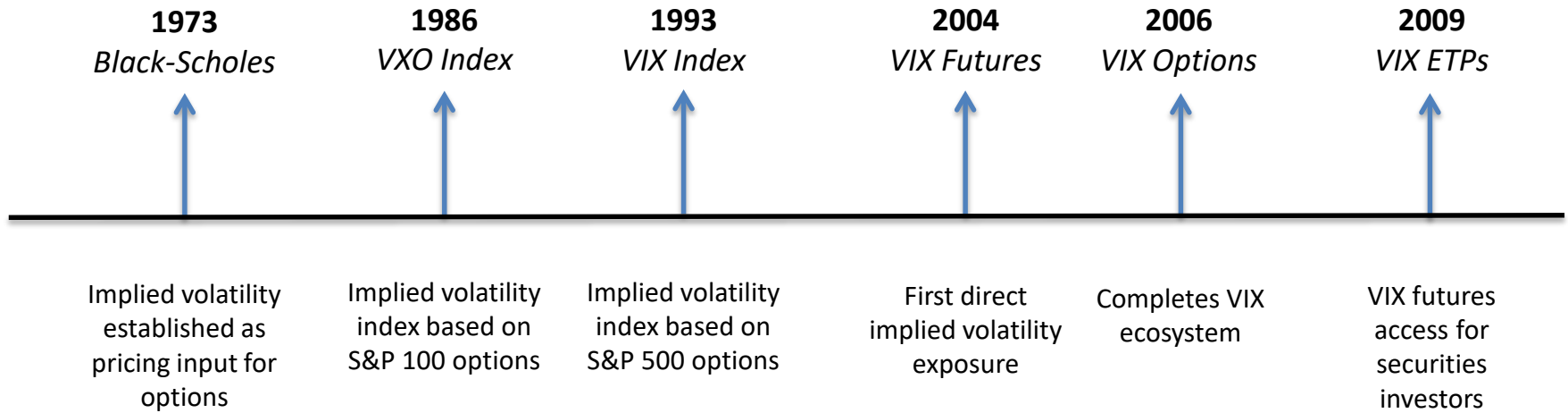


Perspectives On Exchange-Traded Volatility

February 27, 2013

History Of Implied Volatility

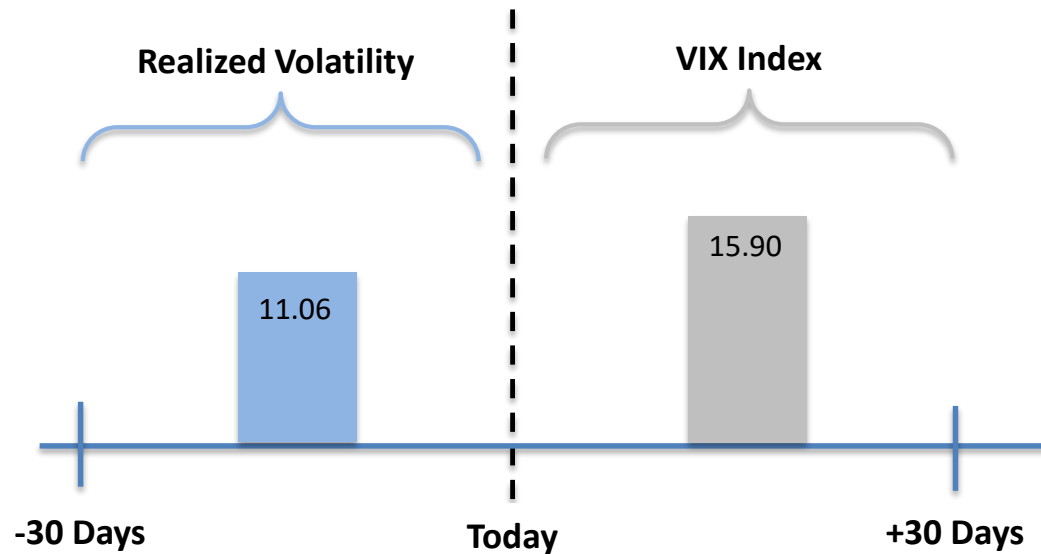
Implied volatility has progressed from an input in options prices to an independently tracked and traded exposure.



