IVOL White Paper: Diversification in Uncertain Times

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The purpose of this white paper is to explain why investors may want to consider incorporating IVOL as a potential long-term diversifier in their portfolio. We explore current as well as various potential market conditions. In doing so, we examine IVOL's potential diversification benefits in relation to more traditional assets.

In setting forth this argument, we rely upon historical correlation data. Of course, past performance does not guarantee future results. Like all potential diversifiers, IVOL may perform well in certain market conditions and not as well in others, which we will attempt to illustrate here. Also, like all assets, IVOL has its own set of risks. We set these forth in greater detail in the IVOL Risk Profile section later in the paper.

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Introduction

As nations battle a global pandemic, we are living through unprecedented times. In a short period of time, the novel coronavirus has cost thousands of lives and destroyed wealth around the world. Investors are asking many questions:

- Are we headed for an extended depression as economic activity comes to a halt? Or are the policy responses going to be effective?
- Is the $2.6 trillion fiscal spend (equivalent to 12.5% of GDP) combined with unbounded and limitless bond buying enough? Is it too much?
- How should investors position portfolios for these volatile markets?

Investors are also worried about diversification in their portfolios. They've seen stocks and bonds sell off together. Parts of their portfolio may not have performed as expected. Many may wonder where they can find potential diversification in a time of heightened correlations. These investors may wish to consider IVOL, the Quadratic Interest Rate Volatility and Inflation Hedge ETF.

The Quadratic Interest Rate Volatility and Inflation Hedge ETF (NYSE ticker: IVOL) seeks to hedge relative interest rate movements and to benefit from market stress when fixed income volatility increases, while providing the potential for enhanced, inflation-protected income. What makes IVOL unique is that it is long interest rate volatility via its access to the OTC fixed income options market. This is the key to IVOL's many applications.

2019 ETF.com Award Winners

IVOL has been recognized by ETF.com as the "Best New US Fixed Income ETF for 2019." IVOL was in good company as the other nominated funds were issued by Blackrock, Goldman Sachs, Nuveen and Van Eck.

To begin, we discuss IVOL's potential performance in three very different market environments – "Risk On," "Risk Off," and "Stagflation." Then we will consider IVOL's potential as a diversifier.

IVOL during Periods of "Risk On"

Some investors may view the global policy response as excessive. With the U.S. government launching a stimulus program equivalent to nearly 12.5% of GDP, the Fed taking rates to zero and global central banks implementing massive QE purchases, some argue that the economy will roar back once the threat from the virus has receded.

The recent economic expansion was the longest recovery in the US since the 1960s, with unemployment at historic lows in many parts of the US. This expansion may resume gradually once Americans return to work. If that happens, there exists the potential for inflation to take off as the economy is fueled by even cheaper money and the massive fiscal stimulus.

Such a move could be difficult for fixed income investors. We have long been conditioned to think of bonds as "safe." But this is far from true for investors who care about the mark-to-market, especially of their longer dated bonds. Bonds are exposed to interest rate risk, commonly called duration. The higher the duration, the higher the sensitivity of the bond to changes in interest rates. As interest rates rise, the price of the bond declines, causing investors to mark down the price. In today's low rate world, the risk is even more pronounced. With yields lower, the duration risk is even higher. It is a treacherous time to be a fixed income investor.

