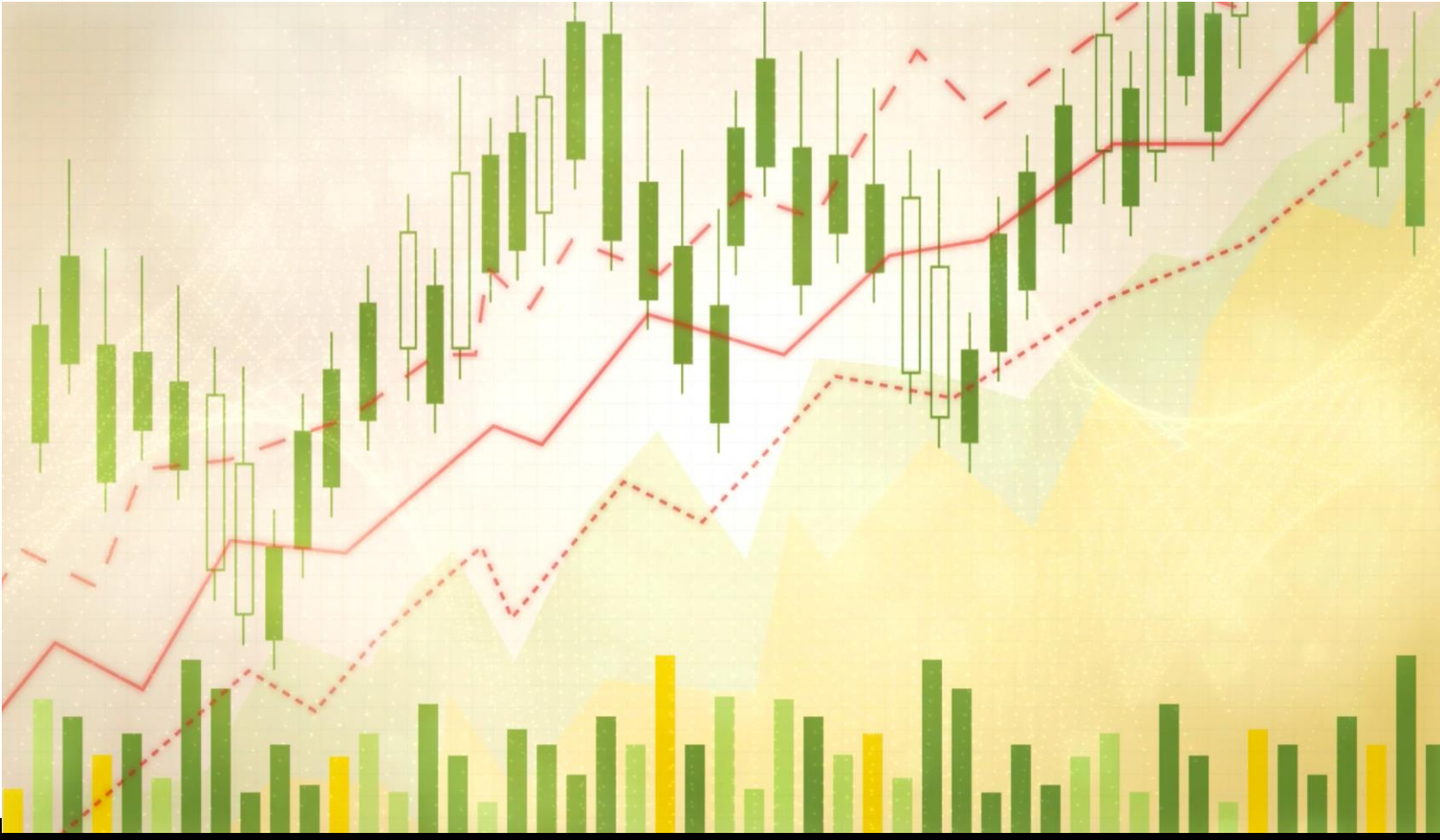

SIFMA Insights:

US Multi-Listed Options Market Structure Primer

September 2018

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Contents

SIFMA Insights Primers

The SIFMA Insights primer series is a reference tool that goes beyond a typical 101 series. By illustrating important technical and regulatory nuances, SIFMA Insights primers provide a fundamental understanding of the marketplace and set the scene to address complex issues arising in today's markets.

The SIFMA Insights primer series, and other Insights reports, can be found at: https://www.sifma.org/insights

Guides for retail investors can be found at http://www.projectinvested.com//markets-explained

SIFMA is the leading trade association for broker-dealers, investment banks and asset managers operating in the U.S. and global capital markets. On behalf of our industry's nearly 1 million employees, we advocate on legislation, regulation and business policy, affecting retail and institutional investors, equity and fixed income markets and related products and services. We serve as an industry coordinating body to promote fair and orderly markets, informed regulatory compliance, and efficient market operations and resiliency. We also provide a forum for industry policy and professional development. SIFMA, with offices in New York and Washington, D.C., is the U.S. regional member of the Global Financial Markets Association (GFMA). For more information, visit http://www.sifma.org.

Executive Summary

An option is a contract to buy or sell an underlying asset or security (stocks, ETFs, etc.) at a specified price on or before a given date. With an equity option, the contract holder (buyer) has the right, but not the obligation, to buy/sell (if a call/put) shares of the underlying stock. The writer (seller) of an option is obligated to sell/buy (if call/put) the shares to/from the buyer of the option at the specified price upon the buyer's request.

Contracts are detailed, and terms include strike price (price the contract may be exercised, or acted on) and an expiration date (point in time the option no longer has value, or no longer exists). Options are frequently used as a risk management tool by investors to hedge positions and limit portfolio losses. For example, an individual investor can buy a put as insurance to protect a stock holding against an unfavorable market move, while maintaining stock ownership.

Options provide flexibility, enabling an investor to tailor their portfolio to investment objectives and market environment, including:

- Protect from a decline in stock prices;
- Arrange to buy a stock at a set lower price in the future;
- Position the portfolio for expected market moves, even if direction of the move is unpredictable;
- Protect against sudden market movements and reversals, such as experienced with the 2010 Flash Crash;
- Boost portfolio returns without the costs or capital outlay of buying the individual stock (the initial investment is limited to the price of the option contract premium); or
- Generate income against stock holdings in your portfolio

As a standalone investment, most options strategies limit the risk to an investor but also present unlimited profit potential (depending upon whether the investor is the buyer or seller of the options contract). Options transactions also typically require less capital than single stock trades. For example, an equity option allows an investor to lock in the price at which he/she can buy/sell 100 shares of stock, paying only the premium or price of the option contract. This leverage enables investors to increase the potential benefit from stock price movements[1]:

- **Stock purchase**: Buy 100 shares of a stock priced at $50 = 100 * $50 = $5,000 total investment

[1] Source: Options Industry Council

- **Call option**: A call option with a $5 premium and a strike price of $50 = $5 * 100 (the option gives the holder the right to buy 100 shares) = $500 investment per option contract

- The stock price increases to $55

    - **Stock purchase**: Gain on the investment = $55 / $50 – 1 = 10%

    - **Call option**: With the increase in the underlying stock price, the premium increases to $7. Gain on the investment = $7 / $5 – 1 = 40%

While the initial capital outlay is less and the gain on investment is higher when the stock price increases, leverage also comes with a potential downside:

- The stock price decreases to $40

    - **Stock purchase**: Loss on the investment = $40 / $50 – 1 = -20%

    - **Call option**: With the decrease in the underlying stock price, the premium decreases to $2. Loss on the investment = $2 / $5 – 1 = -60%

    - Note, an option buyer's loss will be limited to the premium paid for the option contract

While institutional investors have long been users of options – and growth continues in this segment – we have seen a growing usage of options strategies by individual investors to leverage their positions with less capital and bolster portfolio returns.