The VIX Index

VIX Index Measurement

- Derived from S&P 500 options
- Square root of the risk-neutral expectation of the S&P 500 variance over the next 30 calendar days
- Quoted as an annualized standard deviation
- Translates roughly to the expected annualized volatility in the S&P 500 index over the next 30-day period



Unique Properties Of The VIX Index

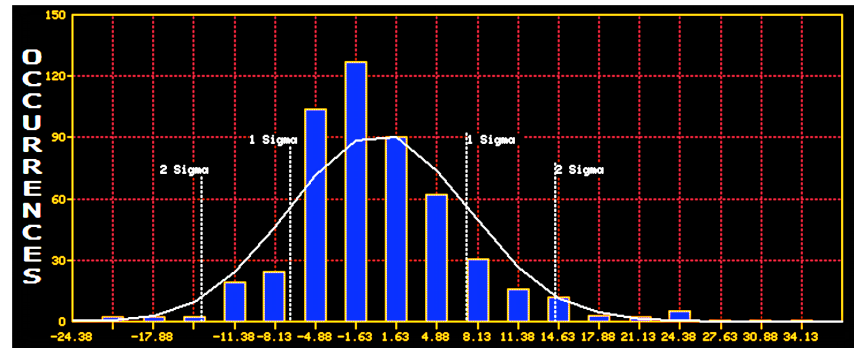
Since implied volatility is a statistic and not a return-generating asset, the VIX index displays certain unique characteristics.

- **Strong Negative Correlation With S&P 500, Large Right Tail**

Daily Correlation With S&P 500 <i>Apr 2004 – Dec 2012</i>	
VIX Index	-0.75
10 Year US Treasury	-0.38
RJ CRB Index	0.36
Gold	0.08

Source: Bloomberg

VIX Index Daily Return Distribution, 2007 - 2009



Source: Bloomberg

- **Strong Mean-Reverting Tendency**

Implied volatility in options always starts at zero, rises, then returns to zero by expiration.

Conceptually, volatility also has natural upper and lower limits and is closely related to realized volatility.

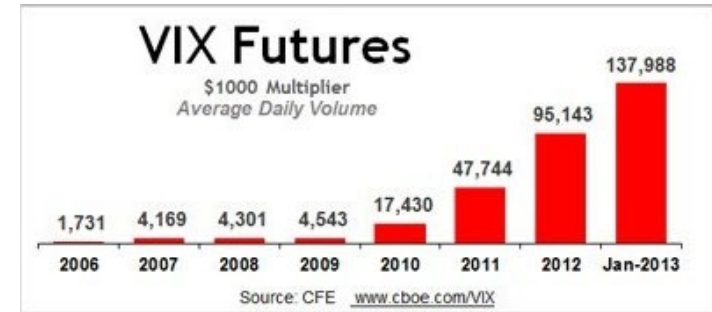
- **Not directly tied to business cycle / fundamentals**

Implied volatility has no supply or demand constraints, it is an estimate combining complex factors and human behavior.

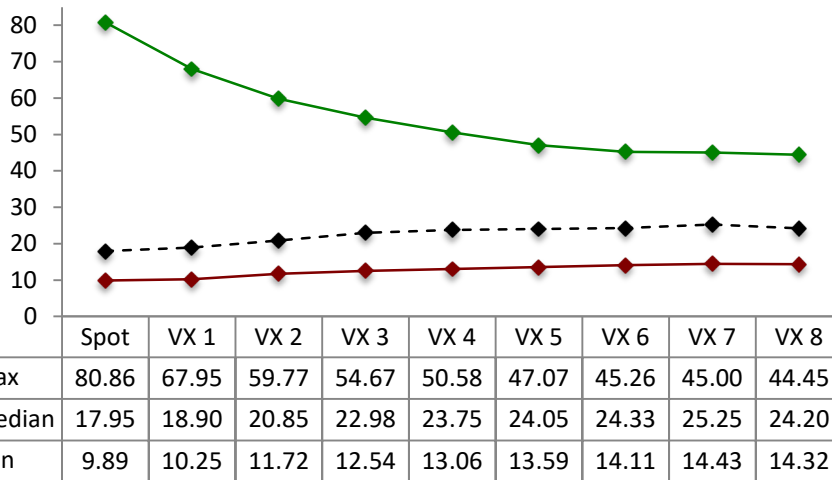
Exchange-Traded VIX

Exchange-Traded VIX : Futures

- Market's expectation for VIX index at each expiration
- Settle to VIX "Special Opening Quotation" on 3rd Wednesday of every month
- 1000x multiplier
- ~\$8B in notional open interest, majority in first three months