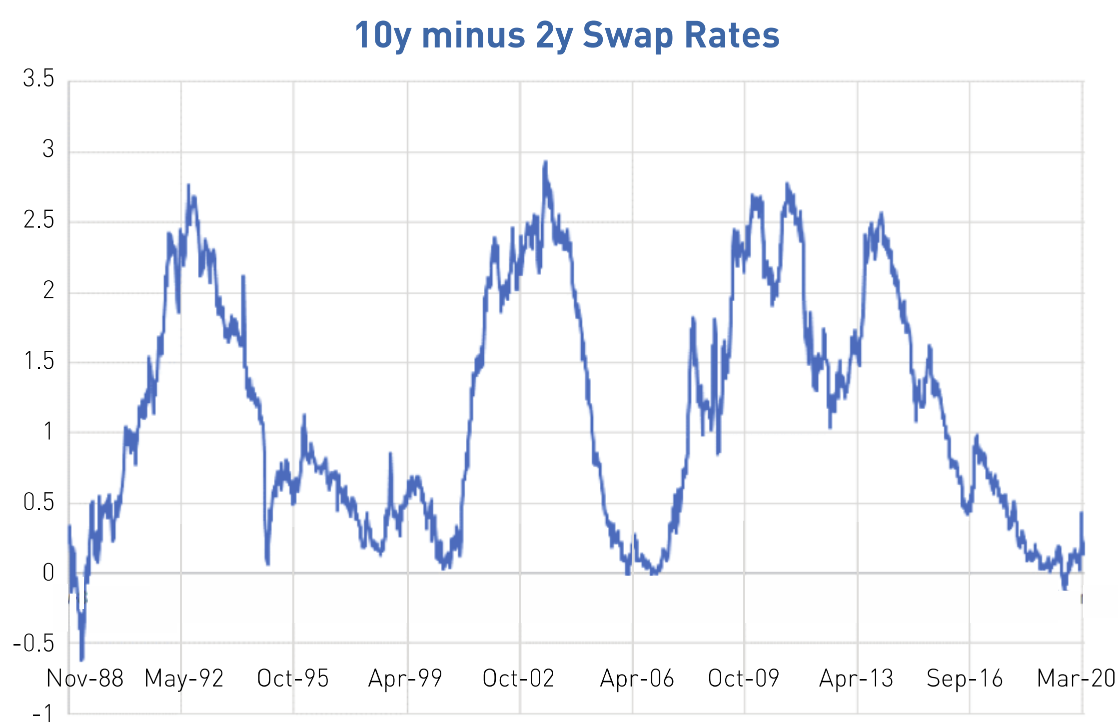
The 10-year Treasury has never been more expensive in the history of financial markets. 10-year Treasury yields hit a low of 32bps intraday on March 9th. If inflation approaches anything remotely close to the 3.15% that annual US inflation averaged from 1913-2018[1], recent buyers of Treasuries will face an unpleasant choice: they could sell their Treasuries and take the mark-to-market loss on what they may have imagined was one of the "safer" parts of their portfolio, or they could hold their Treasuries and lock in negative real returns for close to the next decade. While they don't carry credit risk, long-duration Treasuries are far from risk-free in the current environment.

IVOL is built using Treasury Inflation-Protected Securities (TIPS). But we have enhanced our TIPS with a portfolio of long interest rate options. Why? Aren't TIPS already indexed to inflation?

TIPS are set using the Consumer Price Index (CPI), which represents today's inflation level. But we believe bond investors should care far more about inflation expectations for the future, because it is these expectations for future inflation which really impact the rate sensitivity of bond portfolios. Fed Chairman Powell has said repeatedly that inflation expectations are "the most important driver of actual inflation."[2]

We believe that enhancing our TIPS portfolio with these relatively inexpensive options gives us a way to own inflation expectations which are currently priced at a discount to realized inflation. The yield curve allows investors to observe the market's expectations for inflation. From the chart below, one can see how the curve is relatively flat by historical standards. If the appetite for risk assets returns, we would expect inflation expectations to increase, making the curve steeper and returning it to more normal levels.

Our interest rate options are similar to options on inflation expectations, because the yield curve is largely a result of inflation expectations. Thus, our options have the



Data from Bloomberg and Quadratic as of 4/01/2020 potential to increase in value with a normalization of inflation expectations. As such, IVOL gives investors another way to potentially profit from inflation rather than just waiting for their TIPS to reset.

Owning IVOL allows investors potentially to benefit from increases in long dated interest rates, or a steepening of the yield curve. IVOL might be useful in cushioning the blow of these moves on investors' bond portfolios.

For the reasons mentioned above, we believe that IVOL represents a potential diversifier for investors concerned about the negative effects a normalization of risk pricing may have on their portfolio of nominal Treasuries. Adding IVOL to a portfolio of Treasuries could cause that portfolio to outperform during periods of heightened inflation expectations, fixed income volatility or any time the curve steepens, either from short rates falling or long rates rising. Additionally, in the current environment, adding IVOL is a potential value play because inflation expectations are below realized.

