

A Practitioner's Guide to Volatility Products

Demystifying the Volatility Marketplace

Cboe Global Markets

This Guide was prepared in connection with the launch of Mini Cboe Volatility Index (Mini VIX[™]) futures on Cboe Futures Exchange, LLC (CFE). Before you trade Mini VIX futures, it's important to understand the following:

> Mini VIX futures are complicated financial products that are suitable only for sophisticated market participants.

> Mini VIX futures involve the risk of loss, which can be substantial and can exceed the amount of money deposited for the futures position.

> Market participants should put at risk only funds that they can afford to lose without affecting their lifestyles.

> Before transacting in Mini VIX futures, market participants should fully inform themselves about the characteristics and risks of Mini VIX futures, including in particular those described on this page. Mini VIX futures market participants also should make sure they understand the <u>product specifications</u> and the methodologies for calculating the underlying VIX[®] Index and the settlement values for Mini VIX futures.

Underlying Index: Mini VIX futures are based on the VIX Index, which is a financial benchmark designed to be a market estimate of expected volatility of the S&P 500[®]. The VIX Index is calculated by using the midpoint of quotes of certain S&P 500 Index options.
 (More information on how the VIX Index is calculated is available here and here.)

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- Not Buy and Hold Investment: Mini VIX futures are not suitable to buy and hold because:
- On their settlement date, Mini VIX futures convert into a right to receive or an obligation to pay cash.
- The VIX Index generally tends to revert to or near its long-term average, rather than increase or decrease over the long term.
- Volatility: The VIX Index is subject to greater percentage swings in a short period of time than is typical for stocks or stock indices, including the S&P 500 Index.
- Expected Relationships: Expected relationships with other financial indicators or products may not hold. In particular:
- Although the VIX Index tends to be negatively correlated with the S&P 500 Index—such that one tends to move upward when the other moves downward and vice versa—that relationship is not always maintained.
- The prices for the nearest expiration of Mini VIX futures tend to move in relationship with movements

in the VIX Index. However, this relationship may be undercut, depending on, for example, the amount of time to expiration for the Mini VIX futures contract and on supply and demand in the market for those futures.

- Mini VIX futures contracts trade separately from regular-sized VIX futures, so the prices and quotations for Mini VIX futures and regular-sized VIX futures may differ because of, for example, possible differences in the liquidity of those markets.
- Final settlement Value: The method for calculating the final settlement value of Mini VIX futures is different from the method for calculating the VIX Index at times other than settlement, so there can be a divergence between the final settlement value of Mini VIX futures and the VIX Index value immediately before or after settlement. (More information is available <u>here</u> and <u>here</u>.)

Additional Information: Further information concerning the VIX Index and concerning futures and options based on the VIX Index is available <u>here</u> and <u>here</u>.

This Guide also addresses Cboe Volatility Index (VIX[®]) options offered for trading on Cboe Exchange, Inc. (Cboe Options) and regular-sized VIX futures offered for trading on CFE. In addition to the previous statements, it's important to understand the following before you trade VIX options and VIX futures:

Options involve risk and are not suitable for all investors.trading is not suitable for all investors and involves thePrior to buying or selling an option, a person must receive
a copy of "Characteristics and Risks of Standardized
Options." Copies are available from your broker or from
The Options Clearing Corporation at 125 S. Franklin Street,
Suite 1200, Chicago, IL 60606 or at www.theocc.com. Futurestrading is not suitable for all investors and involves the
risk of loss. The risk of loss in futures can be substantial
and can exceed the amount of money deposited for a
futures position. You should, therefore, carefully consider
whether futures trading is suitable for you in light of your
circumstances and financial resources. For additional

information regarding futures trading risks, see the <u>Risk</u>. <u>Disclosure Statement set forth in Appendix A to CFTC</u>. <u>Regulation 1.55(c)</u> and the <u>Risk Disclosure Statement for</u>. <u>Security Futures Contracts</u>.

What is Volatility?

