Delta is the greek that has the largest influence over the contract price. It represents how the premium of the contract will change as the price of the underlying stock changes. For call options, delta ranges between 0/share and 1/share (0 to 100 per contract). For put options, delta ranges between -1/share to 0/share (-100 to 0 per contract).

Example:

If an operator purchases a call option with a strike of $46, and a 0.45/share (45/contract) Delta, the call option contract increases $0.45/share if the underlying increases in price $1.00/share. Conversely, if an operator has a put option with a strike of $46 and a -0.45/share (-45/contract) Delta, the put option contract decreases $0.45/share with a $1.00 increase in the share price of the underlying.

Delta Tips:

- Delta can be used as a very rough proxy for estimating the probability that an option will expire ITM. For example, if an option has a 15 Delta, there is ~15% chance that that option will expire ITM.
- In periods where the underlying is trending in a certain direction, this may be less valid than when the underlying is in a neutral market regime and behaves more like the random-walk assumption that the BSM assumes. This will be covered in a more comprehensive fashion down below.

Gamma (Γ) | Price & Direction

Gamma measures the change in Delta as the stock changes in price. For math/physics inclined operators, it is Delta's first derivative, and is a convexity instrument. Gamma is to Delta as acceleration is to velocity. Gamma is *not linear*. Gamma tends to be highest with strike prices very close to or 'at the money', and smallest with deep out of the money (DOTM) options.

Example: If you have an option contract with a delta of 0.45 and gamma of 0.05. If the underlying equity appreciates $1, the price of the option contract (at the same $46 strike) is now 0.50.

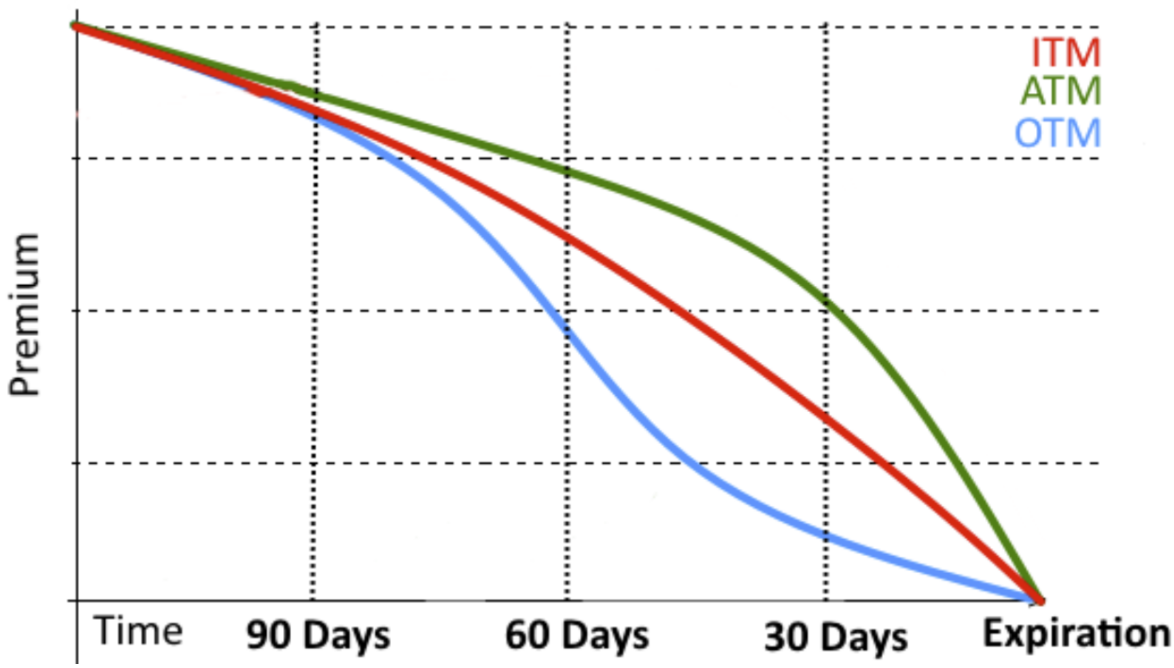
Tip: You may hear the phrase 'gamma squeeze' from time to time. A 'gamma squeeze' occurs when a multitude of operators (or a few very large operators/institutions/banks etc…) are purchasing call options with very little time to expiry. When this occurs, market makers then become short the stock, as their goal is to be directionally (Delta) neutral throughout market fluctuations. However, if the operators decide to buy more call options, the market makers are then forced to buy more shares of the underlying stock to hedge themselves against their own short position. This creates a reflexive loop that pushes the stock price higher in a rapid fashion. If a stock has relatively low liquidity, this condition can greatly enhance any gamma squeeze. The most notable occurrence of this occurred when retail traders inflated the price of GameStop in early 2021.

Theta (Θ) | Time

Theta measures the rate of decay in contract price and represents the amount of premium collected daily per contract. In essence, assuming the underlying price stays constant for a day, Theta represents how much of the premium the option seller collects from the option buyer at a specific period in time. Theta is also non-linear, and changes as a function of magnitude away from the underlying price, and also varies through time until expiry. High Theta presents adversity for option buyers, as the underlying price must move rapidly towards becoming in the money to offset theta over time. As previously mentioned, Theta is collected by option sellers.

Example: If an operator's option contract has a theta value of 0.03/share, the option seller will collect $3/contract of theta decay that trading day.

The figure below showcases theta-decay. Ideally, if an operator wishes to sell an option contract, he should sell the contract at the time period that will present the greatest amount of theta-decay in a given time period for the type of moneyness that he is interested in writing.



Vega (ν) | Volatility

Before we cover Vega in-detail, it is important to get up to speed on a term known as “Implied Volatility”. Implied Volatility (IV), is an approximation of an option contract’s value in the future. Options with higher IV will command higher premiums. IV is based on a few elements: probability of the option price in the future, supply and demand of the contract, and time-value of the option. An option with a few days until expiry will have low IV in most cases, whereas an option with several months or even a few years until expiry will have high IV. This occurs as the underlying stock has more time to move ITM or trend towards the strike price given a longer period of time statistically speaking.

Vega measures how the price of an option contract will be increased by a 1% increase in Implied Volatility (IV). An important but often overlooked component is Vega’s derivative, “Vomma”. In periods of high volatility fluctuations, Vomma non-linearly influences Vega in a similar way as Gamma acts on Delta. During periods of high market volatility, implied volatility is elevated, and as a result Vega is elevated. Option sellers will often sell periods of extremely elevated implied volatility so that they will benefit from implied volatility / Vega contraction in the future. IV contraction is commonly referred to as “IV crush”. Around the time when a stock reports earnings, IV will rise, and inflate the value of an option contract. Unless the underlying stock moves sharply in either direction keeping IV elevated, IV will sharply contract. Please be cognizant of this fact if you are executing strategies that involve purchasing option contracts around an earnings report.