There are scenarios in which IVOL may underperform a portfolio of TIPS alone. These scenarios would include periods of falling inflation expectations. If the market believes inflation will fall further than currently expected, our options may lose value, and this would cause IVOL to underperform a portfolio composed exclusively of TIPS. Similarly, IVOL may underperform if fixed income volatility were to decrease, as it may impact negatively the value of our options. Our options also may lose value if the yield curve were to invert or flatten further.

IVOL during Periods of Recession "Risk Off"

Other investors are convinced that the virus has ended this bull market and that prices for risky assets will not recover quickly. They believe that the next move for risk assets is down, perhaps significantly. These investors may worry that the world economy is entering a prolonged depression with businesses being shut by government order and the economy beginning a major contraction as unemployment spikes dramatically.

The Fed has already taken rates to zero and is now limited only to nontraditional policy responses. Negative rates could be a real possibility within this scenario. With the baby boomers entering retirement, such an outcome could be a nightmare for investors.

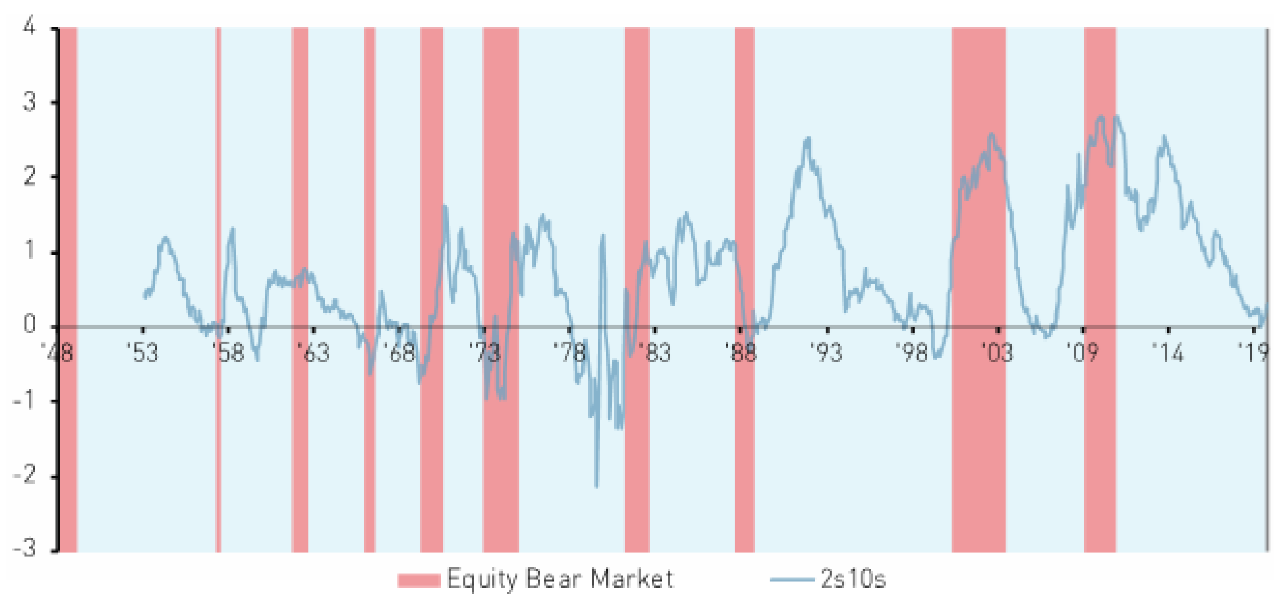
Investors who expect a “risk off” environment in the coming months have to be concerned about their exposure to equities and other risk assets.

IVOL offers a potential hedge against corrections during times of increased fixed income volatility and/or negative US interest rates which have the potential to cause a steepening of the interest rate curve. How is it that options on the shape of the yield curve may be attractive during times of “risk off”?