Fundamentals of Listed Options

Terminology

An option is a contract to buy or sell an underlying asset or security (stocks, ETFs, etc.) at a specified price on or before a given date. The following terms are used in the options industry to analyze and value options contracts:

- **Exercise** – To put into effect the right specified in a contract; ex: the owner of a call/put may buy/sell the underlying stock
- **Underlying** – The underlying asset or security is the instrument on which the options contract is based, or the asset being bought or sold upon exercise notification; ex: a common stock for an equity option
- **Expiration** – The set date at which the options contract ends, or ceases to exist, or the last day it can be traded. Expiration Friday is the last business day prior to the option's expiration date, typically the third Friday of the expiration month for equity options
- **Strike price** – The set price at which the options contract is exercised, or acted upon
- **Premium** – The purchase price of the options contract, or the price the option contract trades at, which fluctuates constantly. The option holder's potential loss is limited to the premium, while the writer's potential loss is unlimited, offset by the initial premium received for the contract.
- **Time decay** – The longer the time remaining until expiration, the higher the premium. Or, the longer the option's life, the greater the probability the option will move in the money. The time value portion of an option's premium decreases as time passes. Time decay increases significantly in the last few weeks of an options life.

Options come in two standard styles, with differences in when the options can be exercised:

- **American** – Option may be exercised on any trading day on or before expiration
- **European** – Option may only be exercised on expiration

Options can have one of two types of rights (from the viewpoint of the holder or buyer):

- **Call** – The right to buy the underlying security (ex: 100 shares of the underlying stock for an equity option), on or before expiration at the strike price

- **Put** – The right to sell the underlying security, on or before expiration at the strike price

An investor can buy (long) or sell (short) either type depending upon their investment objectives. In either case, an investor can let the contract expire (take no action) or sell the contract to another investor. An investor's "right" varies depending upon whether they are buying or selling the contract. The holder's, or buyer's, rights are as listed above – the option, but not the obligation, to buy, sell or not to exercise. The writer, or seller, is actually obligated to buy and deliver the underlying if the holder, or buyer chooses to exercise. Writers have no control over whether or not the contract is exercised (they can purchase an offsetting contract to meet the terms, i.e. close the original contract).

Difference Between Holders & Sellers

	Holder (Buyer)	Writer (Seller)
Call	Right to buy	Obligation to sell
Put	Right to sell	Obligation to buy

Pricing an Option

The price of the option is a function of supply and demand in the market, as with individual stocks. Options pricing is also influenced by characteristics and volatility of the underlying security. Options must be in the money (value greater than $0, described in the next section) to have intrinsic value.

The following walks through the basics of options pricing:

Options Pricing					
Calls	**IV**	**=**	**P**	**-**	**X**
Puts	**IV**	**=**	**X**	**-**	**P**
Option Premium	**OP**	**=**	**IV**	**+**	**TV**

- **Current stock price** (P) – Price of the underlying stock
- **Strike price** (X) – Price the contract may be exercised, or acted on
- **Intrinsic Value** (IV) – The in-the-money portion of an option's premium (for a long position), equal to the difference between the stock price and the strike price
    - Calls – In-the-money when the underlying security's price is higher than the strike price
    - Puts – In-the-money if the underlying security's price is less than the strike price
- **Time Value** (TV; also called extrinsic value) – Any premium in excess of intrinsic value before expiration, reflecting the hope the option's value increases before expiration due to a favorable change in the underlying security's price
- **Option Premium (OP)** – Intrinsic value plus time value

The following factors can impact an options premium:

- **Stock price** – As the value of the underlying security rises, the premium on a call/put option will generally increase/decrease
- **Strike price** – As the option becomes further in-the-money/out-of-the-money, the premium generally increases/decreases
- **Passage of time**, changing time until expiration – An option's time value generally decreases the closer it gets to expiration, for both puts and calls (most noticeable with at-the-money options)
- **Implied volatility** – While difficult to quantify, higher volatility indicates greater expected changes in the underlying security's price and typically raises options premiums for both calls and puts, because it implies a

higher probability the option will move in-the-money (most noticeable with at-the-money options)

- **Interest Rates** – The impact is less significant and reflects the cost to carry shares of the underlying security (potential interest paid for margin or interest which could be earned from another investment, i.e. U.S. T-bill)

- **Dividends** – The impact is less significant and reflects the cost to carry shares of the underlying security (dividends lost from not owning the shares outright)

Moneyness and Profit

The value of an option is determined by whether or not the option is in-the-money (worth greater than $0) or out-of-the-money at expiration. Moneyness can be described as:

- **In-the-Money** – For a call option, when the stock price is greater than the strike price; reversed for put options

- **At-the Money** – Stock price is identical to the strike price; the option has no intrinsic value

- **Out-of-the-Money** – For a call option, when the stock price is less than the strike price; reversed for put options

Options Moneyness			
In-the-Money			
Calls	**P**	**>**	**X**
Puts	**P**	**<**	**X**
At-the-Money			
Calls	**P**	**=**	**X**
Puts	**P**	**=**	**X**
Out-of-the-Money			
Calls	**P**	**<**	**X**
Puts	**P**	**>**	**X**

Call Option Example:

If stock A is trading at $15 (**P**), and the strike price is $12 (**X**) -- the call option is in-the-money.

If stock A is trading at $15 (**P**), and the strike price is $16 (**X**) -- the call option is out-of-the-money.

Note: Reversed for put options

- **Profit** – When an investor buys an option, he/she begins with a net debit, i.e. money spent that may not be recovered. The option premium will then be subtracted from the gross transaction profit to calculate net profit. The reverse is true for sellers of an option (begin with a net credit). The option's potential loss is limited to the premium if buying an option; the writer of an option has potential unlimited loss, offset by the premium received.

Mapping Options Strategies

Options are flexible in terms of strategies offered, providing investors the tools needed to meet a host of different investment objectives and risk tolerances. Options can protect portfolios or improve returns in rising, falling or neutral markets (or a sharp move in markets in either direction). Most options strategies possess limited risk but also limited profit potential. Options transactions (generally) require less capital, thereby returning smaller dollar amounts but (potentially) a greater percentage of the investment versus equivalent stock transactions.

Options are often used as a risk management tool to hedge an investment portfolio and limit potential losses. For example, if an investor expects stock prices to decline, they can purchase put options. This will ensure the investor can sell the stock at the contracted strike price, no matter how far the stock price drops. When purchasing put options to hedge against declining stock prices, the loss is limited to the price paid for the premium. However, choosing an options strategy to limit risk may also limit the potential return.

Regardless of the options strategy, both gains and losses can be realized quickly, with the risk varying by strategy. Risks further differ by whether you are a holder or writer of the option contract. Holders risk the premium paid, but writers can face much higher levels of risk. For example, with an uncovered call, there is no cap upon how high a stock price may move, which presents potential unlimited losses for the call writer. The investor of this side of the contract must go into the market to purchase the stock at these higher prices, as he is obligated to deliver (sell) the stock to the call holder.

Put Option versus Stop-Loss Order

As an example, an investor owns a stock. This investor can (a) buy a put as insurance to protect against an unfavorable market move or (b) put on a stop-loss order, designed to stop losses below a predetermined price set by the investor. Problems with the stop-loss strategy can occur if negative news breaks after the market close, leading to the stock opening up the following day at a price significantly below the day one close. Because the price closed above the stop-loss order price (Day 1 closing trade $101, stop-loss $90), the stop-loss order did not trigger. If day two's opening price is significantly below the investor's stop-loss order price, he/she could experience significant losses (the loss will equal the difference between day one closing and day two opening prices, as shown in the table below). Had the investor purchased a put option, their loss would be limited to the cost of the option plus the difference between the day one closing trade and the strike price.

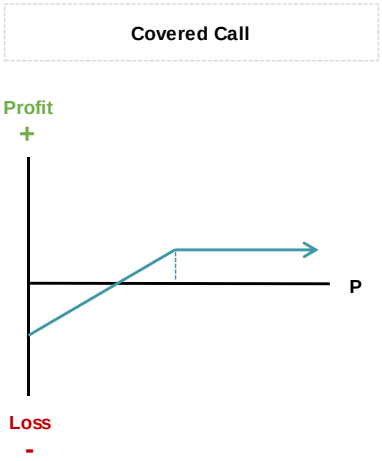
The difference in the two strategies, or the net savings for using a put option, can be calculated as:

Stop-Loss Order: When the market closes, the stop-loss was not active		
Purchase Price of Stock	$100	
Stop-Loss Order	$90	
Day 1 Closing Trade	$101	**A**
Day 2 Opening Trade	$25	**B**
LOSS	$76	**C = A - B = difference between closing prices**
Put Option: Options continue after trading hours and will trigger at the open		
Cost of Option	$5	**D**
Strike Price	$90	**E**
Day 1 Closing Trade	$101	**A**
Day 2 Opening Trade	$25	
LOSS	$16	**F = (A - E) + D = (difference between Day 1 closing trade and the strike price) + the cost of the option**
DIFFERENCE	**($60)**	**= F - C** (net savings)

Writing a Covered Call

A common options strategy is writing a covered call, i.e. the call is covered by an equivalent long stock position. The covered call writer expects a steady or slightly rising stock price in the near to medium term (the length of the contract); they do not expect a significant increase/decrease in the stock price. A covered call provides a small hedge on the stock (downside protection) while earning a premium income and thereby increasing overall returns on a stock holding, albeit the investor temporarily forfeits much of the stock's upside potential.