Example: An option contract costs $2.00/contract with a vega of 0.1. If IV increases by 1%, the option contract will now cost $2.20.

Note: An option greek that is important in high interest rate environments is named Rho. Rho measures the increase in premium as a function of interest rate fluctuation.

It is important to take note of the relationship between all the options greeks as these relationships serve as the foundation for strategies and applications below.

The Black Scholes Option Pricing Model (BSM model)
As you read the above or look at an active option chain, you may be wondering how exactly the prices for options and their greeks are computed. The Black-Scholes option pricing model is perhaps one of the most well-known financial formulas of the modern era. It has multiple variables, and its derivation is rather complex. If you are very heavily mathematically inclined and wish to see its derivation, please visit this link.

There are six main variables used in the BSM to price option contracts:
S_0: underlying stock price (varies throughout life of the contract)
X: strike price (invariant)
σ: volatility (% per-year)
r: compounded risk-free interest rate (% per-year)
q: compounded dividend yield (% per-year)
t: time until expiration (% of year)

The price of a call option (C) is:

$$C = S_0\, e^{-qt} * N(d_1) - X\, e^{-rt} * N(d_2)$$

The price of a put option (P) is:

$$P = X\, e^{-rt} * N(-d_2) - S_0\, e^{-qt} * N(-d_1)$$

Where d1 and d2 are:

$$d_1 = \frac{ln(\frac{S_0}{X}) + t\,(r - q + \frac{\sigma^2}{2})}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

With **N** being the standard normal cumulative distribution function (fancy term for the bell curve).

The appearance of option greeks is more quantitatively oriented, for more information on them please visit:
https://www.macroption.com/black-scholes-formula/

If your eyes gloss over the equations, we don't blame you. Being able to compute the actual mathematics yourself pales in comparison to understanding the interplay between the six main variables. To go through the

manual pricing of the model step by step, please watch this video:
https://www.youtube.com/watch?v=i0sGAds8ztI

Black Scholes Assumptions
Equations are models, which are often imperfect in describing reality. A few significant assumptions made by the BSM are:

- **No dividends**: The underlying is assumed to have no dividend payout throughout the life of the contract.

- **Random walk**: Assumes that price action for the underlying will undergo a perpetual state of randomness. In periods where the underlying is trending strongly in one direction, returns are less likely to obey this assumption.

- **Normal distribution**: This implies that the returns of price action undergoing a random walk is normally distributed. In periods of heavy trend/skew this is rarely the case.

- **Zero commissions**: BSM does not take into account any broker commissions in writing/purchasing option contracts.

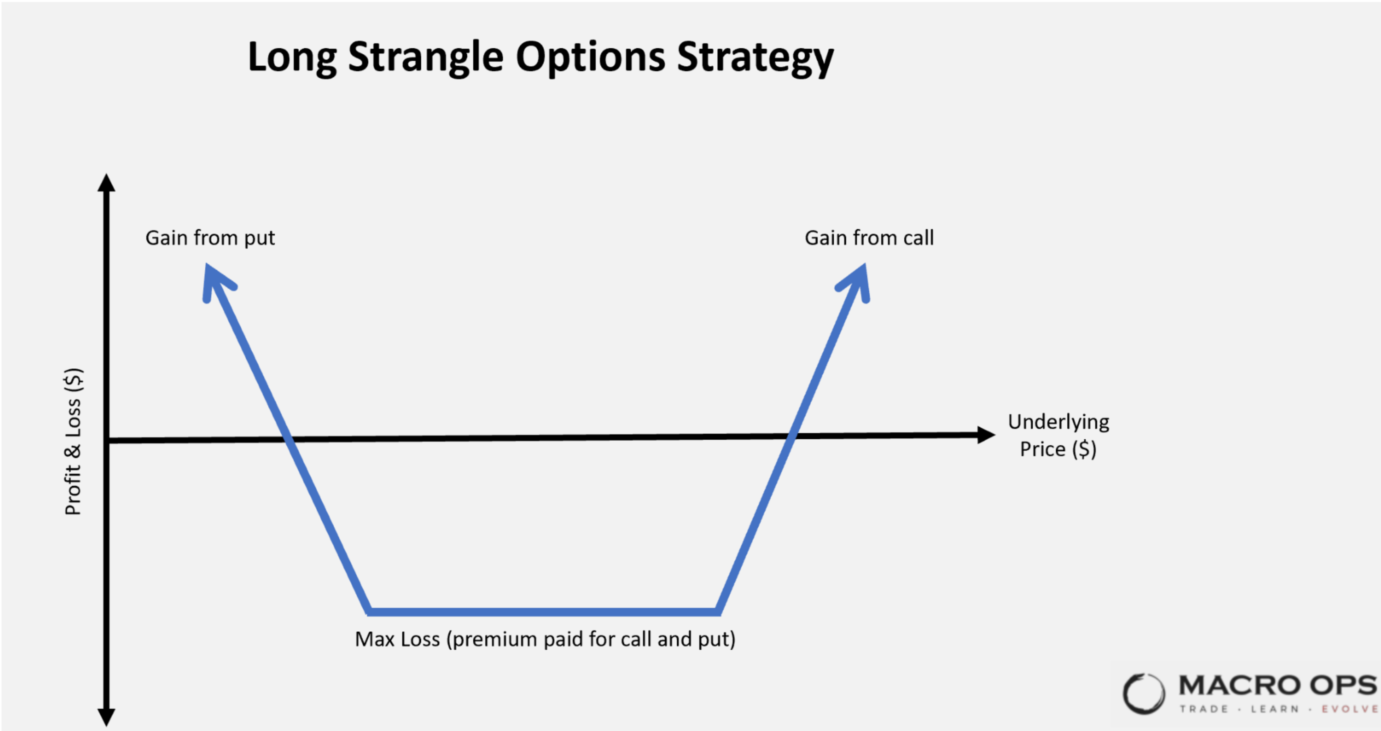
- **Risk-free interest rate**: The BSM assumes that interest rates are held constant throughout the life of the contract. Over longer dated contracts, interest rates have a greater probability of fluctuating.