As the chart below shows, large declines in equity markets are usually accompanied by a marked increase in the steepness of the yield curve. Interestingly, this held true even in the ’08-’09 decline when almost every other asset class fell right along with equities. IVOL seeks to benefit from this increase in yield curve steepness and thus may work as a potential hedge against equity losses.

Despite all the talk about the virus, the truth is that no one knows what path it will take, how long it will last, and how severe it will be. We believe this uncertainty is likely to continue to feed higher volatility and

Relationship Between US Equity Market Sell-Offs and the Yield Curve



Source: Goldman Sachs and Quadratic Capital as of Q1 2020.
S&P500 is the equity index and 2s10s is defined as the difference between the 10y and the 2y swap rates. Past performance does not guarantee future results.

investors should be prepared for multiple scenarios in the coming months. IVOL owns fixed income volatility. If market volatility, and especially interest rate volatility, were to fall, IVOL might not perform well. This is because volatility is a key input into the price of options. Since IVOL owns options on the shape of the yield curve, a fall in volatility may lower the value of the options portfolio. If, on the other hand, volatility were to increase, the value of our options portfolio would be more likely to increase.

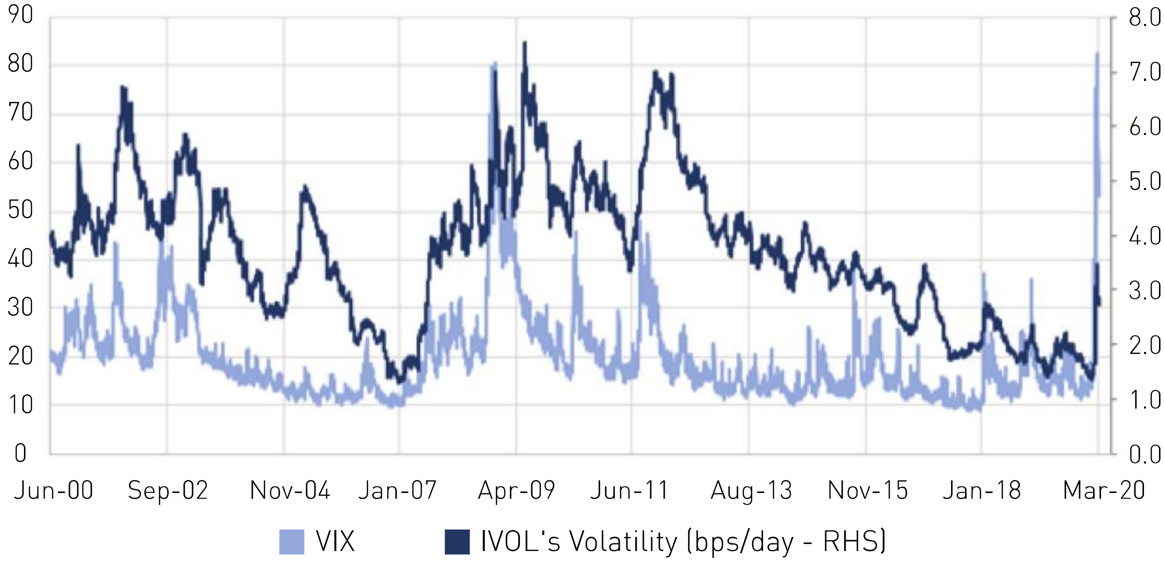
Interest Rate Volatility for Diversification

We have long been advocates for owning volatility, but IVOL is not a standard "long vol" product. An investor who is convinced of the benefits of owning volatility still has other decisions to make. Market commentators (and even sophisticated investors) often lump all long volatility into the same bucket. IVOL is one of the few ETFs available today that use interest rate volatility instead of equity volatility. Equity volatility is generally limited only to options on US equities.

One of the major drawbacks of any option is the negative carry. All options suffer from time decay and decline in value as time passes, all else being equal. But interest rate options have one factor that makes them different from equity options: the concept of rate roll down.

