Portfolio Risk Management with VIX® Futures and Options

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Edward Szado is Associate Professor of Finance, Providence College. He is also the Director of Research at the Institute for Global Asset and Risk Management and received his Ph.D. in Finance from the Isenberg School of Management, University of Massachusetts, Amherst. He has taught Risk Management at the Boston University School of Management, Derivatives at Clark University and a range of finance courses at the University of Massachusetts Amherst. He is a former Option trader and his experience includes product development in the areas of volatility based investments and structured investment products. He is also a Chartered Financial Analyst and has consulted for the Option Industry Council, the Cboe®, the CFA Institute, the Chartered Alternative Investment Analyst Association and the Commodity Futures Trading Commission.
Overview

1. Long VIX® Futures and Long VIX® Call based Strategies in Two Key Years – 2008 and 2016
2. Inverse VIX® Futures and VIX® Call Writing based Strategies in Two Key Years – 2008 and 2016
4. Open Interest and Volume of VIX® options and futures
VIX® Futures and Options Based Strategies in Two Key Years

• Cost of holding futures in contango (when spot price is below futures price) suggests that long VIX futures and long VIX call option positions may be best suited to strategic uses rather than buy and hold.

• However, the convex relationship and strong negative conditional correlation between the VIX index and the S&P 500 suggests long VIX futures and call options may provide an effective hedge for traditional portfolios.

• The following section considers the impact of a small allocation of VIX futures and options to a traditional stock and bond portfolio and a hypothetical endowment portfolios.

• Two years were chosen to represent periods favorable to long positions in VIX futures and call options (2008) and generally unfavorable to long positions in VIX futures and call options (2016)
Exhibit 1: VIX® Futures and Options Based Strategies in 2008

Exhibit 1: This exhibit illustrates the performance of two traditional portfolios as well as two VIX futures based portfolios in 2008. The VIX portfolios are both fully collateralized and rebalanced daily. The one month portfolio invests in one month VIX futures and rolls out on the close the night before expiration. The Three month VIX futures portfolio purchases three month VIX futures and rolls into a new 3 month VIX futures contract after one month at the close before the front month VIX futures contract expires. The traditional portfolios consist of a 60/40 Stock/Bond portfolio and a hypothetical endowment portfolio which invests in a variety of indices based on the average yearly asset allocation of a representative endowment. It is clear from the exhibit that 2008 was favorable year for a long VIX futures exposure. The hypothetical endowment portfolio is constructed by using annually reported asset allocation from an actual endowment and applying them to a set of total return indices representing the corresponding asset classes.

Source: Bloomberg, CFE, Cboe Options Exchange
Exhibit 2: 60/40 Portfolio Performance in 2008 with VIX® Futures and Options

Exhibit 2: This exhibit illustrates the performance of a traditional 60/40 portfolio with and without a small allocation to long VIX futures or long VIX call options. A 1% allocation to 25% OTM VIX calls increases 2008 returns from a 21% loss to a 12% gain, with a small increase in volatility. The other VIX based allocations also improve returns while also reducing volatility and drawdowns.
Exhibit 3: This exhibit illustrates the performance of a hypothetical endowment portfolio with and without a small allocation to long VIX futures or long VIX call options. Similarly to the 60/40 portfolio, a 1% allocation to 25% OTM VIX calls provides the largest improvement in 2008 returns from a 39% loss to a 10% loss, with a small increase in volatility. The other VIX based allocations also improve returns while also reducing volatility and drawdowns.
Exhibit 4: VIX® Futures and Options based strategies in 2016

This exhibit illustrates the performance of two traditional portfolios as well as two VIX futures based portfolios in 2016. The VIX portfolios are both fully collateralized and rebalanced daily. The one month portfolio invests in one month VIX futures and rolls out on the close the night before expiration. The Three month VIX futures portfolio purchases three month VIX futures and rolls into a new 3 month VIX futures contract after one month at the close before the front month VIX futures contract expires. The traditional portfolios consist of a 60/40 Stock/Bond portfolio and a hypothetical endowment portfolio which invests in a variety of indices based on the average yearly asset allocation of a representative endowment.