Volatility measures the frequency and magnitude of price movements, both up and down, that a financial instrument experiences over a certain period. The more dramatic the price swings in that instrument, the higher the level of volatility. Volatility can be measured using actual historical price changes (realized volatility) or it can be a measure of expected future volatility that is implied by option prices.

While we know much of this intuitively, volatility is often misunderstood. It can be associated with a negative connotation arguably because market participants tend to be more concerned about sharp downward moves as opposed to steadily rising prices. Historically, market participants benefited from the long-term tendency of the broad market to rise. This long bias is understandable, often profitable, and implicitly short volatility.

Demystifying the Volatility Marketplace

Volatility products trade much like any other asset class. Market participants start with an investment idea or opinion. Then, they decide how best to express their idea(s) utilizing the researched financial instruments they deem appropriate for their investment strategies.

In fact, each time a derivatives (option or futures) contract trades, one party becomes long volatility while the other party becomes short volatility.

To understand how long and short volatility positions may be used to generate profits and/or losses, it's important to first familiarize oneself with the different types of volatility.



Source: Cboe Options Institute and Zephyr StyleAdvisor Past performance is not predictive of future returns.

Types of Volatility

Realized Volatility: is backward-looking volatility that describes how the asset actually performed in the past, i.e. historical or actual volatility achieved.

Implied Volatility: is a forward-looking estimate derived from the price of an option through the use of a theoretical pricing model. Implied volatility levels change dynamically when derivative markets are open. Option prices reflect several factors that are directly observable or known such as the underlying price, the time until expiration, and strike price. Future volatility, however, is *unknown* and must be estimated.

The VIX Index is a measure of **expected volatility** that is implied from prices of options (the market) set to expire 30 days in the future. Expected and Implied volatility are related but unique.



What VIX Measures: Future Expected Volatility, 30 Days Out

The VIX Index is a calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500[®] Index (SPX[®]) call and put options. Remember, the VIX Index aggregates option price information without using an option-pricing model.

VIX[®] Index Product Suite:

The Cboe Volatility Index (VIX), Futures & Options

A Barometer of Market Sentiment – VIX Index

Like all indices, the Cboe Volatility Index is a measurement tool. The index itself is not a tradeable or arbitragable product.

The VIX Index is expressed as an *annualized* standard deviation expectation. As such, the VIX Index is a non-directional (up or down) forecast based on one-month SPX option strips. This information can be used to inform one's understanding of the magnitude of potential market movements and possibly the impact of such moves on one's portfolio. Like other forecasts, these estimates can change quickly, which presents both opportunity and risk. As a simple "rule of thumb," a VIX Index measuring 16 forecasts an +/- move of 16% annually for the S&P 500, which is equivalent to daily S&P 500 changes of ~1% and monthly +/- range of ~4.5%.

<u>Click here</u> for a handy calculator that shows what different VIX Index levels forecast about future market movement.



Volatility: Standard deviations from "expected"

The History of VIX

For the investor who knows what [s]/he is doing, volatility creates opportunity.

-John Train

$$\sigma^{2} = \frac{2}{T} \sum_{i} \frac{\Delta K_{i}}{K_{i}^{2}} e^{RT} Q(K_{i}) - \frac{1}{T} \left[\frac{F}{K_{0}} - 1 \right]^{2}$$

While the academic community was transforming our understanding of risk management in 1973, Cboe celebrated its founding and the first listed options trade.

That same year, the Nobel prize-winning options pricing formula first appeared in the Journal of Political Economy. The explicit link between continuous-time finance and options pricing was established by Robert Merton in his pioneering research in which

he coined the term "Black-Scholes options pricing model." The Black-Scholes formula utilizes observable parameters to calculate the average future volatility of the underlying asset. In 1993, the Cboe Volatility Index (VIX Index) was created and would soon emerge as the world's premier gauge of U.S. equity market volatility.

The defining inflection point for the VIX Index happened in 2004 when Cboe introduced VIX futures, transforming the VIX Index from a measurement tool to tradeable asset class. In 2006, Cboe listed VIX options.