In the interest rate market, the forward rate can be significantly different from the spot rate. In the case of the options held by IVOL, whenever the interest rate curve is upward sloping, then the rates roll down will be positive and will improve the carry of the options. This means that under these market conditions, the interest rate options owned by IVOL could have their negative time decay mitigated partially or completely by the roll down in the interest rate curve. Of course, the inverse would also be true: if the curve is downward sloping, then the rates roll up would be an additional hurdle for the options. Historically, the curve has had a positive slope most of the time, making the positive roll down more frequent than the negative roll up.

IVOL's Options Volatility vs. VIX



Data from Bloomberg and Quadratic as of 4/1/2020

Additionally, the cost of buying any option depends on the level of implied volatility. As the chart above demonstrates, interest rate implied volatility, the type used to buy the options in IVOL, remains well below historical averages even after its recent spike. Note how the VIX, by contrast, has risen sharply.

IVOL during Periods of High Inflation and Lower Growth ("Stagflation")

Stagflation is a disastrous outcome for investors. Higher prices coupled with lower growth is a potentially terrible environment to generate positive real returns. With the virus curtailing economic activity while simultaneously disrupting and altering supply chains around the world, we could see prices for many goods rise even as the economy slows. Policy changes that result in reductions of international trade or immigration could also be catalysts for stagflation.

Investors might hope that a large bond portfolio would provide some protection in this stagflation environment, but stagflation could be difficult for holders of fixed income instruments. Bonds could be just as likely to sell off as equities, foiling the popular "risk parity" strategy.

Additionally, the bond market is also susceptible to supply and demand dynamics that could lead to a decoupling of normal correlations. A classic example occurred during the immediate aftermath of the financial crisis from January to March 2009.

During these months, the equity market deteriorated along with the economic data. Investors who looked for a haven in Treasuries were not successful. 2 year (2Y) United States Treasuries (UST's) sold off by 19 basis points (bps) and 10Y USTs sold off by 41bps due to higher supply as the Treasury sought to finance increasing deficits.

As assets of all stripes decline and correlations increase, equities and bonds could sell off together. The type of options portfolio held by IVOL has the potential to benefit from such a scenario. In an environment of increasing volatility, rising prices and higher inflation expectations, IVOL's TIPS and options would be expected to do very well because the interest rate curve is likely to steepen, and volatility increases in such an environment. The positive effect could be even further enhanced by any negative rate cuts the Fed may undertake to stimulate the economy. If, on the other hand, prices fall and the economy experiences disinflation, IVOL may underperform. This is because lower levels of expected inflation might, other factors being held equal, cause the value of the options owned by IVOL to fall. Lower levels of expected future inflation might also cause the TIPS portion of the portfolio to fall.

We certainly do not hope for a stagflation scenario in the US, but, under such an interest rate scenario as described, IVOL's options portfolio may help mitigate investor losses elsewhere in their portfolio.

Diversification? In this market?

IVOL is a potentially attractive addition to a portfolio looking for diversification during a time when many other holdings may have behaved very similarly. It may act as a partial hedge, given how it has very low correlations with the major indexes shown below.

Note in the table on the next page that IVOL has stronger, negative correlations with major US equity indexes on days that those equity indexes fall. It remains largely uncorrelated – or even slightly positively correlated – on days that those indexes increase. Holdings with such characteristics may be very attractive to investors looking to temper large swings in their portfolios.

Historic data does not guarantee future trends, and it is possible that these correlations may change over time. But investors looking for a potential partial hedge of their risk assets with the potential for inflation protected yield may want to consider if IVOL may alter the risk/reward profile of their portfolio.

IVOL Correlation To:	DOW	S&P 500	Barclays Agg	MSCI EM	HY Credit	VIX
Overall	-0.10	-0.08	0.41	0.03	-0.07	0.08
On Down Days	-0.34	-0.26	0.21	0.02	-0.31	0.01
On Up Days	0.06	-0.01	0.47	0.03	0.16	0.13

Daily correlation from 5/14/19 to 3/31/20. "Up Days" refers to days on which the index experienced a positive return. While "Down Days" would have the opposite definition.
Data from Bloomberg and Quadratic calculations.