Source: Bloomberg, CFE, Cboe Options Exchange
Exhibit 5: 60/40 Portfolio Performance in 2016 with VIX® Futures and Options

Exhibit 5: This exhibit illustrates the performance of a traditional 60/40 portfolio with and without a small allocation to long VIX futures or long VIX call options. While a 5% long allocation to one month VIX futures significantly increase returns, a 1% allocation to ATM or 25% OTM VIX calls significantly reduces returns 2008 returns, albeit with a small reduction in volatility and drawdowns.
Exhibit 6: Endowment Portfolio Performance in 2016 with VIX® Futures and Options

Exhibit 6: This exhibit illustrates the 2016 performance of a hypothetical endowment portfolio with and without a small allocation to long VIX futures or long VIX call options. Similarly to the 60/40 portfolio, a 5% long allocation to one month VIX futures significantly increase returns, a 1% allocation to ATM or 25% OTM VIX calls significantly reduces returns 2008 returns, albeit with a small reduction in volatility and drawdowns.

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<th>Endowment</th>
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<th>Endowment Plus 5% 3 Mo. Futures Held 1 Mo.</th>
<th>Endowment Plus 1% 25% OTM Options</th>
<th>Endowment Plus 1% ATM Options</th>
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Source: Bloomberg, CFE, Cboe Options Exchange, Optionmetrics
Short (Inverse) VIX® Futures in two key years

- Cost of holding futures in contango suggests that VIX futures and options may be best suited to strategic uses rather than buy and hold.
- Periods of strong contango may generate high returns to short (inverse) VIX futures or VIX call option writing strategies if a volatility event does not occur.
- However, a volatility event may result in catastrophic losses to inverse VIX futures or written VIX call option positions.
- The following section considers the impact of a small allocation of inverse VIX futures and written call options to a traditional stock and bond portfolio and a hypothetical endowment portfolios.
- Two years were chosen to represent periods generally unfavorable for inverse VIX positions (2008) and generally favorable for inverse VIX positions (2016).
Exhibit 7: Inverse VIX® Futures and Options based strategies in 2008

This exhibit illustrates the performance of two traditional portfolios as well as two inverse VIX futures based portfolios in 2008. The VIX portfolios are both fully collateralized and rebalanced daily. The one month portfolio takes short positions in one month VIX futures and rolls out on the close the night before expiration. The Three month VIX futures portfolio shorts three month VIX futures and rolls into a new short 3 month VIX futures contract after one month at the close before the front month VIX futures contract expires. The traditional portfolios consist of a 60/40 Stock/Bond portfolio and a hypothetical endowment portfolio which invests in a variety of indices based on the average yearly asset allocation of a representative endowment. It is clear from the exhibit that 2008 was an unfavorable year for inverse VIX futures exposure.

Source: Bloomberg, CFE, Cboe Options Exchange
Exhibit 8: This exhibit illustrates the 2008 performance of a traditional 60/40 portfolio with and without a small allocation to inverse VIX futures or written VIX call options. In this period of crisis, even a small allocation to VIX call writing can significantly reduce returns and increase volatility. A 5% allocation to inverse VIX futures has a smaller impact but also reduces returns while slightly increasing volatility and drawdowns.
Exhibit 9: This exhibit illustrates the 2008 performance of a hypothetical endowment portfolio with and without a small allocation to inverse VIX futures or written VIX call options. In this period of crisis, even a small allocation to VIX call writing can significantly reduce returns and increase volatility. A 5% allocation to inverse VIX futures has a smaller impact but also reduces returns while slightly increasing volatility and drawdowns.
Exhibit 10: Inverse VIX® Futures based strategies in 2016

This exhibit illustrates the performance of two traditional portfolios as well as two inverse VIX futures based portfolios in 2016. The VIX portfolios are both fully collateralized and rebalanced daily. The one month portfolio takes short positions in one month VIX futures and rolls out on the close the night before expiration. The Three month VIX futures portfolio shorts three month VIX futures and rolls into a new short 3 month VIX futures contract after one month at the close before the front month VIX futures contract expires. The traditional portfolios consist of a 60/40 Stock/Bond portfolio and a hypothetical endowment portfolio which invests in a variety of indices based on the average yearly asset allocation of a representative endowment. It is clear from the exhibit that 2016 was a generally favorable year for inverse VIX futures exposure.