Best Practices and Applications

Now that we have an understanding of what an option contract is as well as the mechanics behind one, let's take a look at some popular option strategies. While we've all seen the 0 DTE YOLOs shared on social media, the below strategies do not focus on that, nor does Macro Ops advocate engaging in such a practice.

Long Strangle
A strangle is an options strategy where an operator expects a large move in the underlying but is unsure of the direction. On average, strangles are often purchased (long strangle) more than sold (short strangle).

Strategy Makeup:
Purchase an OTM (out of the money) call and put both expiring on the same date to account for a large move in each direction.



When to Deploy:
Deploy when IV is low. This allows the operator to realize profit if the underlying moves sharply in both directions. It is important to note that IV rises around earnings (as noted in the description of Vega above), so an operator should be cautious in purchasing a strangle around an earnings report unless conviction of a sharp move is high.

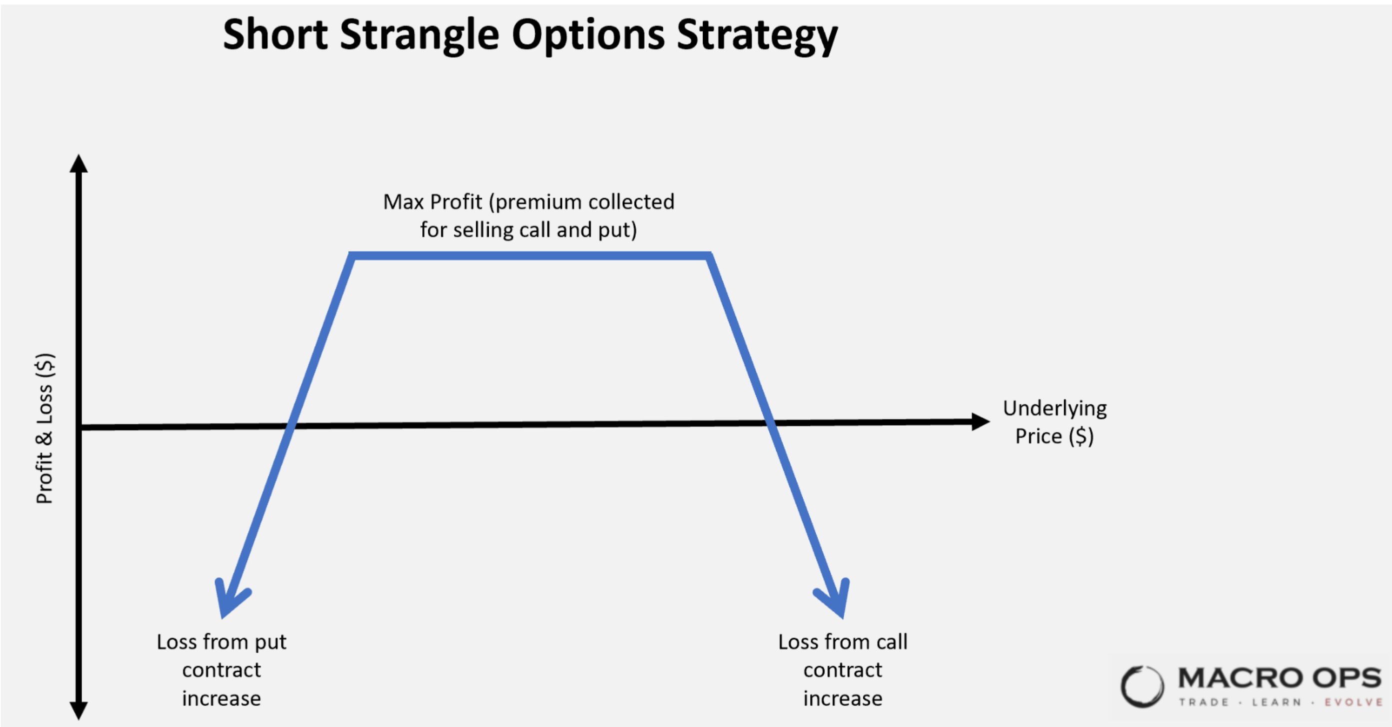
Maximum Profit and Risk:
The maximum gain of a long strangle is in theory, unlimited as the underlying could rise infinitely in price. If the asset falls in price, rapid appreciation of the option contract is also realized. The maximum loss is limited to the premium paid for both the call and put contract if the underlying does not become ITM by expiry if an operator is still holding onto the contract when it expires.

Option Greek Risk:
In purchasing a long strangle, theta decay is often realized. Vega is influenced by implied volatility, which rarely remains constant until expiry. A sudden decrease in implied volatility will cause the option contracts to decrease in price.

Short Strangle
On the contrary, a short strangle options strategy can be sold when an operator expects the price of the underlying to remain relatively constant, and not experience a sharp move in either direction.

When to deploy:
Deploy when IV is high to participate in IV crush. This allows the operator to capture theta by selling an OTM call and put.

Maximum Profit and Risk:
The maximum gain of a short strangle is the premium collected by the short call and put. The maximum loss in theory is unlimited as the underlying could move rapidly in either direction increasing the price of the option contract.



Option Greek Risk:
In selling a short strangle, theta is captured. Vega is influenced by implied volatility, which rarely remains constant until expiry. A sudden increase in implied volatility will cause the option contracts to increase in price.

Short Strangle Tips:

- In selling strangles, best returns are realized when the IV exceeds 50; structure each leg 2-sigma OTM.
- When selling, it is often ill-advised to capture the majority of the theta and/or IV fade, as any rapid change in the underlying will increase the price of option contract and may offset any premium collected by theta-decay. Take your profits frequently, and redeploy this strategy on a more favorable underlying.
- It is wise for an operator to couple selling a strangle at a rate of maximum theta decay shown by the OTM theta-decay curve (see the curve above).

Bull Put Spread
When an operator is bearish on the underlying equity, he will purchase put options. Although the name seems counterintuitive from the main thesis of a put option, a bull put spread is a strategy that an operator deploys when he expects neutral movement, or a rise in the price of the underlying equity.