VIX futures and options have become two of the most actively traded volatility products in the market. In 2019, VIX options had an average daily volume (ADV) of approximately 500k and VIX futures had ADV of about 250k. This compares to approximately 130k and 32k, respectively, a decade prior. This is a testament to much greater understanding of volatility trading and the products' broad utility.

VIX Characteristics

Groundbreaking products, like VIX futures and options, often have unique characteristics that appeal to market participants. In many ways, volatility exposure has become a new asset class. Volatility, by definition, is directionally agnostic with upper and lower bounds, as well as having other traits that may allow for unique investing strategies and opportunities.

Inverse Relationship with S&P 500

Generally, the VIX Index tends to have an inverse relationship with the S&P 500 Index. This negative correlation has earned the VIX Index the "fear gauge" moniker because the VIX Index has a tendency to move up quickly when the broad market declines with velocity. The inverse correlation of the VIX Index makes the tradeable futures and options contracts potentially attractive risk management or hedging vehicles. The negative correlation tends to improve (become more negative) during periods of meaningful macro duress (e.g., 2008 and 2020).



Expected volatility typically increases when markets are turbulent or the economy is faltering. In contrast, if stock prices are rising the VIX Index tends to fall or remain steady at the low end of the scale. Source: Cboe

Mean-Reverting

As a forward-looking indicator, the VIX Index also tends to be mean reverting; over time it will generally return or move back to its historical average. Volatility cannot move higher in perpetuity. It also cannot move to zero, which is distinct from equities. Volatility is a constant. It oscillates in a wide range around a mean (which changes over time). This inherent dynamic does not lend itself to buy-and-hold strategies.



Term Structure

The relationship between contract prices of different expiries is known as the product's term structure. It can be described by its shape as being in contango (near term is priced *lower* than longer term) or backwardation (near term is priced *higher* than longer term). Since 2007, the VIX futures term structure has been in contango (front month future at a discount to second month future) during approximately 80% of the daily observations¹, including those on February 19, 2020. However, when market expectations for near-term volatility rise, the term structure can shift into backwardation as it did during the market decline in March 2020.



¹CFA Institute, 2020, "The VIX Index and Volatility-Based Global Indexes and Trading Instruments."

VIX Index (^VIX)



VIX Options (VIX and VIXW) VIX options provide market participants with opportunities to hedge portfolio volatility risk distinct from market price risk and trade based on their view of the future direction or movement of volatility.

- \$100 multiplier.
- Both VIX and VIXW options are eligible for a portfolio margin account.
- VIX options trade during U.S. regular trading hours and a limited global trading hours session (2:00 a.m. to 8:15 a.m. CT).



The VIX Index is a calculation designed to produce a measure of constant, 30day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500 Index call and put options.



• VIX options are available in monthly and weekly expirations and have a

VIX Futures

VIX futures are designed to reflect the market's estimate of the value of the VIX Index on various expiration dates in the future and trade nearly 24 hours a day, five days a week.



Daily closing values. (Jan. 1990 - June 2020) The VIX Index is not investable. Sources: Bloomberg and Cboe Exchange, Inc

Mini VIX Futures (VXM)

- Notional contract size is \$100 times the VIX Index value or 1/10th the size of standard VIX futures.
- Designed to provide additional flexibility in volatility risk management and greater precision when allocating among smaller managed accounts.
- Aims to meet market participant demand for expanded offerings tracking the Cboe Volatility Index.
- Began trading August 10, 2020.

Standard VIX Futures (VX)

- Notional contract size is \$1000 times the VIX Index level and trades in increments of 0.05 or \$50 per tick (although calendar spreads may be quoted in increments of 0.01 or \$10 per tick).
- Monthly and weekly expirations available.
- VIX futures are the most frequently traded exchange-listed volatility futures contracts in the world.

Daily closing values, (Jan, 1990 - June 2020) The VIX Index is not investable. Sources: Bloomberg and Cboe Exchange, Inc.

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Use Cases

Risk Management: Capital Protection Through Portfolio Diversification & Hedging

The foremost concern for most investors tends to be capital protection, even when the additional objective of income generation is present.