Source: Bloomberg, CFE, Cboe Options Exchange
Exhibit 11: 60/40 Portfolio in 2016 with Inverse VIX® Futures and Written VIX Calls

Exhibit 11: This exhibit illustrates the 2016 performance of a traditional 60/40 portfolio with and without a small allocation to inverse VIX futures or written VIX call options. In this period of low volatility and generally positive market returns, a small allocation to VIX call writing can significantly increase returns with a moderate increase in volatility. A 5% allocation to inverse VIX futures has a smaller impact but also provides a meaningful increase in return with a small increase in volatility and drawdowns.
Exhibit 12: This exhibit illustrates the 2016 performance of a hypothetical endowment portfolio with and without a small allocation to inverse VIX futures or written VIX call options. In this period of relative calm and positive performance, small allocations to inverse VIX futures or VIX call writing increase returns significantly with a moderate increase in volatility. A 5% allocation to inverse three month VIX futures doubles returns with no increase in volatility and a reduction in drawdown.
Exhibit 13: This exhibit illustrates the performance of two traditional portfolios as well as two inverse VIX futures based portfolios and two long VIX futures based portfolios over the entire, almost 12 year, period of study. The volatility and drawdowns of the four VIX futures based portfolios suggest that VIX futures may be best suited for shorter term strategic portfolio risk management or return enhancement rather than long term buy and hold strategies.
Exhibit 14: 60/40 Portfolio Performance with VIX® Futures and VIX Options

Exhibit 14: This exhibit illustrates the performance of a 60/40 traditional portfolio with and without a small allocation to long VIX futures or VIX call options. The base 60/40 portfolio provides the highest return without a long VIX based allocation. While the long VIX based allocations generally reduce volatility and drawdowns they do so while reducing returns.
Exhibit 15: This exhibit illustrates the performance of a hypothetical endowment portfolio with and without a small allocation to long VIX futures or VIX call options. Similar to the 60/40 portfolio, the base endowment portfolio provides the highest return without a long VIX based allocation. While the long VIX based allocations reduce volatility and drawdowns they do so while reducing returns.
Exhibit 16: This exhibit illustrates the performance of a 60/40 traditional portfolio with and without a small allocation to inverse VIX futures or written VIX call options. The returns of the 60/40 portfolio are improved with the addition of VIX call writing or inverse VIX futures, although the VIX call writing strategies significantly increase both volatility and drawdowns.
Exhibit 17: This exhibit illustrates the performance of a hypothetical endowment portfolio with and without a small allocation to inverse VIX futures or written VIX call options. The returns of the endowment portfolio are improved with the addition of inverse VIX futures with a small increase in volatility. In contrast, VIX call writing reduces returns with a small impact on volatility.
Open Interest and Volume of VIX® Futures and Options

Volume and Open Interest

- VIX Futures and Options Volume have both increased significantly in recent years, coinciding with lower levels of VIX.
- VIX Futures and Options Open Interest have also significantly increased, coinciding with lower levels of VIX.
- Lower levels of VIX tend to correspond with a shift of option volume towards puts and away from calls.
- In recent years, at low VIX levels, non-commercial (speculative) traders have significantly increased their short (inverse) position open interest as a proportion of total short open interest.
- Commercial (hedging) traders have recently increased their long positions as a proportion of total short open interest, although these positions are at historically low levels.
Exhibit 18: VIX® Futures Volume and Spot VIX®

Exhibit 18: This exhibit illustrates the historical levels of spot VIX® and the daily Volume of VIX® futures as well as the 20-trading day rolling average of VIX® futures volume. VIX® Futures volume has increased significantly since 2010. Over the same period, Spot VIX® has generally trended lower. While many factors have contributed to the increase in volume, at the very least, the data suggests that low levels of spot VIX® do not result in a decrease in futures volume.

Source: Bloomberg, CFE, Cboe Options Exchange
Exhibit 19: This exhibit illustrates the historical levels of spot VIX® and the daily difference between the volume of VIX® call options and put options as well as the 20-trading day rolling average of VIX® call minus put volume. VIX® put options volume has generally increased relative to the volume of VIX® call options since 2011. Over the same period, Spot VIX® has generally trended lower with a number of sharp spikes. The data suggests that low levels of spot VIX® may result in a tendency for VIX® options volume to shift from calls towards puts.
Exhibit 20: This exhibit illustrates the historical levels of the open interest of VIX® futures by trader category based on weekly data from CFTC Commitment of Traders reports. The data indicates that non-commercial (speculative) short (inverse) VIX futures exposure has increased in recent years, while commercial (hedging) long VIX futures exposure has decreased. All measures are presented as a percentage of total open interest so they do not reflect the overall significant increase in open interest in recent years. The left panel provides the breakout by trader category of long interest in VIX futures while the right panel provides the breakout in short interest.

*Note: White bars represent missing data

Source: Bloomberg, CFE, Cboe Options Exchange, CFTC
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