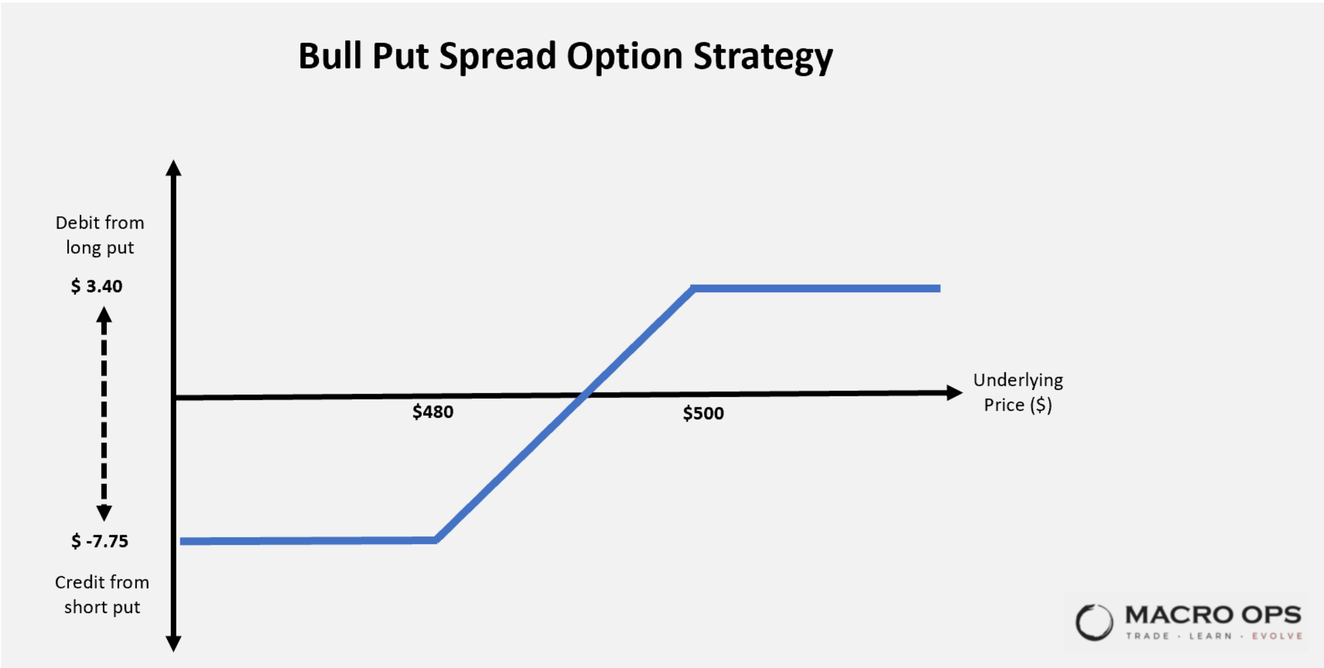
Structure: A bull put spread is made up of two puts, set to expire on the same date. Sell a put at a higher strike price, and purchase/long a put at a lower strike price.

Bull Put Spread example:

Sell 1 TSLA $500 put at:	7.75
Buy 1 TSLA $480 put at:	3.40
Net credit:	(7.75 - 3.40) = $4.35/share or $435/contract

Note: The net credit received is approximately 57% of the premium from selling the higher strike put.

Graphically, the bull put option strategy looks like this:



Maximum Profit & Risk:
The maximum profit is the net credit received, which is again realized if the underlying stock price is at or above the strike price of the short put (in this example $500). The maximum risk is equal to the difference between the two strike prices ($20 in this hypothetical example) minus the credit received ($4.35), or $15.65/share ($1565/ contract).

Option Greek Risk:
If the underlying equity decreases in price, any theta captured from the higher valued short put will be counteracted, however somewhat insulated by the downside protection of the long put as it will appreciate in value.

Bull Put Spread Tips:

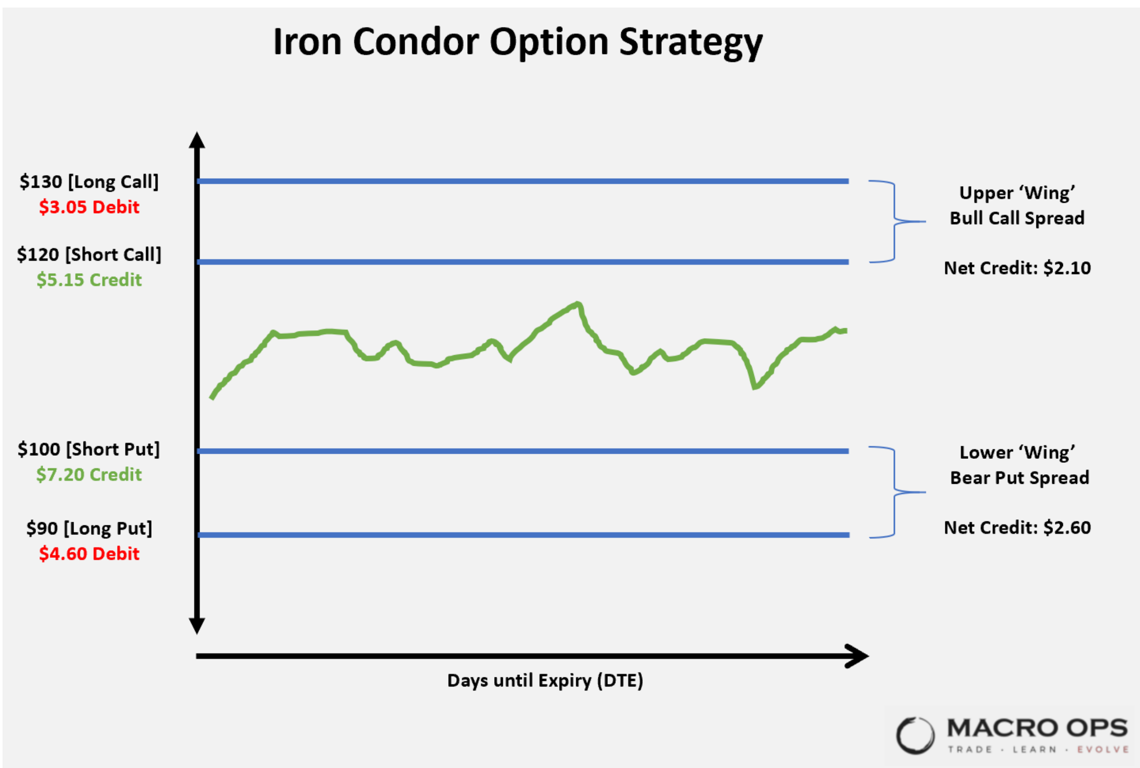
- A good rule of thumb to follow is the net credit received [credit from selling the higher strike put - debit from purchasing the lower strike put] should be greater than 50% the credit of the short put.
- Over time, this is a strategy where probability of profit is over 50%.