- Buy 100 shares of KMK stock
- Sell 1 KMK call with a strike price of $60
- Maximum gain = strike price - stock purchase price + premium received
- Maximum loss = stock purchase price - premium received
- Breakeven = starting stock price – premium received



Options Strategies by Investment Objective

The table below summarizes options strategies as they are positioned for outlook, investment objective or implied volatility. On the following pages, we map out select (not all) options strategies, showing the potential profit or loss scenarios, grouping them by the investment outlook on the underlying.

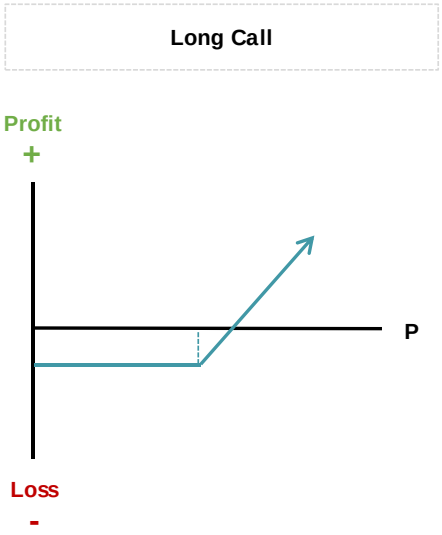
	Outlook				Objective			Implied Volatility	
	Bullish	Bearish	Neutral	Sharp Move	Acquire Stock	Hedge Stock	Generate Income	Increase	Decrease
Bear Call Spread		X	X				X		X
Bear Put Spread		X	X	X				X	
Bull Call Spread	X			X				X	
Bull Put Spread	X						X		X
Cash-Backed Call	X			X	X			X	
Cash-Secured Put	X		X		X		X		X
Collar	X					X			
Covered Call	X		X			X	X		X
Covered Put		X	X				X		X
Covered Ratio Spread	X		X			X	X		X
Covered Strangle	X		X		X		X		X
Long Call	X			X				X	
Long Call Butterfly			X						
Long Call Calendar Spread			X		X			X	
Long Call Condor			X						X
Long Condor				X				X	
Long Iron Butterfly				X				X	
Long Put		X		X				X	
Long Put Butterfly			X						
Long Put Calendar Spread			X					X	
Long Put Condor			X						X
Long Ratio Call Spread	X			X				X	
Long Ratio Put Spread		X		X		X		X	
Long Stock	X						X		
Long Straddle				X				X	
Long Strangle				X				X	
Naked Call		X	X				X		X
Naked Put	X		X				X		X
Protective Put	X			X		X		X	
Short Call Butterfly				X					
Short Call Calendar Spread				X					X
Short Condor			X				X		X
Short Iron Butterfly			X				X		
Short Put Butterfly				X					
Short Put Calendar Spread				X					
Short Stock		X							
Short Straddle			X				X		X
Short Strangle			X				X		X
Short Ratio Call Spread		X	X				X		X
Short Ratio Put Spread	X		X				X		X
Synthetic Long Put		X		X				X	
Synthetic Long Stock	X			X					
Synthetic Short Stock		X		X					

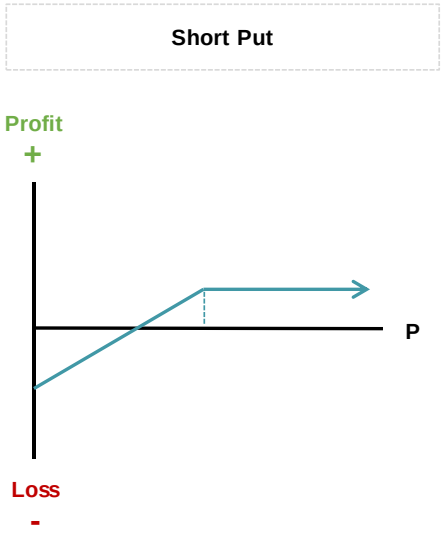
Source: Options Industry Council

Strategies for Expected Bull Markets

In bull strategies, the investor expects the price of the underlying to increase but also want to limit risk:

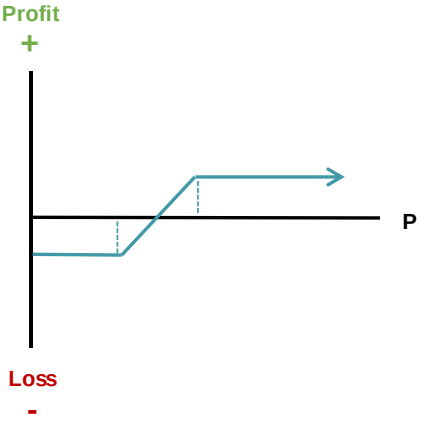
- **Long Call** – Buy a call
- **Short Put** – Sell a put
- **Bull Call Spread** – Buy a call and sell another call at a higher strike price
- **Bull Put Spread** – Sell a put and buy another put at a lower strike price with the same expiration
- **Covered Call** – Buy the stock and sell calls on a share-for-share basis
- **Protective Put** – Buy a put and own 100 shares of the stock
- **Cash-Secured Short Put** – Sell a put and hold cash equal to the strike price times 100



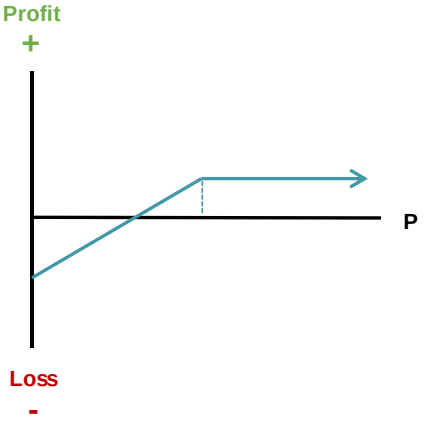


Source: The Options Industry Council (P = stock price)

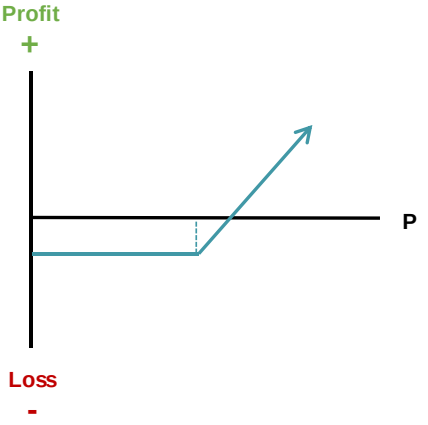
Bull Call/Put Spread



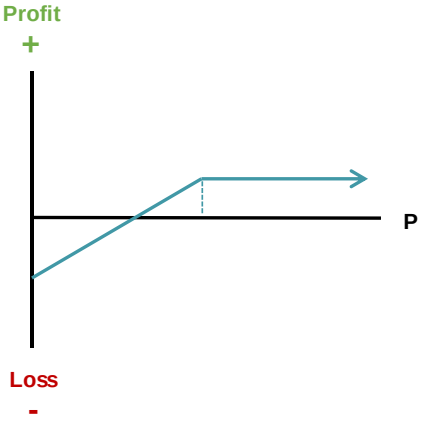
Covered Call



Protective Put



Cash-Secured Short Put



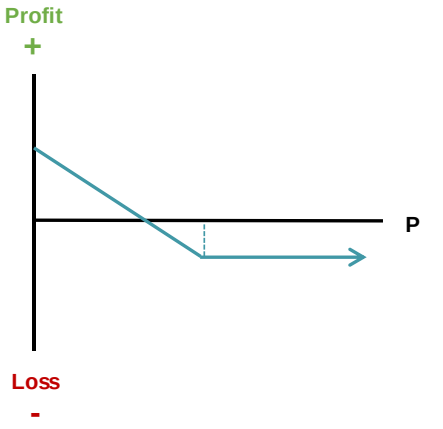
Source: The Options Industry Council (P = stock price)