VIX Term Structure Range
2004 - 2013

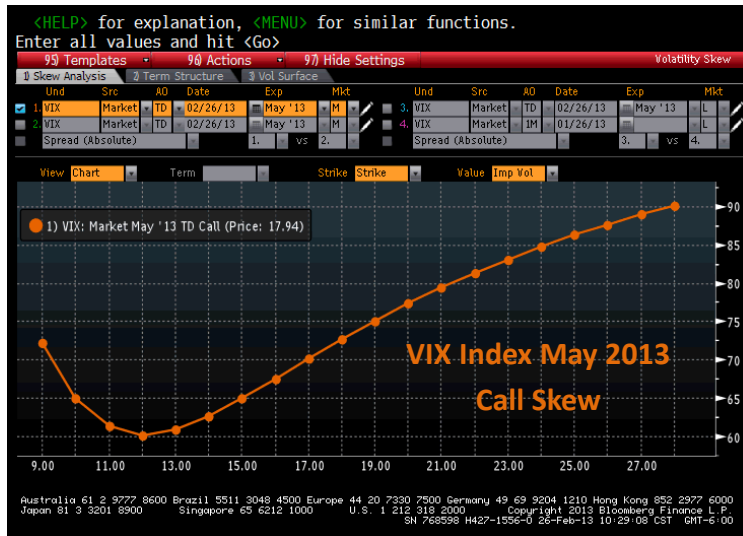


Source: Advocate Asset Management research

- Curve in contango approx 80% of days
- More convexity in near months
- Out months price in VIX mean-reversion
- Greek-like variables, specifically gamma

Exchange-Traded VIX : Options

- Based on corresponding future for each expiration, *not VIX index*
- Lognormal distribution not appropriate assumption given large right tail
- Implied vol typically *drops* after VIX spike, reflecting VIX mean reversion



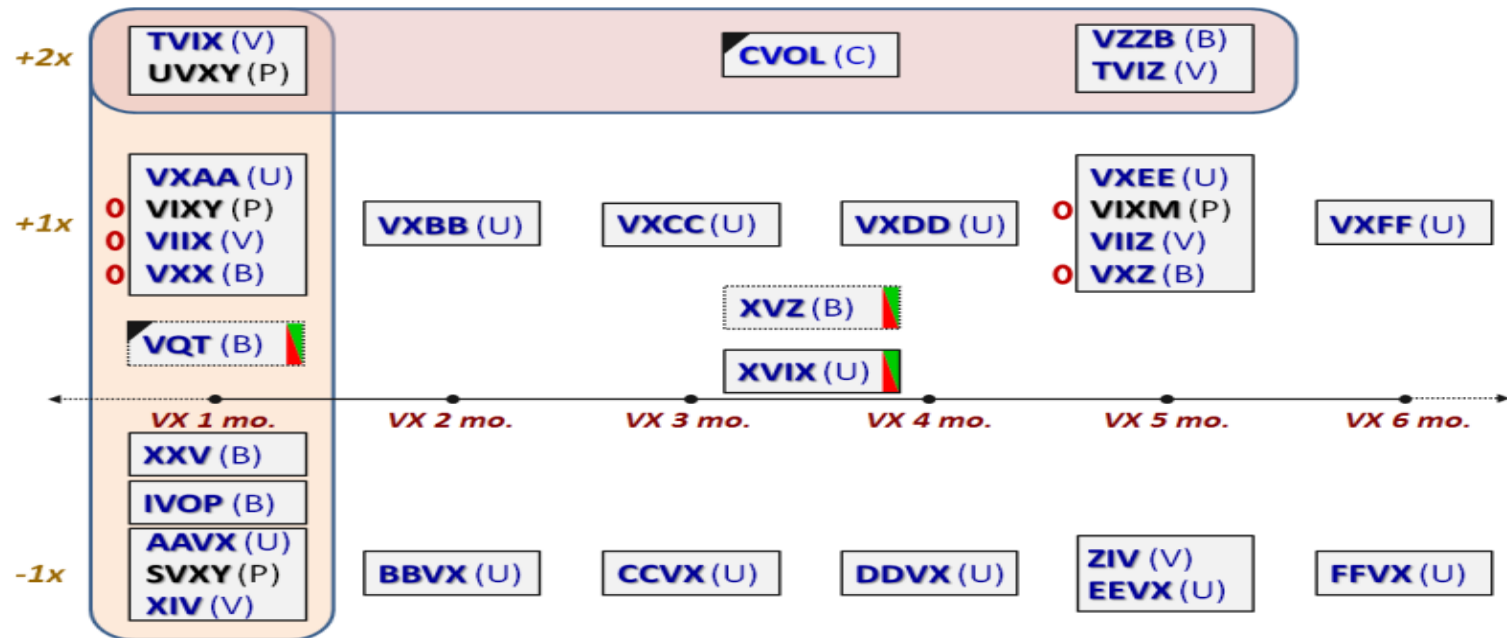
- Unique theta decay profile versus equity options
- OTM options remain relatively highly priced until just before expiry
- Skew is typically inverse of S&P 500