- Probability of profit is higher when an equity is in a bull-quiet regime, as any slight decrease in the price of the equity is likely to reverse and continue higher, allowing the maximum amount of premium to be collected from the short put; the downside protection of the purchased put option will expire worthless.

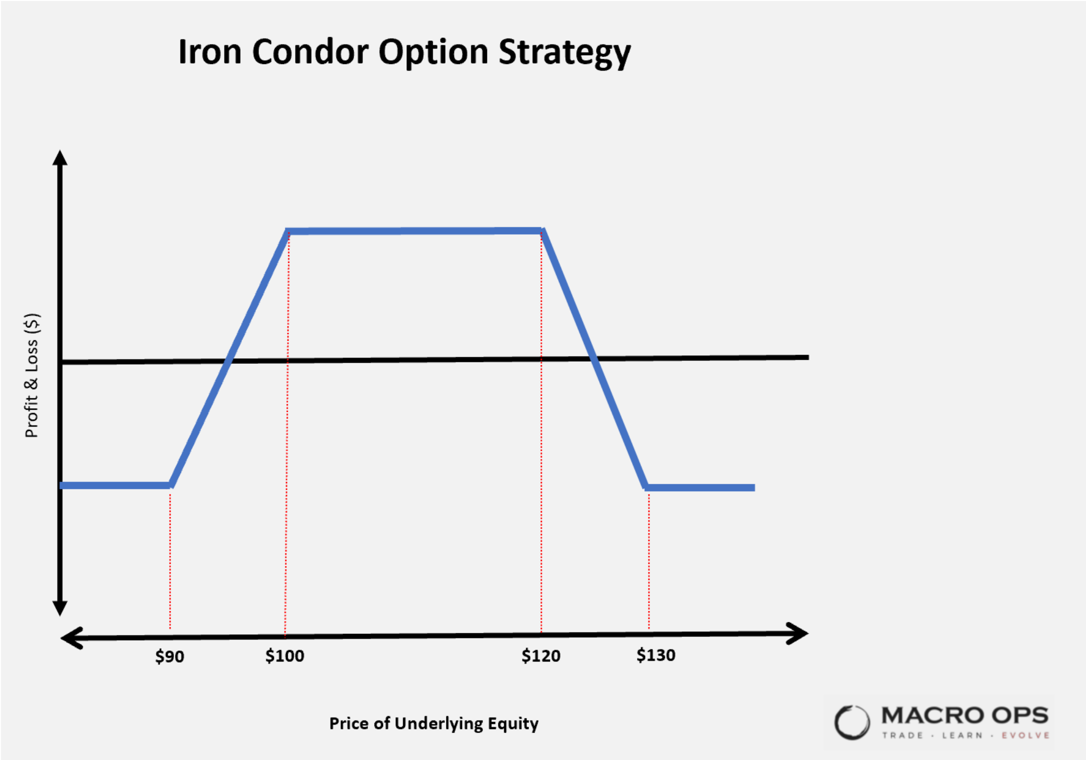
Iron Condor

An iron condor is deployed when an operator believes that the movement of the underlying equity will be neutral / trade sideways for an extended period of time. This is a neutral strategy. You do not want the underlying to move significantly in either direction, resulting in theta capture from both legs. The 'condor' component of the strategy name is given due to the two spreads that comprise each 'wing'.

Structure:
1 - Selling a bear put spread (bullish side of the condor)
2 - Selling a bull call spread (bearish side of the condor)



Maximum Profit & Risk:
Premium = (short put credit - long put debit) + (short call credit - long call debit)
Max Gain = realized when all premium is collected
Max Loss = maximum width between the two puts or the two calls (whichever wing is greater) - the premium collected



Option Greek Risk:
The primary purpose of an iron condor is to capture the maximum amount of theta, coupled with the OTM theta decay curve. As always, be on the lookout for any catalysts in the underlying which could prompt a sharp move in either direction. It is advisable to set the wings of the condor one sigma OTM (approximate Deltas of 34 and 68) to two sigma OTM (approximate Deltas of 5 and 95). This ensures the wings of the condor are spread far enough away from the expected price movement, but also know that the premium collected for a one-sigma OTM Iron Condor is much greater than premium collected for a two-sigma Iron Condor.

Iron Condor Tips:

- As a general rule, look to collect a minimum of 1/3rd the width of the strike price between a wing in premium under normal market operations.
- If market conditions look to trade sideways (neutral regime), it is permissible to collect 45% the width of the strike in premium.

Conversely, an operator can purchase an iron condor when he expects a large move in the underlying in a short period of time, however is unsure of directionality. Instead of selling the two spreads, buy them. The P/L graphic above is reversed for a long iron condor.

Poor Man's Covered Call (PMCC)
A PMCC is a capital efficient strategy that allows an operator to mimic a covered call position. Instead of needing to own 100 shares of the underlying equity per contract, an operator can initiate this ‘covered call’ position synthetically.

Structure:
Step 1 - Long a DITM (deep in the money) call option with Delta ranging from ~0.75 to 0.9. At these Delta levels, the call option will act very closely to the movement of the underlying stock. Additionally, ensure that this call option is placed to expire at a significant amount of time in the future. This component of the PMCC is colloquially referred to as a LEAP, or ‘Long Term Equity Anticipation Security’. It is important to note that the farther out in time an operator chooses to long a call option, the more premium he will pay.

Step 2 - Next, short an OTM call option around ~30 Delta at a much shorter time period with respect to the LEAP. Selling this call option allows an operator to collect premium and capitalize from theta decay while holding onto the synthetic 100 shares of stock via the LEAP. Treat this call option like a normal covered call; once an operator’s desired amount of premium is collected, he should buy back the short call at the reduced price. An operator can then choose to long another OTM option with an expiry at a later date, and repeat the process at will.

Option Greek Risks:
Actively monitor the rate of ascension in the underlying stock price. The rise in Delta will eat away at any theta decay (accumulated profit in the form of premium) if this occurs.

Covered Call (CC)
A covered call involves an operator currently owning 100 shares of an underlying equity, and posting those shares as collateral through selling a call option at a strike he is comfortable with having them called away. He will sell the call at a predefined delta level (usually within the range of 20 to 40 Delta), and collect premium, collected daily through theta-decay. If the underlying equity does not reach or exceed the strike price come expiry, he will collect the maximum amount of profit, which is equal to the premium received initially, and his shares will not be called away. If the share price reaches or exceeds the strike price come expiry, the operator will have his shares called away but keep 100% of the premium. An operator can close out his position buying back the same covered call contract anytime until expiry.