Strategies for Expected Bear Markets

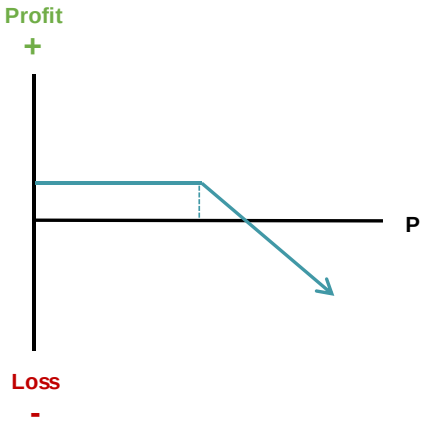
In bear strategies, the investor expects the price of the underlying to decrease but also want to take on less risk:

- **Long Put** – Buy a put
- **Short Call** – Sell a call
- **Bear Put Spread** – Sell a put and buy another put at a higher strike price
- **Bear Call Spread** – Sell a call and buy another call at a higher strike price

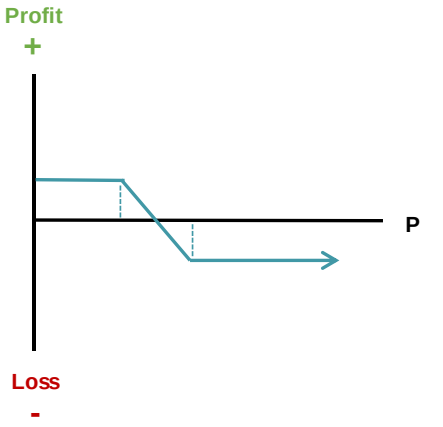
Long Put



Short Call



Bear Put/Call Spread



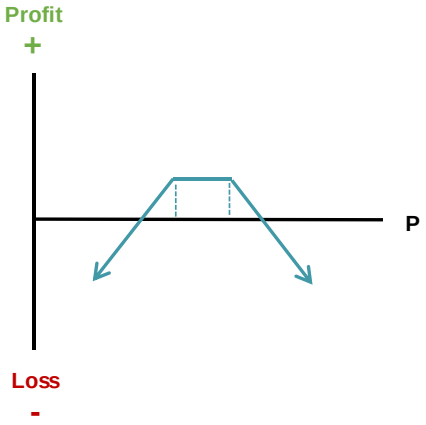
Source: The Options Industry Council (P = stock price)

Strategies for Expected Neutral Markets

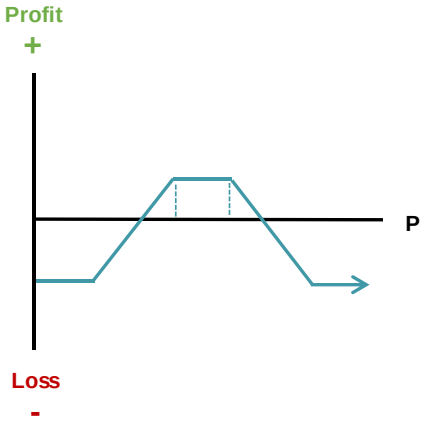
Market outlook is neutral or range bound, i.e. the investor expects no/little change in the underlying's price and is willing to limit upside potential in exchange for downside protection:

- **Short Strangle** – Sell a call with a higher strike price and sell a put with a lower strike price
- **Iron Condor** – Sell a call, buy a call at a higher strike price, sell a put and buy a put at a lower strike price; all options have the same expiration
- **Collar** – Own the stock and protect it by purchasing a put and selling a call with a higher strike price
- **Covered Strangle** – Own the stock, sell a call and sell a put
- **Long Call Butterfly** – Sell two calls, buy a call at a lower strike price and buy a call at a higher strike price; the strike prices are equidistant
- **Short Straddle** – Sell a call and sell a put at the same strike price
- **Calendar Spread** – Sell a call (put) and buy a call (put) at the same strike price but a longer expiration

Short Strangle

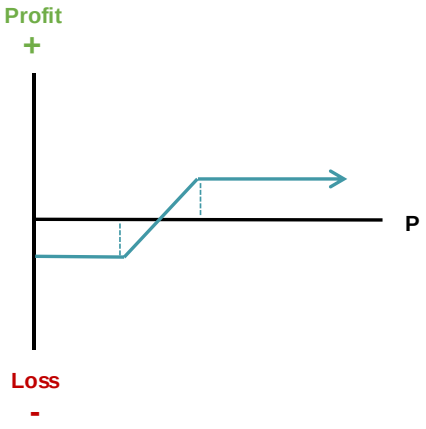


Iron Condor

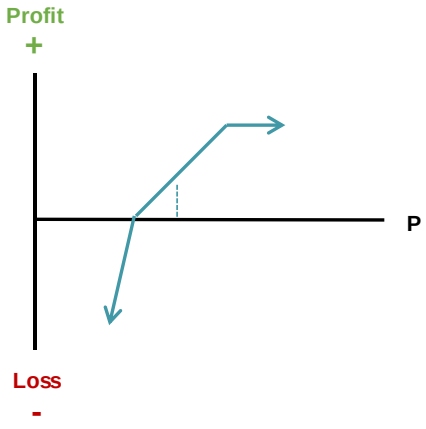


Source: The Options Industry Council (P = stock price)