Source: Bloomberg

Exchange-Traded VIX : ETNs & ETFs

- Provide futures exposure through cash-listed instrument
- High carry cost due to rolling VIX futures in upward-sloping curve
- Some managed funds attempt to reduce carry cost via VIX timing models

Volatility ETP Landscape, Feb 2013



Key:
 ▲ = includes non-VIX legs
 ■ = includes long + short legs
 □ = legs are dynamically allocated
 ○ = optionable
 ◻ = high leverage/compounding risk
 ◻ = high roll yield risk

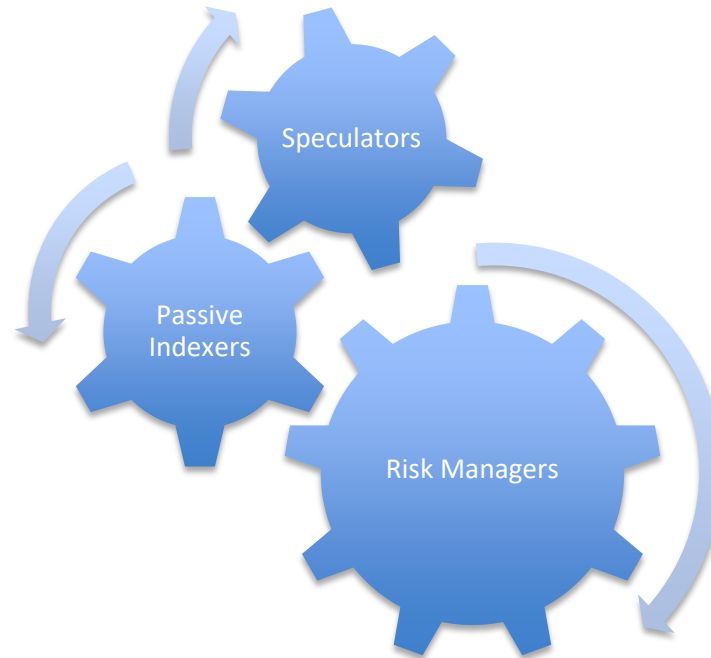
Necrology:
 VZZ closed (7/11/11); replaced by VZZB
 IVO closed (9/12/11); replaced by IVOP

as of 2/21/12

Source: vixandmore.blogspot.com

Exchange-Traded Volatility Ecosystem

Implied volatility exposure has traditionally been viewed as a risk management tool, but as with any market, both hedgers and speculators are necessary to complete the ecosystem.