Cash Secured Put (CSP)
A cash secured put involves an operator writing a contract to purchase 100 shares of an underlying equity at a select strike price. In exchange for keeping the required cash on hand, the operator is paid a premium, collected daily through theta-decay. If the underlying equity does not fall at or below the level of the strike price, he will collect the maximum amount of profit which is equal to the initial premium received. If the contract does fall at or below the strike price, the operator is forced to buy 100 shares of the underlying stock at the strike price. However, an can close out his position at any time until expiry by purchasing the same put contract.

Macro Ops Theta Capturer

Macro Ops has developed a small tool to assist operators in maximizing their theta collection when selling covered calls or writing cash secured puts.

To use the tool, please visit this link. Enter your desired ticker and desired delta level of choice in the respective fields. Allow the analysis a few minutes to complete (this routine searches through 5 years of daily option data).

A few notes:

- The tool works best with US equities
- It accepts the absolute value of your initial delta value for both puts and calls

Theta Capturer Interpretation Guide
In the middle column in the figures below, the current option chain along with the associated days to expiry are displayed.

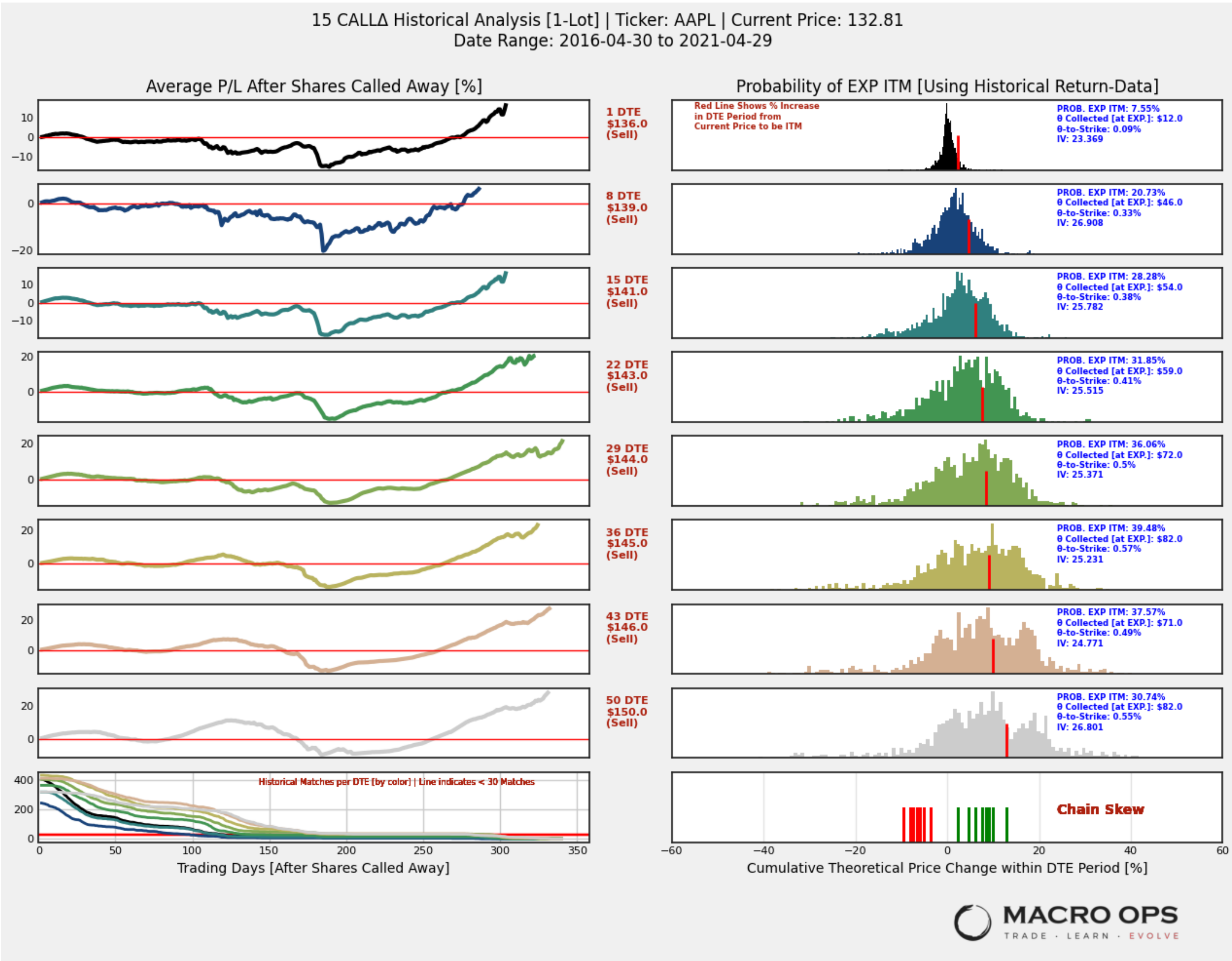
At left, data are collated for all occurrences when the option, starting from the input delta level (in this example 15 Delta), became ITM within the period of time indicated in each center column at expiry. The graph shows the resultant price action post-expiry.

At right, each graph displays a distribution indicating the cumulative change in price (%) that the underlying stock underwent within the given period of time until expiry. Additional information is provided for each contract, such as the maximum amount of premium collected (if the operator holds the option contract to expiry), the ratio of premium collected to the strike, and the respective IV level for each contract.

Aside from the historical component, operators may also use this tool to determine any theta arbitrage opportunities by comparing the levels of theta for each period of time until expiry.