IVOL's Risk Profile

Since IVOL owns volatility in its portfolio, it should do well whenever interest rate volatility increases. This does not mean there is no risk to owning IVOL. It is important to understand that IVOL may also underperform or lose money when the interest rate curve flattens or inverts, perhaps significantly.

Additionally, the OTC options used by IVOL may give rise to a form of leverage, which may magnify the fund's potential for gain and the risk of loss. The prices of options can be highly volatile, and the use of options can lower total returns.

It is important for investors to understand how OTC options work. OTC options generally have more flexible terms negotiated between the buyer and the seller. As a result, they are generally subject to greater credit risk and counterparty risk. OTC instruments also may be subject to greater liquidity risk. As discussed previously, IVOL seeks to mitigate the risk associated with the potential impact of a steepening swap curve ("curve risk") on the performance of U.S. government bonds by investing in OTC options designed to appreciate in value when the swap curve steepens. There is no guarantee that the Fund's investments will completely eliminate the curve or inflation risk of its long positions in U.S. government bonds.

IVOL's use of such instruments is not intended to mitigate credit risk, or non-curve interest rate risk. In addition, when the curve flattens, the Fund's investments will generally underperform a portfolio comprised solely of U.S. government bonds. In a flattening curve environment, IVOL's hedging strategy could result in disproportionately larger losses in the Fund's options as compared to gains or losses in the U.S. government bond positions attributable to interest rate changes. The Fund's exposure to derivatives tied to interest rates subjects IVOL to potentially greater volatility than investments in traditional securities, such as stocks and bonds. Investing in derivatives tied to interest rates, including through options tied to the shape of the swap curve, is speculative and can be extremely volatile.

Additionally, IVOL invests in debt securities, which typically decrease in value when interest rates rise. This risk is usually greater for longer term debt securities.

Conclusion

Investors need to prepare for the possibility of all three of the market environments discussed above: "Risk On," "Risk Off," and "Stagflation." Even those with high conviction on a likely outcome need to be prepared to be wrong. We believe that IVOL has the capability to work well in all three scenarios, potentially functioning as a yield generator, a low correlation allocation, a value play and/or a hedge depending on how it is used in a portfolio.

IVOL's unique structure and defined strategy make it a potential long-term asset allocation diversifier.

About Quadratic Capital

Quadratic Capital is an innovative asset management firm founded in 2013 by Nancy Davis. Ms. Davis serves as the firm's Chief Investment Officer and is the portfolio manager for the Quadratic Interest Rate Volatility and Inflation Hedge ETF (NYSE ticker: IVOL). IVOL was recently named the "Best New US Fixed Income ETF" by ETF.com.

Quadratic is a registered Small/Minority Business Enterprise and a majority woman-owned firm, and it is a member of the Sustainability Accounting Standards Board (SASB) Alliance which supports the elevation of financially material ESG standards. The firm is based in Greenwich, CT.

Citations

1. Source: https://inflationdata.com/Inflation/Inflation/DecadeInflation.asp),
2. Testifying before Congress on Feb. 26 2019, Fed Chairman Jerome Powell called inflation expectations “the most important driver of actual inflation”. https://www.bloomberg.com/news/ articles/2019-03-15/feds-put-inflation-expectations-at-heart-of-major-policy-review

Definitions

Yield curve: The yield curve shows the prevailing yield of bonds having the same credit risk, but different maturity dates. The most common yield curve is the treasury yield curve that displays the 3m, 2y, 5y, 10y and 30y bond yields. The x-axis displays the maturity and the y-axis displays the yield.

Long interest rate volatility: A strategy that purchases options in the market and benefits if the implied volatility used to price these options increase.

OTC fixed income options: Options whose underlying are fixed income instruments and don’t trade in the listed market or on an exchange. The options are traded in the over-the- counter market directly between two parties.

CPI: The Consumer Price Index (CPI) is a metric that measures a basket of consumer goods and services. Changes in the CPI are commonly used to assess changes in the cost of living. It is used to identify periods of inflation or deflation.

Disinflation: It is the slowing of the pace of price inflation.

Risk parity: It is strategy used in portfolio management focused on the volatility of the underlying asset instead of the allocation of capital. It relies on historical volatility and correlation between assets to determine the optimal asset allocation.