The VIX suite of products uniquely affords market participants the opportunity to potentially insulate their capital from the risks associated with large, unexpected market moves. Because VIX futures and options often demonstrate performance that is inversely correlated with the U.S. stock market, this feature may offer a diversification element when added to an investor's portfolio.

Correlations of Weekly Returns

(January 1990 - July 2020)

			Russell			
		S&P 500	2000	MSCI EAFE	10-Yr UST	
	VIX Index	Index	Index	Index	Notes	S&P GSCI
/IX Index	1.00					
S&P 500 Index	-0.68	1.00				
Russell 2000 Index	-0.61	0.87	1.00			
MSCI EAFE Index	-0.50	0.72	0.68	1.00		
10-Year US Treasury Notes	0.22	-0.20	-0.24	-0.17	1.00	
S&P GSCI (Commodity) Index	-0.18	0.24	0.26	0.30	-0.12	1.00

Source: Cboe Options Institute

Recall the negative correlation relationship between the S&P 500 Index and VIX futures. With the understanding that a hedge is something that has a value because it moves in the opposite direction of the asset you're looking to protect, one can see why the VIX product complex is potentially a compelling addition to a diversified portfolio.

Research studies suggest that relatively small allocations to VIX futures or options-based strategies may mute the impact of sharp S&P 500 Index declines. Most recently, Prof. Edward Szado released a study examining the performance of strategies that buy VIX futures or VIX call options as well as alternative strategies, including long S&P 500 Index protective put strategies, as part of a protective portfolio allocation.

VIX futures and options enable market participants to gain exposure to expected market volatility that has been isolated, which is independent of overall market direction. Most passive market participants are "long only" and tend to benefit from markets that move higher over time. Those positions are implicitly "short volatility." As such, VIX futures and/or options may be used to hedge portfolios against volatility shocks when used passively or, when used strategically, may be used to potentially reduce overall portfolio risk.

Cboe Benchmark Indices

The Cboe Benchmark Indices measure the performance of hypothetical strategies using index options, VIX options or VIX Futures.

Cboe VIX Tail Hedge Index (VXTH)

Strategy: VIX call buying

VXTH illustrates the effect of incorporating a VIX call buying strategy in a portfolio that is long the U.S. Equity market.



Cboe Options Institute

VXTH was higher by roughly 92% in late July, which compares to an S&P 500 Index that measured unchanged on the year.

- The VXTH Index buys one-month 30-delta call options on the VIX Index.
- New VIX call options are purchased monthly, a procedure known as the "roll."

• The weight of the VIX call options in the portfolio varies at each roll and depends on the forward value of VIX Index, an indicator for the perceived probability of a "swan event."

Use Cases Efficient Exposure & Income Generation

Derivative contracts are capital efficient tools. The Cboe VIX product suite is particularly suited for sophisticated market participants seeking to monetize their volatilitycentric investment thesis.

The nature of volatility creates trading opportunities. Volatility is a constant and thus, cannot move to zero. In general, volatility tends to be mean reverting. In theory, the VIX Index level could exceed 100 (or more), but in reality it likely cannot be sustained. These characteristics are important for market participants to understand when utilizing volatility information and especially when trading volatility products.

Historically, we observe a propensity for the option market to price in slightly more expected volatility than what is subsequently realized. Like actuarial science and the insurance industry, risk premiums, over long timeframes, typically exceed claims on those contracts.

S&P 500 Implied Volatility Risk Premium

Daily closing values for this spread - S&P 500 implied volatility (as represented by the VIX[®]Index) minus the subsequent 30- trading day S&P 500



Furthermore, sophisticated market participants that understand the term structure of VIX futures may look to capitalize via "rolldown" strategies. Most of the time, VIX futures exhibit a

Curious about the differences between Mini VIX futures and standard VIX futures?

This means that if a VIX futures contract is trading at 25.00, then one contract has a notional value of \$25,000 USD. That contract can be held in an account (long or short) with at least \$13,750 in available capital (assuming front month contract) or significantly less if the future has a longer maturity.