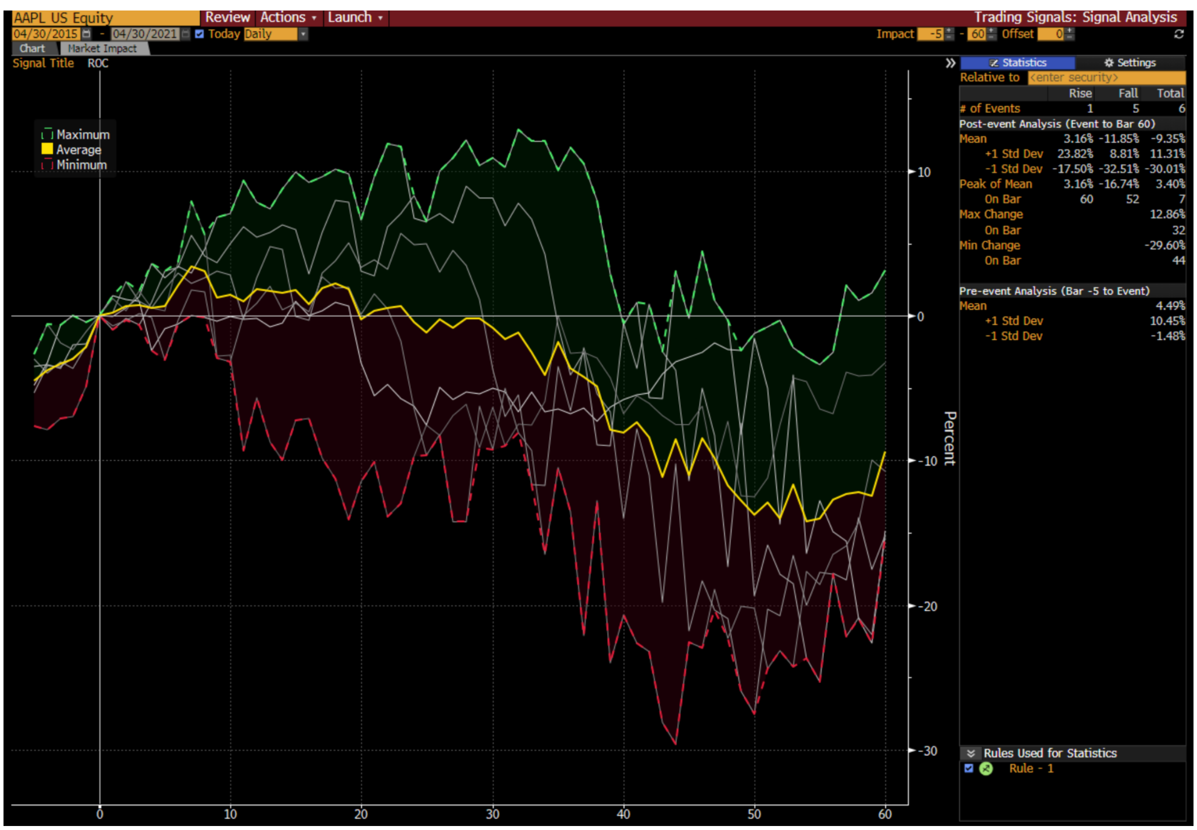
Tip: Common levels to sell calls and puts are between 15 and 35 Delta. When the analysis is complete, you will see figures like the following:

Covered Call Analysis

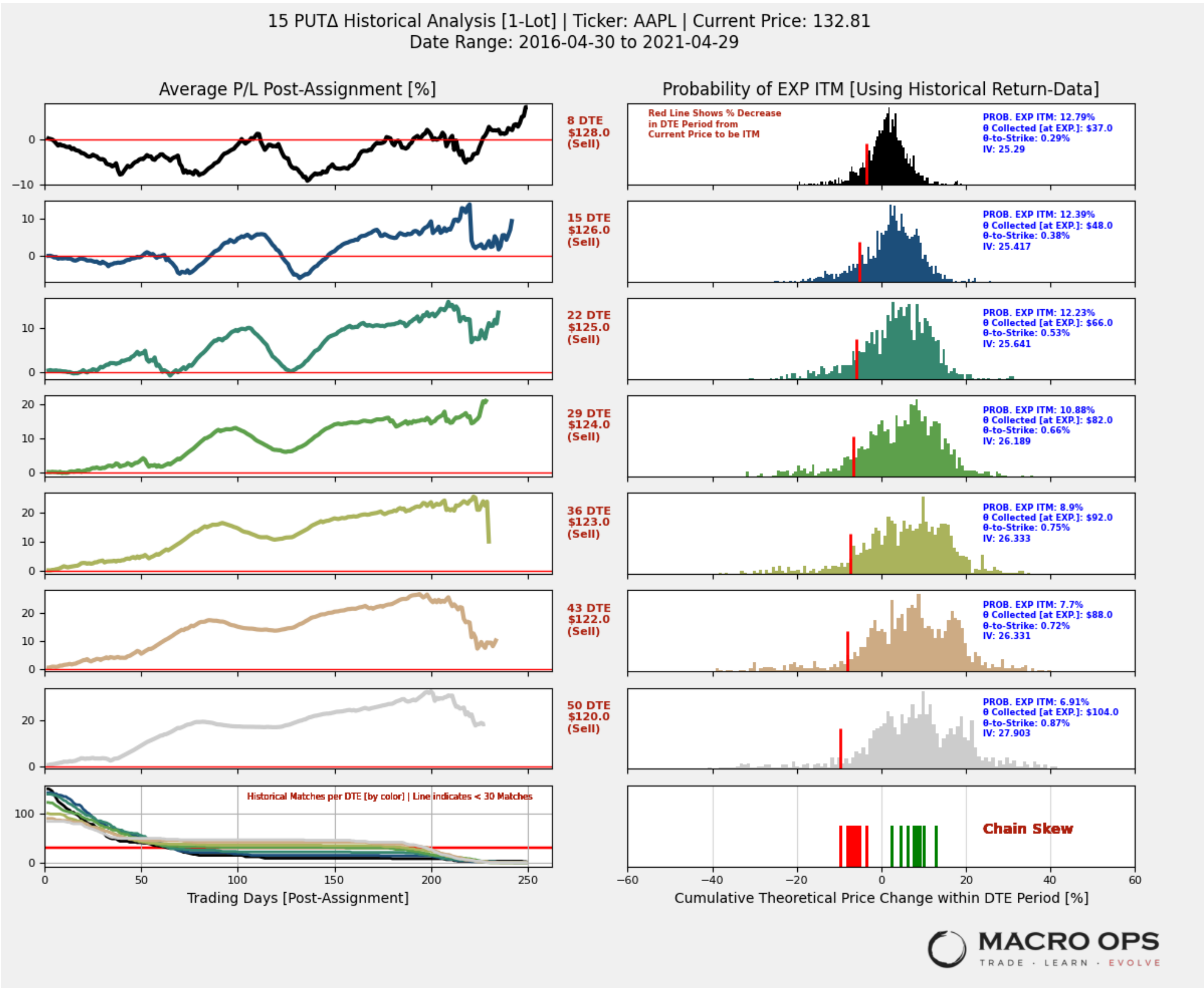


Tip: If an equity has an impressive runup, be sure to sell covered calls when the trend is showing signs of exhaustion. Below, a quick study was performed for AAPL's future 60-day returns when price action has exceeded a rise of 10% in the last 10 days, and the SQN indicator is well into a bull volatile regime (for demonstration purposes the SQN was set to a value of 3 or above:

We can see the future returns averaged a 10% drawdown in the next 60 days. Writing call options during these buy climax helps to offset any forthcoming drawdown due to increased IV.