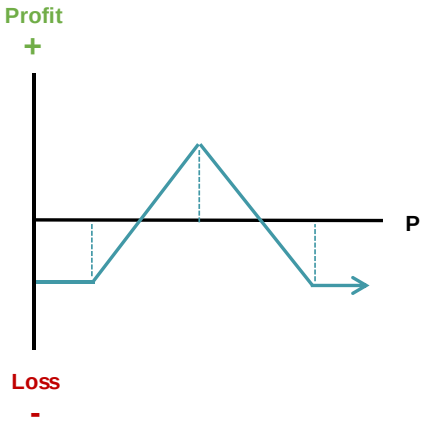
Collar



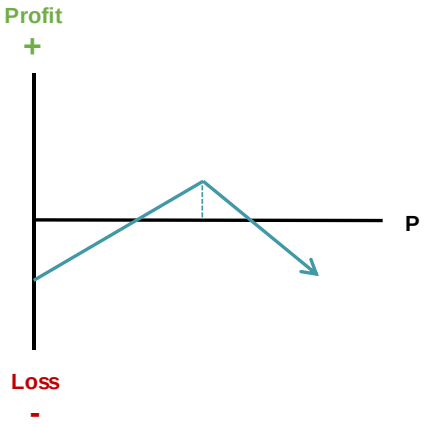
Covered Strangle



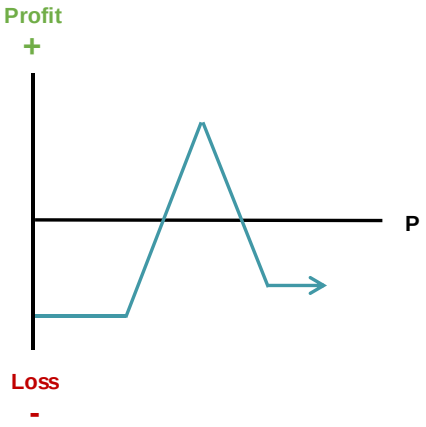
Long Call Butterfly



Short Straddle



Calendar Spread

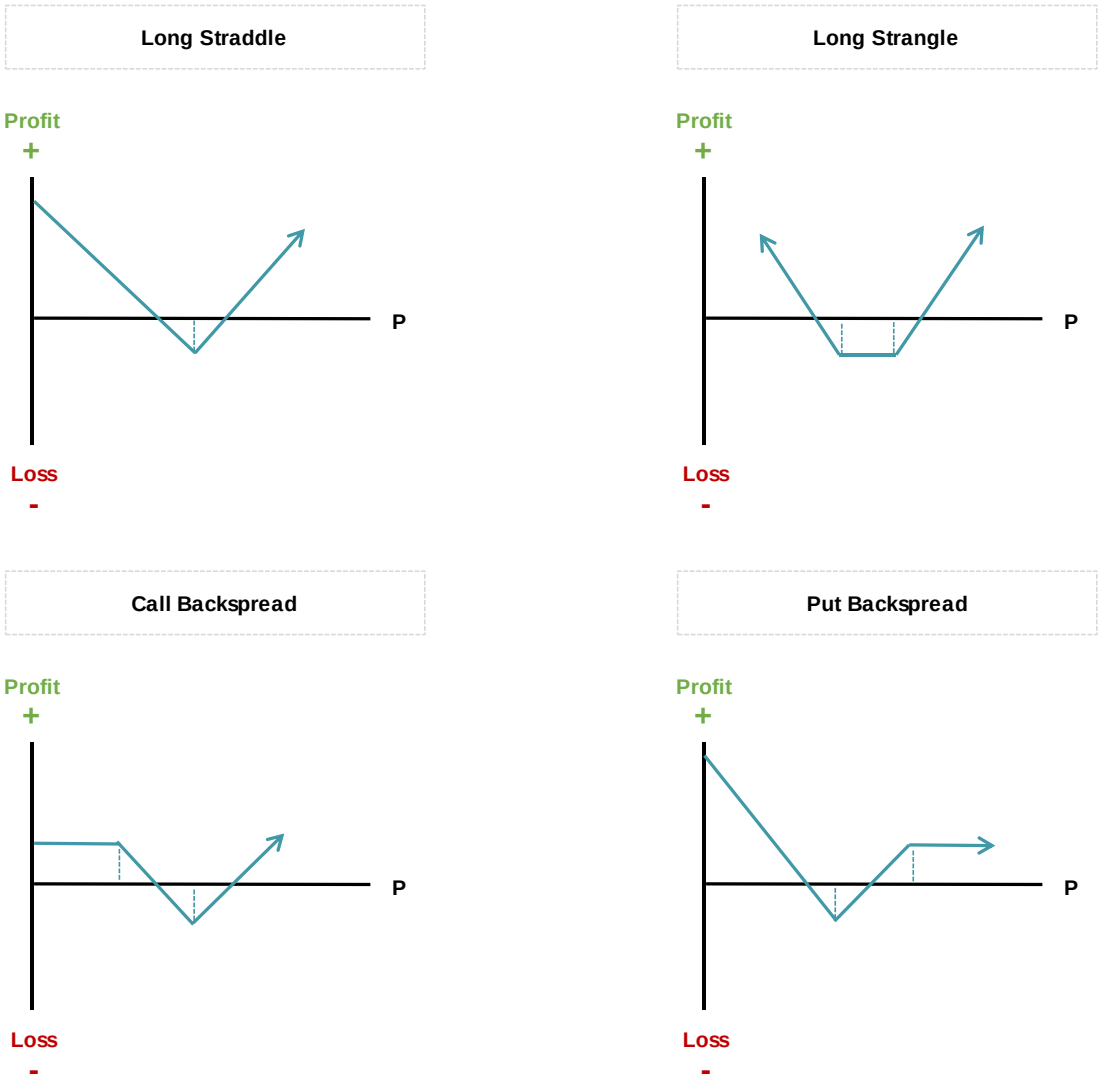


Source: The Options Industry Council (P = stock price)

Strategies for Expected Market Volatility

Investors expect large market moves, with prices moving either higher or lower, and want to position their portfolio to either profit from the price movement or provide downside protection:

- **Long Straddle** – buy a call and buy a put at the same strike price
- **Long Strangle** – buy a call with a higher strike price and buy a put with a lower strike price
- **Call Backspread** – sell a call and buy two calls at higher strike prices
- **Put Backspread** – sell a put and buy two puts at lower strike prices

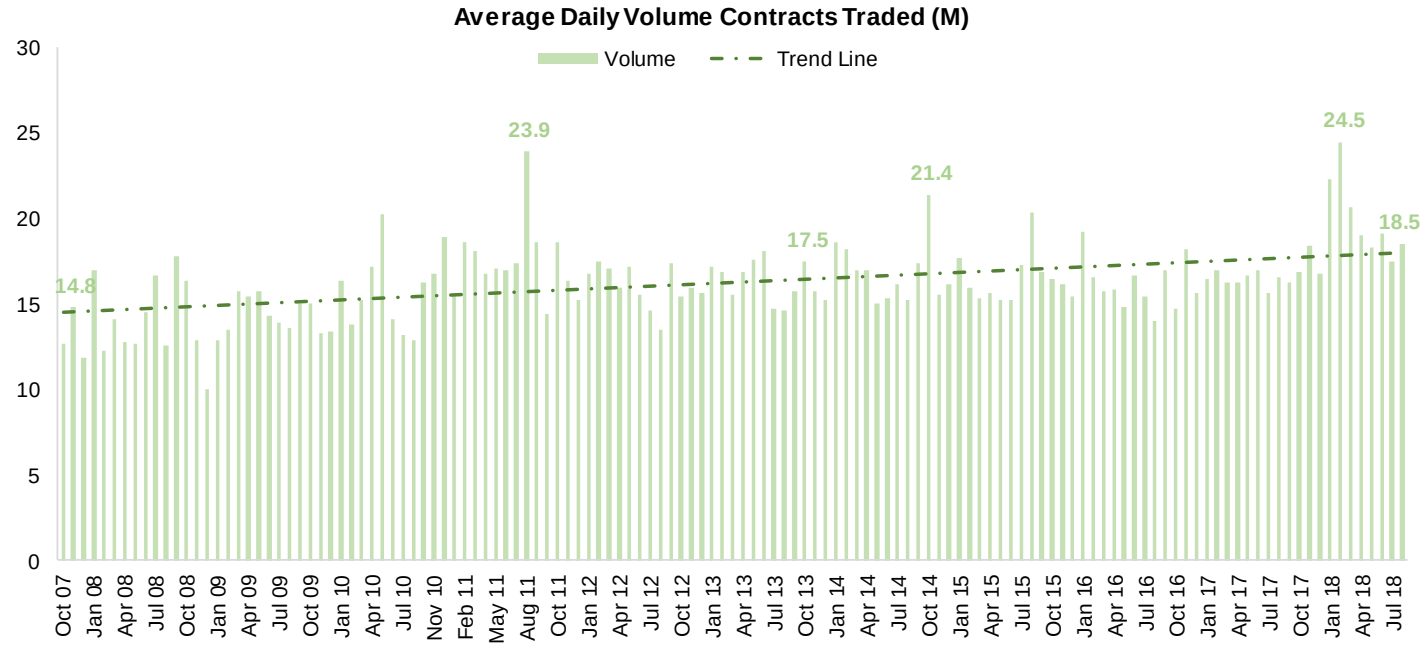


Source: The Options Industry Council (P = stock price)