Risk Management With Exchange-Traded VIX

Risk Management With Exchange-Traded VIX

Figure 1: Summary Statistics with VIX Futures Aug. 2008 to Dec. 2008

Aug. 1, 2008 to Dec. 31, 2008	100% E/B/A Portfolio	97.5% E/B/A Portfolio / 2.5% VIX Futures	90% E/B/A Portfolio / 10% VIX Futures
Period Return	-19.68%	-15.85%	-4.02%
Period Std Deviation	25.25%	22.65%	16.33%
Maximum Drawdown	-32.17%	-27.72%	-14.00%
Period Sharpe Ratio	-0.79	-0.71	-0.26

Because of its reliably inverse correlation and high convexity during large selloffs, implied volatility is a very effective hedge for equity portfolios.

Source: "VIX Futures And Options – A Case Study of Portfolio Diversification During The 2008 Financial Crisis"
UMass Amherst Center for International Securities and Derivatives Markets

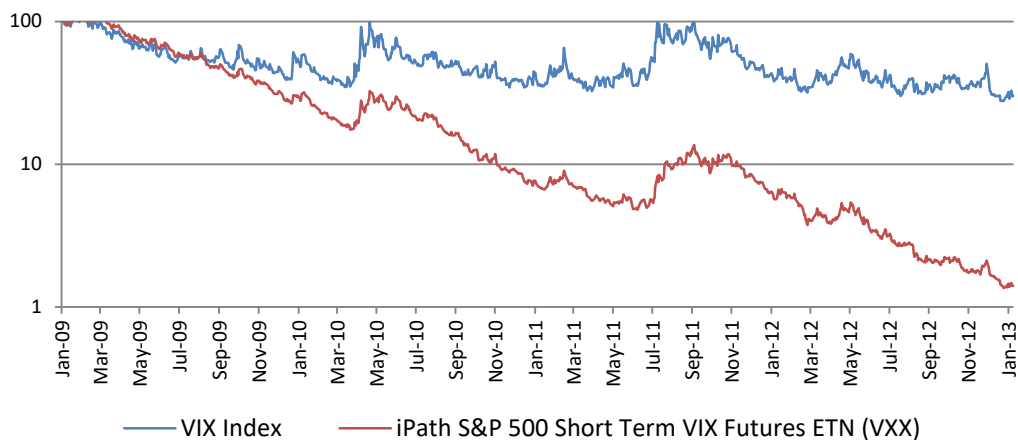
However, carry costs are often significant.

Velocity Shares Volatility ETNs Prospectus

"The long term expected value of your ETNs is zero. If you hold your ETNs as a long term investment, it is likely that you will lose all or a substantial portion of your investment."

iPath S&P 500 Short Term VIX Futures ETN (VXX) vs VIX Index

Jan 2009 - Feb 2013, Rebased To 100



Source: Yahoo! Finance

Risk Management Example : Fall 2008



Societe General Flow Equity Derivatives Desk Commentary, January 4, 2009

In late September, with the spot and near-term VIX futures in the mid-20s, we had a customer buy 15k Nov 50 calls for \$0.15...

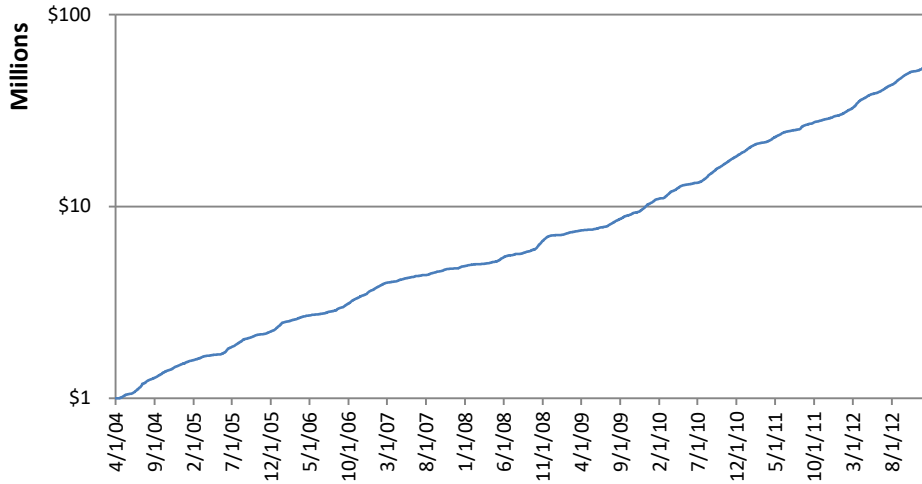
If held to expiration, these would have been worth \$17.22, for a profit of more than \$25 million dollars on the 15k that were bought. ...for a premium outlay of only \$225k, you had 2-month market crash protection that provided a far better risk/reward than owning a downside put in SPX or even in XLF.