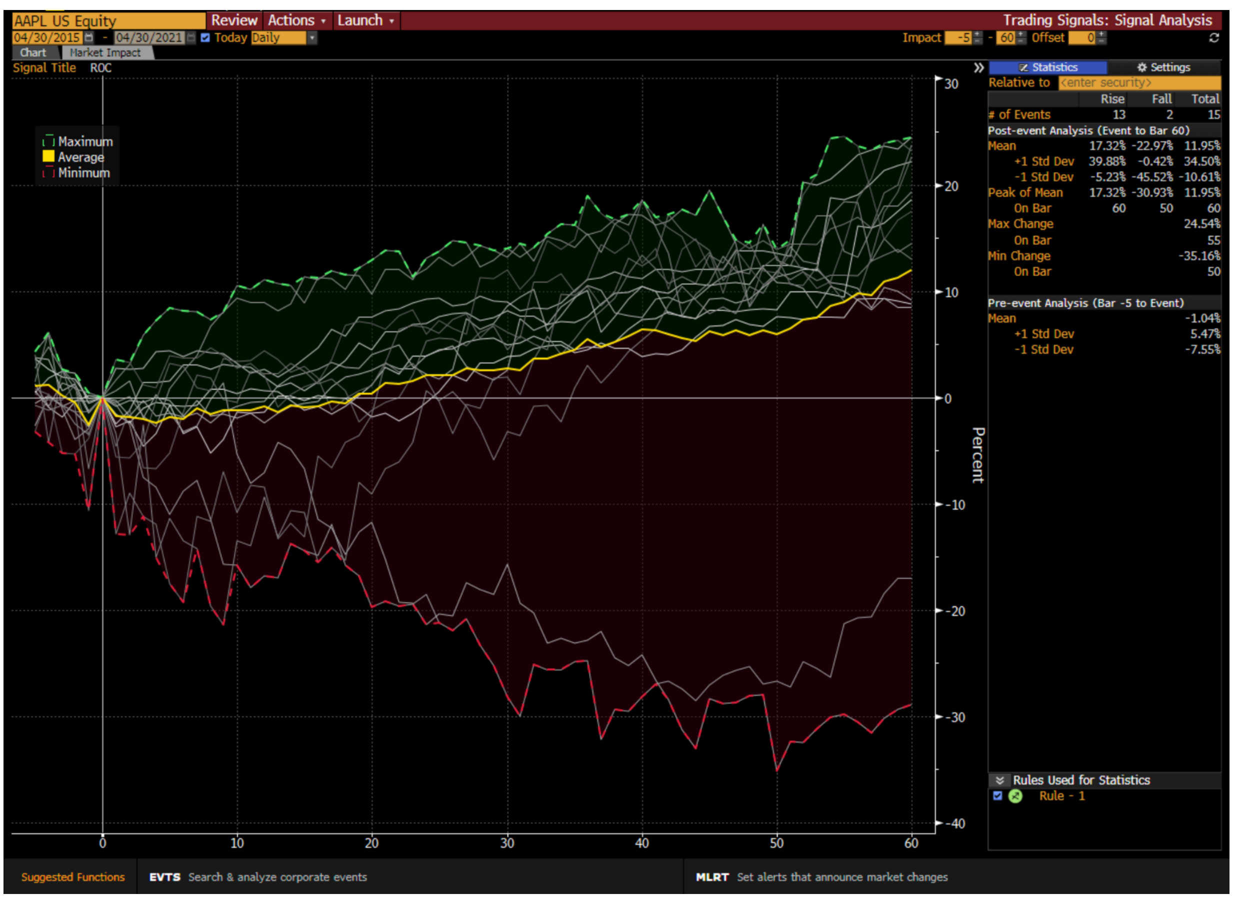


Cash Secured Put Analysis



Tip: It is also advisable to buy into weakness when in a bull-quiet regime, or to sell cash secured puts during these periods. The following results look at AAPL's future 60-day returns when it has dipped 5%:


AAPL US Equity
Review
Actions
Launch
Trading Signals: Signal Analysis
04/30/2015 - 04/30/2021
Today
Daily
Impact -5 - 60 Offset 0
Chart
Market Impact
Signal Title ROC
Track
Annotate
Zoom
AAPL US Equity 133.16
Statistics
Factors
Settings
Relative to
Rise Fall Total
# of Events 13 2 15
Post-event Analysis (Event to Bar 60)
Mean 17.32% -22.97% 11.95%
+1 Std Dev 39.88% -0.42% 34.50%
-1 Std Dev -5.23% -45.52% -10.61%
Peak of Mean 17.32% -30.93% 11.95%
On Bar 60 50 60
Max Change 24.54%
On Bar 55
Min Change -35.16%
On Bar 50
Pre-event Analysis (Bar -5 to Event)
Mean -1.04%
+1 Std Dev 5.47%
-1 Std Dev -7.55%
ROC (10) on Close (AAPL US) -0.7454
a (AAPL US) 0.00
b (AAPL US) 0.00
c (AAPL US) 0.00
d (AAPL US) 0.00
e (AAPL US) 0.00
f (AAPL US) 0.5442
Rules Used for Statistics
Rule - 1
2015
2016
2017
2018
2019
2020
2021
Suggested Functions
EVTS Search & analyze corporate events
MLRT Set alerts that announce market changes


AAPL US Equity
Review
Actions
Launch
Trading Signals: Signal Analysis
04/30/2015 - 04/30/2021
Today
Daily
Impact -5 - 60 Offset 0
Chart
Market Impact
Signal Title ROC
Statistics
Settings
Relative to
Maximum
Average
Minimum
Rise Fall Total
# of Events 13 2 15
Post-event Analysis (Event to Bar 60)
Mean 17.32% -22.97% 11.95%
+1 Std Dev 39.88% -0.42% 34.50%
-1 Std Dev -5.23% -45.52% -10.61%
Peak of Mean 17.32% -30.93% 11.95%
On Bar 60 50 60
Max Change 24.54%
On Bar 55
Min Change -35.16%
On Bar 50
Pre-event Analysis (Bar -5 to Event)
Mean -1.04%
+1 Std Dev 5.47%
-1 Std Dev -7.55%
Percent
Rules Used for Statistics
Rule - 1
Suggested Functions
EVTS Search & analyze corporate events
MLRT Set alerts that announce market changes