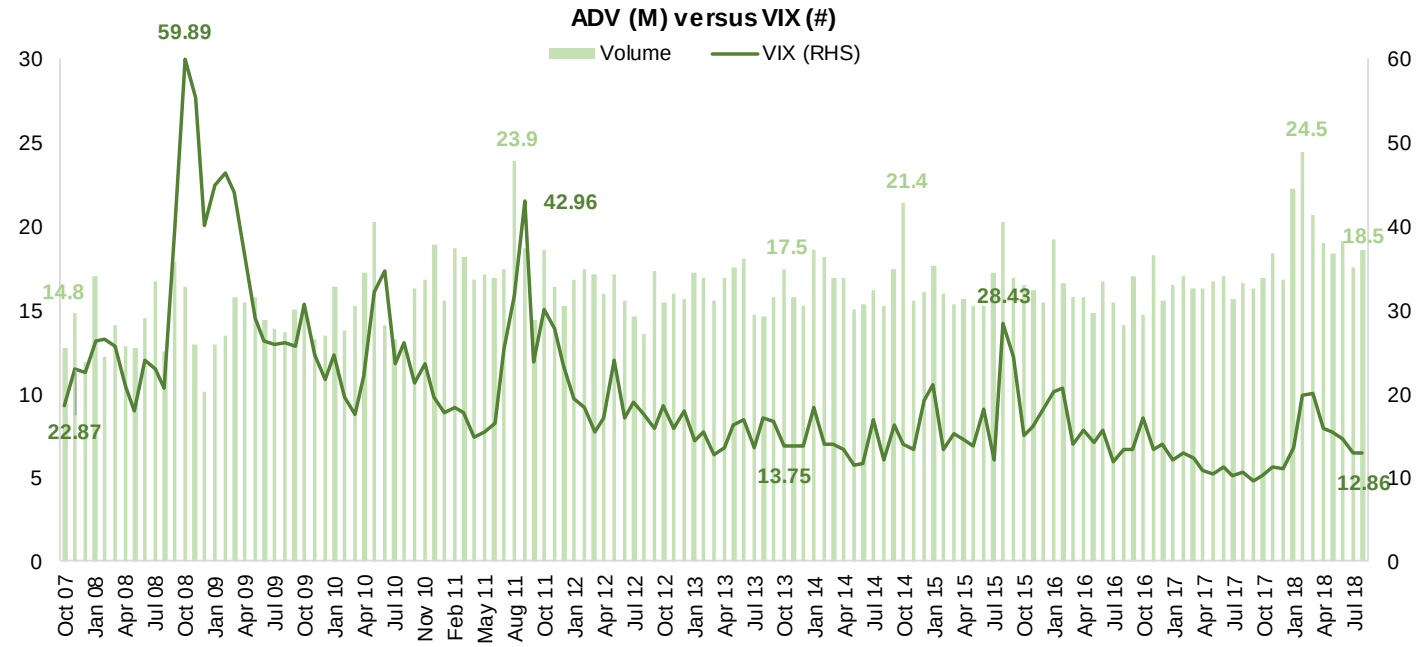
Drivers of Market Volumes

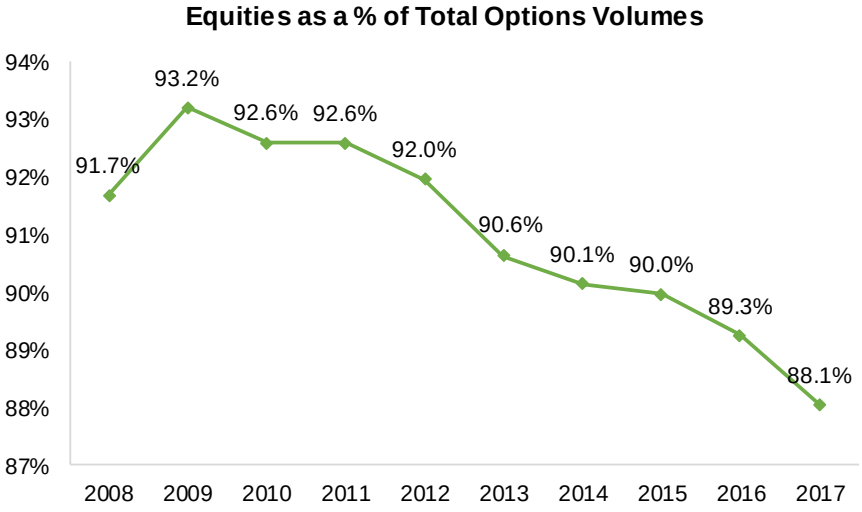
Sustained volatility is a driver of U.S. multi-listed options – market terminology meaning the same options contract is listed on multiple trading exchanges – and volatility has been well below historical rates since the financial crisis. The rolling average VIX has ranged between 12 and 13 since 2017. Options ADV was 18.5 million contracts traded in August 2018, up from 12.7 million in October 2007. The low was 10.1 million in December 2008, with a high of 24.5 million in February 2018. ADV averaged 19.0 million to 17.7 million over the last 12 to 24 months respectively. The seven month average was 19.7 million given the February peak in the VIX (19.85 versus the FY17 average 11.05), as volatility increased significantly over inflation and other economic concerns.

Listed options volumes are concentrated in a small number of symbols: a few popular ETFs and a select group of single-stock names. Equities continue to represent the largest asset class for options, 88.1% for 2017. Yet, this proportion has declined from the low 90%, as exchanges expanded product offerings, such as the Cboe SPX and VIX contracts. Additionally, there has been a growing usage of more advanced trading strategies by individual investors, using futures and options to leverage their positions with less capital to bolster returns. Many exchanges and dealers offer free education to investors to assist them in choosing options strategies.