Alpha Strategies With Exchange-Traded VIX

Alpha Strategies With Exchange-Traded VIX

Growth of \$1MM

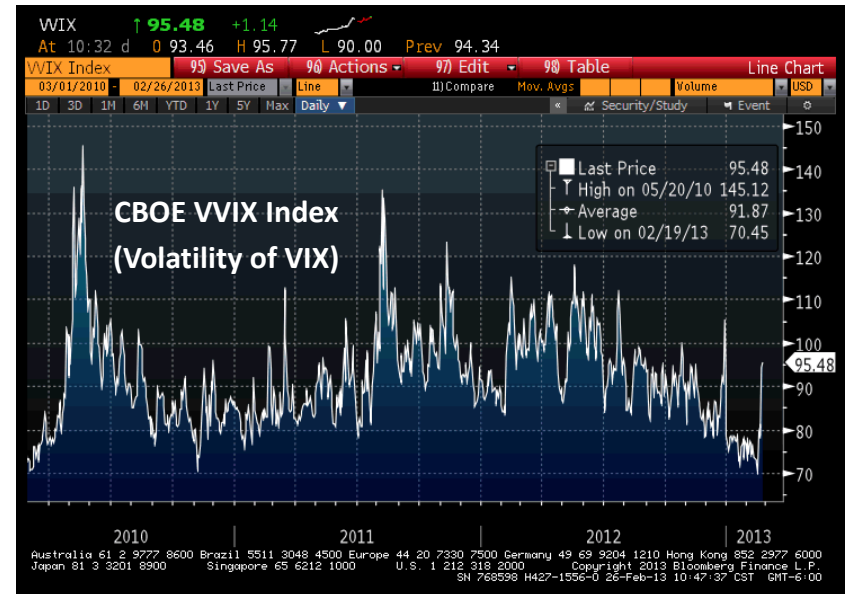
Perfectly Vega-Neutral 1M / 2M VIX Basis



Source: Advocate Asset Management research

VIX futures basis represents a substantial return opportunity.

However, VIX futures are volatile and require a constant cost-effective hedge.



Source: Bloomberg

Alpha Strategy Example : CBOE VIX Premium Index (VPD)



Source: Bloomberg

CBOE VIX Premium Index (VPD) overlays a sequence of short one-month VIX futures on a money market account. The number of VIX futures sold at each roll is set to preserve 75% of the initial value of the portfolio in the event that the VIX futures increase by 25 points.

Alpha Strategy Example : S&P VIX Term Structure Index



Source: Bloomberg

The S&P VIX Term Structure Index is a composite Index that measures the return from taking a long 100% position in the S&P 500 VIX Mid-Term Futures™ Index Excess Return (the “Mid-Term Index”) with a short, or inverse, 50% position in the S&P 500 VIX Short-Term Futures™ Index Excess Return (the “Short-Term Index” together with the Mid-Term Index, the “Sub-Indices”), with daily rebalancing of the long and short positions..

Other Markets

Volatility futures in other markets are hoping to emulate the success of VIX futures.

Contract	2/22 Volume	2/22 Open Interest
CBOE Volatility Index (VIX)	121,511	415,656
Euro Stoxx 50 Index (VSTOXX)	33,214	202,484
CBOE Emerging Mkt Vol Index	50	583
CBOE Gold ETF Vol Index	150	453
CBOE Brazil ETF Vol Index	0	451
CBOE Oil ETF Vol Index	9	289
Nasdaq 100 Vol Index	10	4