The margin numbers in the examples above are as of Aug. 24, 2020 for the Sept. 2020 contracts and are used for illustrative purposes only. Margin requirements fluctuate and are subject to change. Brokerage firms may require customers to post higher margins than the minimum margins specified in this Guide. These examples are not intended to influence trading decisions.

Therefore, strategies that systematically sell volatility on a broadbased equity index may potentially capture positive risk premium over longer time horizons. This approach would add to a short volatility position, which is implicit in long market exposure and may be inappropriate for some market participants.

contango (normal) term structure whereby short dated futures trade at a discount to contracts with longer maturities. Designing a trading strategy to potentially capitalize on the path dependency of VIX futures in a normal trading environment is possible. This strategy is complex and generally profitable only when VIX futures spreads narrow as they move toward expiration. Please note, understanding the risks as well as potential rewards of all derivative contracts and trading strategies is important.

Standard VIX futures

1 VIX Future 1000 Multiplier

Mini VIX futures 1 Mini VIX Future 100 Multiplier

This means that if a VIX futures contract is trading at 25.00, then one contract has a notional value of \$2,500 USD. That contract can be held in an account (long or short) with at least \$1,375 in available capital (assuming front month contract) or significantly less if the future has a longer maturity.

Trading Strategies

Before employing any options strategies as part of your investment decision making process, please consult your financial advisor, download and read the Characteristics and Risks of Standardized Options.

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Investment Thesis	Strategy	Characteristics	Payout Diagram	Considerations		Investment Thesis	Strategy	Characteristics	Payout Diagram	Conside	
Bullish on realized volatility	Long future	Unlimited profit potential if underlying value rises. Limited, but significant loss potential if underlying value falls.	Profit A Proce	Margin requirements.		No directional opinion and volatility will increase in the short-term	Strangle	 Buy 1 call and Buy 1 put Different strikes and expiry 	Pick	Typically less expensive	
Bearish on realized volatility	Short future	Unlimited loss potential if underlying value rises. Limited, but significant profit potential if underlying value falls.	Profit	Margin requirements.		Asset price or level will remain in a narrow range for a period of time	Call butterfly spread	Multi-part strategy that includes the combination of: • Long call spread • Short call spread	Podt	Fixed risk and capped pr A relatively low-cost stra of two options (Strike B) attaining maximum poss	
Realized volatility will be	Buy put	Limited, but significant profit potential	Profit Proce	Bearish strategy, no margin required. Loss limited to premium paid, limited profit potential as underlying decreases.		Implied volatility increasing	Calendar spread	 Sell 1 near-term call and Buy 1 longer-term call Same strike and different expiry 		Can be speculative in nat advantageously with resp rate of theta. If asset pric strikes, trade losses resul	
implied volatility	Buy call	Unlimited profit potential	Profe	Bullish strategy, no margin required. Loss limited to premium paid, unlimited profit potential as underlying increases.					atorios and Droducto?		
Realized volatility will be	Sell put	Limited, but significant loss potential	Profit	Make money on decreased levels of realized volatility and also on time decay (collect theta P&L).		Sign up for Cboe' & interesting trade	S Inside Volatility s at: <u>www.cboe.co</u>	ty Newsletter for the latest insights on the volatility market, breaking news,			
implied volatility	Sell call	Unlimited loss potential	Pickt	Although you generate immediate return by collecting the premium, significant risk is taken, margin is required and unlimited loss may result.	[Click here to subscribe for updates about Mini VIX futures. Additional Recommended Resources: Learn more about: <u>The VIX Index, Mini VIX Futures, Standard VIX Futures, and VIX Options</u>. 					
No directional opinion, immediate increase in short- term volatility	Straddle	 Buy 1 call and Buy 1 put Same strike and expiry 	Profit	Provide greatest absolute volatility exposure. Has significant time decay component.		 CFA Institute Research Foundation - "The VIX Index and Volatility-Based Global Indexes and Trading Instruments - <u>A Guide to Investment and Trading Features" (2020)</u> <u>Robert E. Whaley – "Understanding VIX" (2008)</u> 					

• <u>S&P Dow Jones Indices - "A Practitioner's Guide to VIX" (Dec. 2017)</u>



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