Source: Options Clearing Corporation, SIFMA estimates

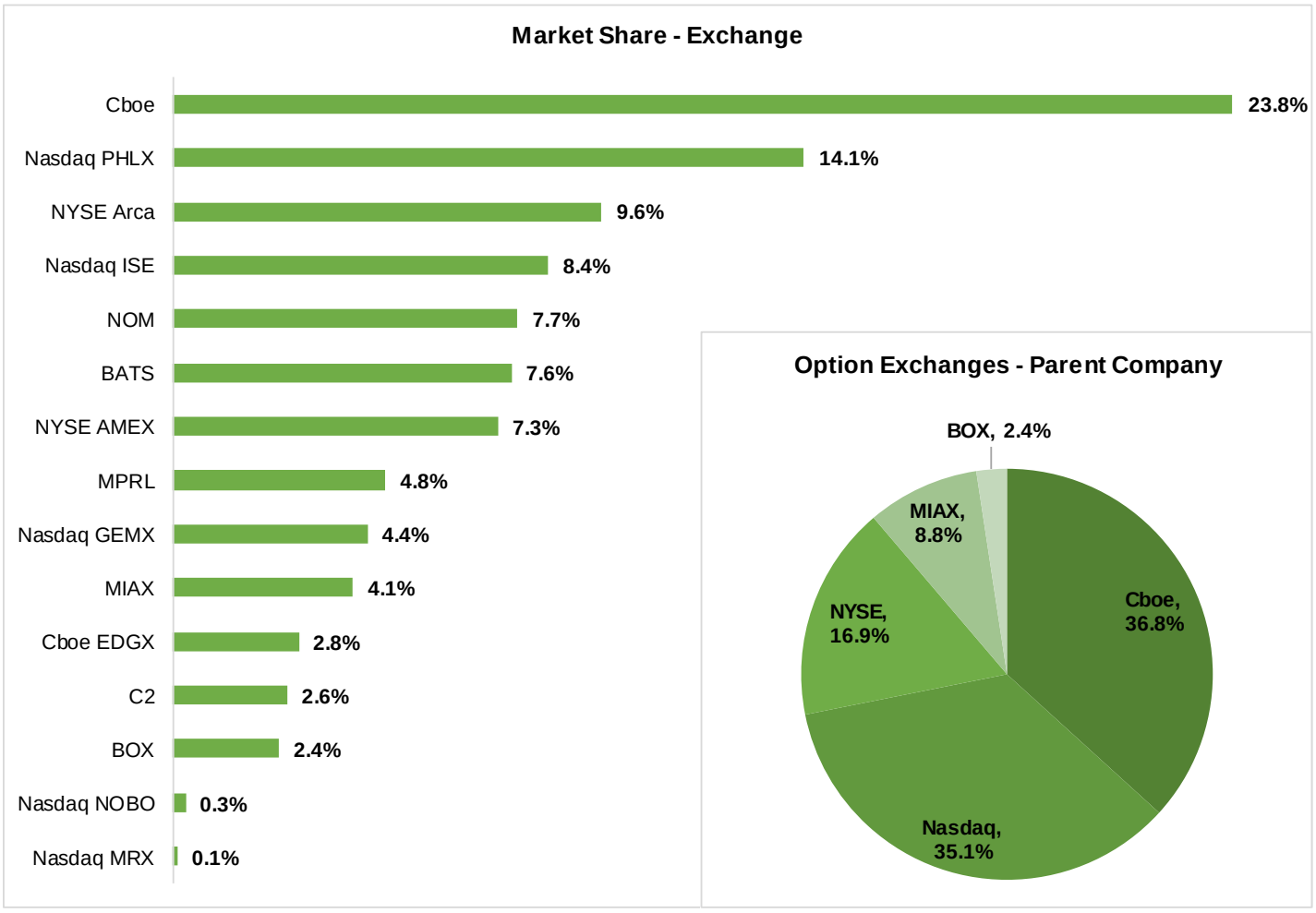




Source: Options Clearing Corporation, SIFMA estimates

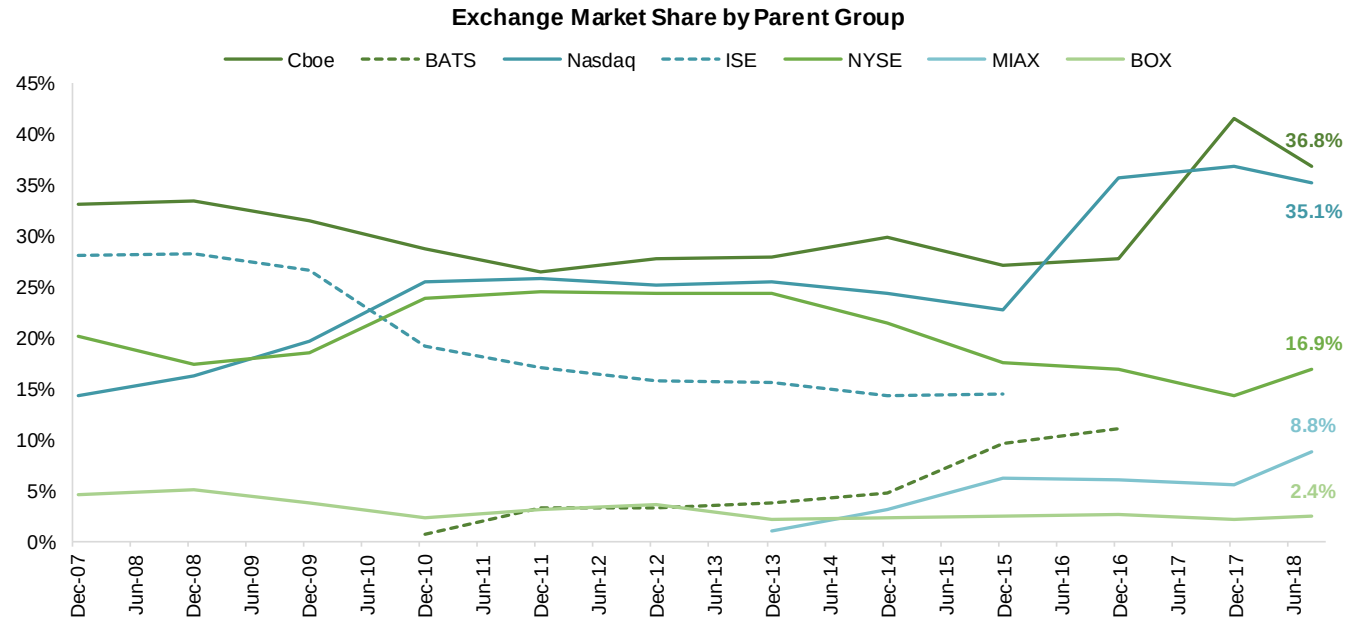
Evolution of the Market Landscape

There were two large mergers of options exchanges parent groups over the last few years: (1) Cboe acquired BATS in 2017 and (2) Nasdaq bought the ISE exchanges from Deutsche Börse in 2016. Therefore, within trading on exchanges, the top two exchange groups each hold 35%-37% market share in aggregate across all their individual exchanges, followed by 17% at the number three exchange group. Market share can vary within each exchange group's individual exchanges (different exchanges are set up to serve the various needs of end users, mainly based on pricing model), as shown in the following charts.



Source: Options Clearing Corporation, SIFMA estimates

Note: As of August 2018. Cboe =Cboe, BATS, Cboe EDGX, C2; Nasdaq = Nasdaq PHLX, Nasdaq ISE, NOM, Nasdaq GEMX, Nasdaq NOBO, Nasdaq MRX; NYSE = NYSE Arca, NYSE AMEX; MIAX = MPRL, MIAX. Intercontinental Exchange (ICE) owns the NYSE exchanges, as well as other exchanges and clearing houses across the globe.



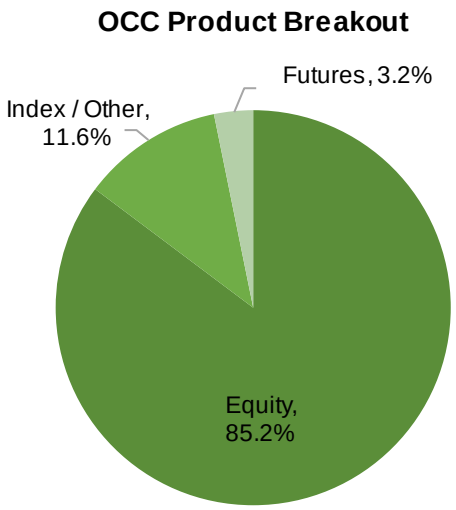
Source: Options Clearing Corporation, SIFMA estimates (as of August 2018)

Classes of Options

In the U.S., the industry clears all multi-listed options through the Options Clearing Corporation (OCC). Founded in 1973, the OCC clears the exchange traded multi-listed options discussed in this report, as well as OTC options, security futures and options on futures. It is regulated by the SEC and the CFTC.

The OCC breaks out the multi-listed contracts it clears into the following classes:

- Equity options (one equity option represents 100 shares of a stock)
- Index and other options
- ETFs
- Equity futures
- Index and other futures
- Debt options (no recorded data since 2013)
- Commodity and currency options



Source: Options Clearing Corporation (as of FY17), SIFMA estimates

Fun Facts on Options

An option is called an option for a reason – you have a choice. An option gives the option buyer the right, but not the obligation, to buy or sell the underlying asset at a set price on a set date. This differs from futures contracts, which are contracts with the obligation to buy or sell the underlying asset at a fixed price on a designated date. With futures, you either have to buy the asset or trade out of the futures contract. As an option buyer, you can either buy the asset or let the contract expire, taking no action. (Option sellers are obligated to buy and deliver the underlying security if the buyer chooses to act.)

No ownership. Options do not give the investor the same rights as shareholders (voting rights, dividends, etc.).

When multi isn't multi. After the options market shifted to multi listings in 2000, it became important for exchanges to develop proprietary products to set themselves apart from their competitors. The exchange creating proprietary options maintains exclusive rights to trade these contracts and indexes (or license the right to trade to other exchanges).

LEAP to the future. Equity LEAPS (Long-term Equity AnticiPation Securities) are long-term equity options, providing the holder the right to buy/sell shares of a stock at a set price on or before a date in the future of up to three years. LEAPS are available in calls and puts and are American style options. LEAPS enable investors with a longer term view of a stock to benefit from a stock price increase without making an outright stock purchase for those investors.

Markets close for days of mourning for U.S. presidents. Markets have a long tradition of closing for days of mourning, formally dating back to the burial of President Ulysses S. Grant in 1885 (albeit the NYSE closed in 1865 after the assassination of President Abraham Lincoln). Markets can also take up a shortened trading schedule, instead of a full day, as seen with former President Herbert Hoover's funeral in 1964. The last day of mourning was in 2006 for former President Gerald Ford, when markets closed for four consecutive days including the weekend and New Year's Day (markets hadn't closed for this long since the six-day closure during the September 11, 2001 terrorist attacks). Investor concerns around closures include the inability to reset positions should market-moving news break in other countries. Further, since the last day of mourning, markets have introduced options with weekly expirations, which will need to be managed differently than traditional monthly expiration contracts.

It's Halloween several times a year in options, with:

- Triple witching – The last hour of the trading day when contracts for stock index futures, stock index options and stock options simultaneously expire. It happens four times a year on the third Friday of March, June, September and December. It can bring escalated trading activity and volatility as traders close, roll or offset expiring positions.
- Quadruple witching – The same as triple witching, but inclusive of stock index futures, stock index options, stock options and single stock futures. Single stock futures were added in 2002.

The History of US Options Exchange and Market Events[2]

- **Ancient Greece**, Philosopher Thales of Miletus, predicting the next olive harvest would be significant, created essentially the first call option when he paid the owners of olive presses money to secure the rights to use the olive presses at harvest time. He then resold his rights to the olive presses to others who needed more olive presses at harvest time.
- **1630s**, Tulip Bulb Mania in Holland – As the demand for tulip bulbs increased at a dramatic rate, tulip growers would buy puts to protect from price decreases, while tulip wholesalers would buy calls to protect from price increases. As the demand for tulips increased prices of the bulbs, the options value also increased, forming a secondary market for these contracts. Eventually the bubble burst and tulip bulb prices plummeted, driving away buyers. Since the options market was unregulated, there was no way to force investors to fulfill their obligations.
- **1790**, Board of Brokers of Philadelphia (will become the Philadelphia Stock Exchange) founded
- **1817**, New York Stock and Exchange Board (will become NYSE) founded
- **1834**, **Boston** Stock Exchange (BX, formerly BSX or BSE) opened
- **Late 1800s**, American financier Russell Sage created call and put options to trade over-the-counter. He is also believed to have established a pricing relationship between the option, the underlying security and interest rates. Using put-call parity, he created synthetic loans by buying stocks and related puts, loaning money at an interest rate set by fixing contract prices and strike prices.
- **Late 1800s**, Put and Call Brokers and Dealers Association was formed to establish networks to match buyers and sellers of contracts more effectively. There was still no standard options pricing and a lack of liquidity in the market.
- **1864**, Oil Exchange (Pittsburgh Coal Exchange, Pittsburgh Oil Exchange; will become Pittsburgh Stock Exchange) founded
- **1864**, Open Board of Stock Brokers founded
- **1869**, Open Board of Stock Brokers merged with NYSE
- **1875**, Board of Brokers of Philadelphia renamed itself the Philadelphia Stock Exchange (PHLX)
- **1884**, Washington Stock Exchange began operating
- **1881**, Baltimore Stock Exchange opened
- **1882**, San Francisco Stock and Bond Exchange founded
- **1894**, Pittsburgh Oil Exchange rebranded as Pittsburgh Stock Exchange

[2] This section is not meant to be exhaustive of all U.S. exchanges or highlights in the history of options markets.