Spread: Additional yield that a bond pays above the benchmark rate.

Risk On / Risk Off: Risk On is broadly defined as periods when equity prices are rising, overall market sentiment is positive, and perceived risk is low. Risk Off is the opposite of risk On.

Stagflation: Stagflation is an economic condition when there is slow economic growth accompanied by or inflation.

Roll down: A roll down is the effect that happens to instruments purchased at a future price that is different from the price today. As time goes by, the value of the instrument converges from the future price to the present price as maturity is approached.

Spot: The spot price is the current price at which an asset is traded for immediate delivery.
Carry: Cost or benefit of holding a position over time assuming no changes in the market.

Implied Volatility: Implied volatility is a metric used to measure the market's probability of changes in the price of an instrument. Investors use to price options contracts.

The Dow Jones Industrial Average ("Dow") is an index that tracks 30 large, publicly-owned companies trading on the New York Stock Exchange and the NASDAQ.

The S&P 500, ("S&P"), is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the US.

The MSCI Emerging Markets ("MSCI EM") Index captures large and mid-cap representation across 26 Emerging Markets (EM) countries.

The iBoxx iShares High Yield Corporate Bond Index (HY) is designed to reflect the performance of USD denominated high yield corporate debt. VIX is a CBOE index that represents equity volatility of 30-day expectations of the S&P 500 equity index.

Bloomberg Barclays US Agg ("BarclaysAgg") The Bloomberg Barclays US Aggregate Bond Index is a broad-based flagship benchmark that measures the investment grade, US dollar-denominated, fixed-rate taxable bond market. The index includes Treasuries, government-related and corporate securities, MBS (agency fixed-rate pass-throughs), ABS and CMBS (agency and non-agency).

Important Information

For Institutional Use Only. Not for Retail Distribution.

This material represents the opinion of the manager. It should not be regarded as investment advice or recommendation of specific securities.

The fund's investment objectives, risks, charges and expenses must be considered carefully before investing. The prospectus contains this and other important information about the company and may be obtained by calling +1-833-IVOL-ETF. Please read it carefully before investing.

Investing involves risk. IVOL has a limited performance history, and there is no guarantee the Fund will achieve its investment objectives. Principal loss is possible. Shares of any ETF are bought and sold at market price (not NAV) and are not individually redeemed from the Fund. Brokerage commissions will reduce returns. The Fund is non-diversified.

There are risks involved with investing in options including total loss of principal. Options investing is not suitable for all investors. This fund utilizes sophisticated options strategies which may not be suitable for all investors. For a more comprehensive discussion of the risks involved in options investing, please review Characterizations and Risks of Standardized Options available at www.theocc.com/about/publications/character-risks.jsp or contact the Options Clearing Corporation directly at 1 N. Wacker Dr., Suite 500, Chicago, IL 60606. (1-888-678-4667)

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Nancy Davis is the founder and managing partner of Quadratic Capital Management in 2013 and is the portfolio manager for The Quadratic Interest Rate Volatility and Inflation Hedge ETF (NYSE Ticker: IVOL).

Ms. Davis began her career at Goldman Sachs where she spent nearly ten years, the last seven with the proprietary trading group where she rose to become the Head of Credit, Derivatives and OTC Trading. Prior to starting Quadratic, she served as a portfolio manager at Highbridge Capital Management. She later served in a senior executive role at AllianceBernstein.

She has been the recipient of numerous industry recognitions. She was named by Barron's as one of the "100 Most Influential Women in U.S. Finance." Institutional Investor called her a "Rising Star of Hedge Funds." The Hedge Fund Journal tapped her as one of "Tomorrow's Titans." Ms. Davis is considered a leading expert in the global financial markets and writes and speaks frequently about markets and investing.

Ms. Davis has been profiled by Forbes, and interviewed by The Economist, The Wall Street Journal, and The Financial Times among others. Ms. Davis is a frequent guest on financial television including CNBC, CNN, Sina, Fox and Bloomberg. She is a sought-after speaker for industry events.