- **1899**, Los Angeles Oil Exchange founded
- **1908**, the New York Curb Market Agency was established, with formal trading rules for curbstone brokers
- **1928**, San Francisco Stock and Bond Exchange took the name San Francisco Stock Exchange
- **1929**, New York Curb Market Agency changed its name to New York Curb Exchange
- **1939**, National Association of Securities Dealers established as a SRO to play a leading role in the management of stock trading in the markets
- **1949**, Philadelphia Stock Exchange and Baltimore Stock Exchange merged
- **1953**, New York Curb Exchange changed its name to the American Stock Exchange (AMEX)
- **1954**, Philadelphia-Baltimore Stock Exchange merged with the Washington Stock Exchange
- **1956**, Pacific Coast Stock Exchange (becomes NYSE Arca) was formed with the merger of the San Francisco Stock and Bond Exchange and the Los Angeles Oil Exchange
- **1968**, Chicago Board of Trade (CBOT) decided to expand to options trading and eventually spun off the Chicago Board of Options Exchange (CBOE), which established open outcry trading pits (similar to futures exchanges)
- **1969**, Philadelphia-Baltimore-Washington Stock Exchange acquired the Pittsburgh Stock Exchange
- **1969**, Institutional Networks Corporation (Instinet) founded
- **1970s**, Standardized options contract terms created (uniform expiration dates, established strike prices, etc.)
- **1971**, National Association of Securities Dealers Automated Quotations (NASDAQ, now Nasdaq) founded as the world's first electronic stock market
- **1973**, The Pacific Coast Stock Exchange was renamed the Pacific Stock Exchange
- **1973**, CBOE opened the first formal options exchange, offering call options on 16 stocks
- **1973**, Economists Fischer Black and Myron Scholes developed the Black-Scholes options pricing model. Robert Merton published an additional study and mathematical amplification of the Black-Scholes model.
- **1975**, Cboe Clearing Corporation became The Options Clearing Corporation (OCC), the industry clearinghouse for all U.S. options trades
- **1977**, CBOE added put options
- **1977**, CBOE acquired the Midwest Stock Exchange's options business
- **1978**, CBOE automated order-routing and limit order book access
- **1982**, The industry reached 500,000 contracts traded in one day
- **1983**, CBOE introduced its first contracts on the S&P indexes (SPX)
- **1985**, CBOE introduced electronic execution of small customer orders (retail investors)
- **1989**, Options on interest rates began trading
- **1992**, Options on sector and international indexes began trading

- **1993**, CBOE introduced the VIX index, now widely viewed as the gauge of implied market volatility
- **1994**, TerraNova Trading was founded; it started accepting orders on Archipelago in 1997
- **1997**, CBOE launched the first options on the Dow Jones Industrial Average
- **1998**, Attain (will become Direct Edge) founded
- **2000**, Options began trading on multiple exchanges (multi listed)
- **2000**, International Securities Exchange Holdings (ISE) founded as the first fully electronic U.S. options exchange
- **2004**, BOX Holding Group (BOX) founded
- **2004**, NYSE merged with Euronext
- **2004**, CBOE Future Exchange (CFE) opened
- **2005**, Bats Global Markets (BATS) founded, launching as an alternative trading system
- **2005**, Nasdaq acquired Instinet (from Reuters, which acquired it in 1987; Nasdaq kept the INET electronic trading platform but spun off the rest of the Instinet businesses)
- **2005**, Archipelago acquired the Pacific Exchange
- **2006**, NYSE merged with Archipelago Exchange (ArcaEx, now NYSE Arca), an exchange on which both stocks and options are traded
- **2007**, Nasdaq merged with OMX, a leading exchange operator in the Nordic countries and renamed itself the NASDAQ OMX Group
- **2007**, BX was purchased by Nasdaq
- **2007**, PHLX was purchased by Nasdaq
- **2007**, Deutsche Börse bought ISE
- **2007**, Knight Capital Group spun off Attain (which it bought two years earlier) and rebranded it as Direct Edge, as an electronic communication network
- **2008**, NYSE Euronext acquired AMEX; AMEX was integrated with the Alternext European small-cap exchange and renamed NYSE Alternext US
- **2008**, Bats Global Markets became an operator of a licensed U.S. stock exchange
- **2009**, NYSE Alternext US rebranded as NYSE Amex Equities
- **2010**, CBOE opened C2 opens as an all-electronic exchange
- **2010**, Direct Edge received approval to operate licensed national securities exchanges
- **2010 Flash Crash**, In May 2010, the U.S. equity markets experienced “a severe disruption”, as a large number of stock prices suddenly dropped by significant amounts in a very short time period and then equally suddenly reversed to pre-decline levels. This led to a large number of trades being executed at temporarily depressed prices, including many that were more than 60% away from pre-decline prices.
- **2011**, Bats Global Markets acquired Chi-X Europe

- **2012**, Miami International Securities Exchange (MIAX) founded
- **2012**, NYSE Amex Equities changed its name to NYSE MKT
- **2013**, ICE acquired NYSE Euronext
- **2013**, ISE launched Gemini
- **2014**, Direct Edge merged with BATS
- **2013**, ISE launched Mercury
- **2016**, Nasdaq acquired ISE
- **2017**, NYSE MKT renamed NYSE American
- **2017**, CBOE acquired BATS
- **2017**, Trading on MIAX PEARL commenced

Appendix

Terms to Know

CFTC	Commodity Futures Trading Commission
FINRA	Financial Industry Regulatory Authority
SEC	Securities and Exchange Commission
SRO	Self-Regulatory Organization

ADV	Average Daily Trading Volume
ETF	Exchange-Traded Fund
Call	The right to buy the underlying security, on or before expiration
Put	The right to sell the underlying security, on or before expiration
Holder	The buyer of the contract
Writer	The seller of the contract
American	Option may be exercised on any trading day on or before expiration
European	Option may only be exercised on expiration
Exercise	To put into effect the right specified in a contract
Underlying	The instrument on which the options contract is based; the asset/security being bought or sold upon exercise notification
Expiration	The set date at which the options contract ends, or ceases to exist, or the last day it can be traded
Stock Price	The price at which the underlying stock is trading, fluctuates continuously
Strike Price	The set price at which the options contract is exercised, or acted upon
Premium	The price the option contract trades at, or the purchase price, which fluctuates constantly
Time Decay	The time value portion of an option's premium decreases as time passes; the longer the option's life, the greater the probability the option will move in the money
Intrinsic Value	The in-the-money portion of an option's premium
Time Value	(Extrinsic value) The option premium (price) of the option minus intrinsic value; assigned by external factors (passage of time, volatility, interest rates, dividends, etc.)
In-the-Money	For a call option, when the stock price is greater than the strike price; reversed for put options
At-the Money	Stock price is identical to the strike price; the option has no intrinsic value
Out-of-the-Money	For a call option, when the stock price is less than the strike price; reversed for put options

Investors	
Institutional	Organization, fewer protective regulations as assumed to be more knowledgeable and better able to protect themselves*
Retail	Individual, a non-professional investor
Accredited	Individual, income > $200K ($300K with spouse) in each of the prior 2 years OR net worth >$1M, excluding primary residence

*Types of institutional investors: endowment funds, commercial banks, mutual funds, hedge funds, pension funds and insurance companies

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