July 31, 2019

The Quadratic Interest Rate Volatility and Inflation Hedge ETF (NYSE ticker: IVOL) seeks to hedge the risk of increased fixed income volatility and rising inflation and to profit from rising long-term interest rates or falling short-term interest rates, often referred to as a steepening of the U.S. interest rate curve, while providing inflation-protected income. The portfolio uses TIPS and long options based on the shape of the **yield curve**. IVOL is agnostic in terms of the *direction* of any changes in interest rates. It aims to profit whether interest rates fall in the short end, rise in the long end or simply become more volatile.

As such, IVOL has the potential to perform well in "Risk On," "Risk Off" and "Stagflation" environments. By doing so, it looks to accomplish many of the same objectives that investors are attempting to address using TIPS, bonds, floating rate notes, real estate, "min vol" stocks, or volatility. It does so in a way that avoids many of the downsides associated with these assets. Investors who currently own any of these assets should consider whether IVOL works as an enhancement to their current allocation or could better accomplish their portfolio goals.

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.

The purpose of this white paper is to explain how IVOL can be used and where it may fit in an investor's portfolio. We will examine how IVOL may perform in "Risk On," "Risk Off" and "Stagflation" environments. We will then compare IVOL to several other assets that investors are currently using to address these risks. In some cases, we believe IVOL works well to enhance allocations. In other instances, we believe it works better than other tools investors may currently be using.

IVOL's Expected Performance in Various Market Environments

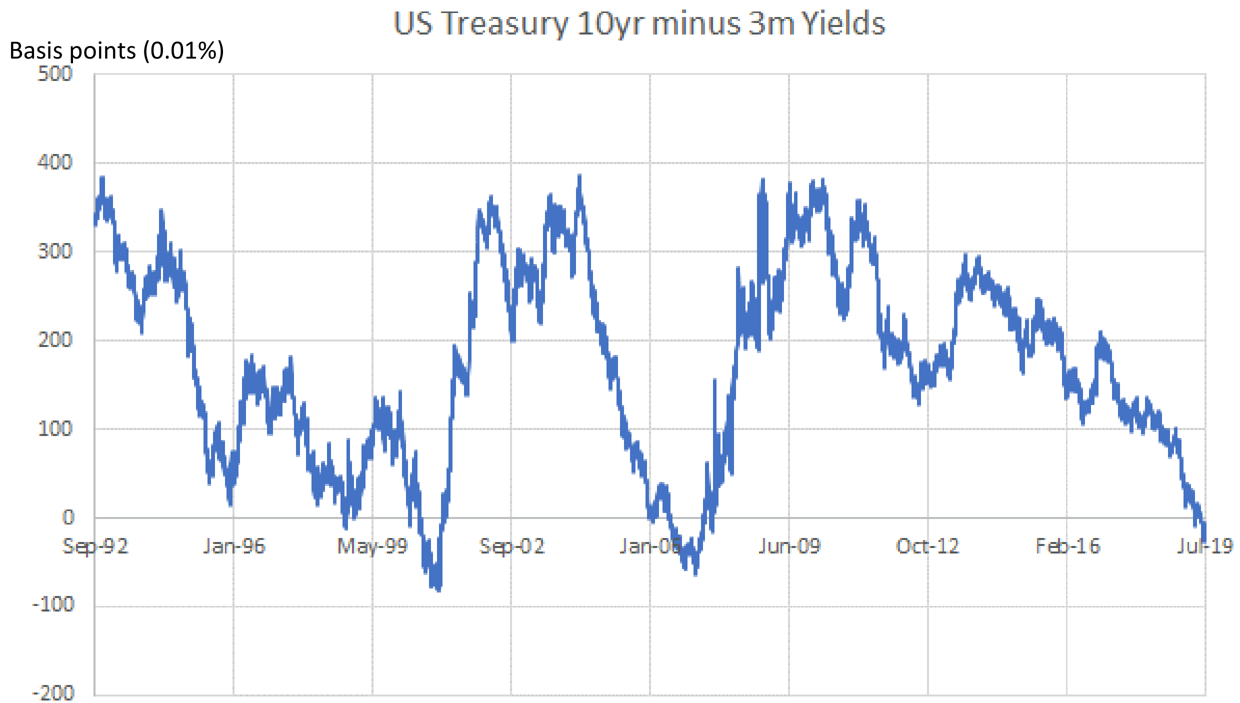
As investors, we spend a lot of time thinking about what is coming next. Will markets continue to climb? Are they due for a correction? Could something even worse be around the bend? Below, we discuss how IVOL's potential performance in three very different market environments – "Risk On," "Risk Off," and "Stagflation."

IVOL during Periods of Inflation Normalization ("Risk On").

The Federal Reserve has succeeded in nearly all of its post-crisis goals with the exception of inflation. Unemployment is at 50 year lows. Equities, bonds and real estate have all seen tremendous price appreciation, with many assets near all-time highs. But inflation remains lower than the Fed would like, with **CPI** at 1.6% and 5 year inflation break evens even lower than

current realized inflation.[1] Surely, if the appetite for risk remains high and unemployment remains at generational lows, the Fed will be hoping to see inflation expectations normalize.

Interestingly, Treasury and TIPS market data does not support this. The Treasury yield curve allows investors to observe the market's expectations for inflation. Currently, the curve is inverted and investors are paid more to own a 3 month T-bill than a 10 year Treasury bond. Put another way, the Treasury market is pricing in **disinflation** in the US for the next decade:



Source: Bloomberg as of July 19th, 2019.
The performance data quoted represents past performance and is for illustrative purposes only.
It does not reflect management fees, transaction costs or expenses.
It does not represent actual fund performance, which can be obtained at www.IVOLETF.com.
Past performance does not guarantee future results.

Data from the TIPS market tells a similar story. Breakeven inflation rates implied by current TIPS levels suggest that the market expects average inflation of just 1.59% over the next 5 years.[2]

[1] Source: Bloomberg as of 7/22/19
[2] Source: Bloomberg as of 7/22/19

The Fed cannot be happy with any of these numbers. Chairman Powell has said that inflation expectations are "the most important driver of actual inflation."[3]. If we remain in a "Risk On" scenario, the Fed will certainly be focused on trying to increase these expectations.

Investors who believe in a continuing "Risk On" environment accompanied by increasing inflation expectations could benefit from having IVOL in their portfolios. IVOL may profit from a "Risk On" environment if the Fed is successful in achieving its goals for inflation, or if inflation expectations rise organically.

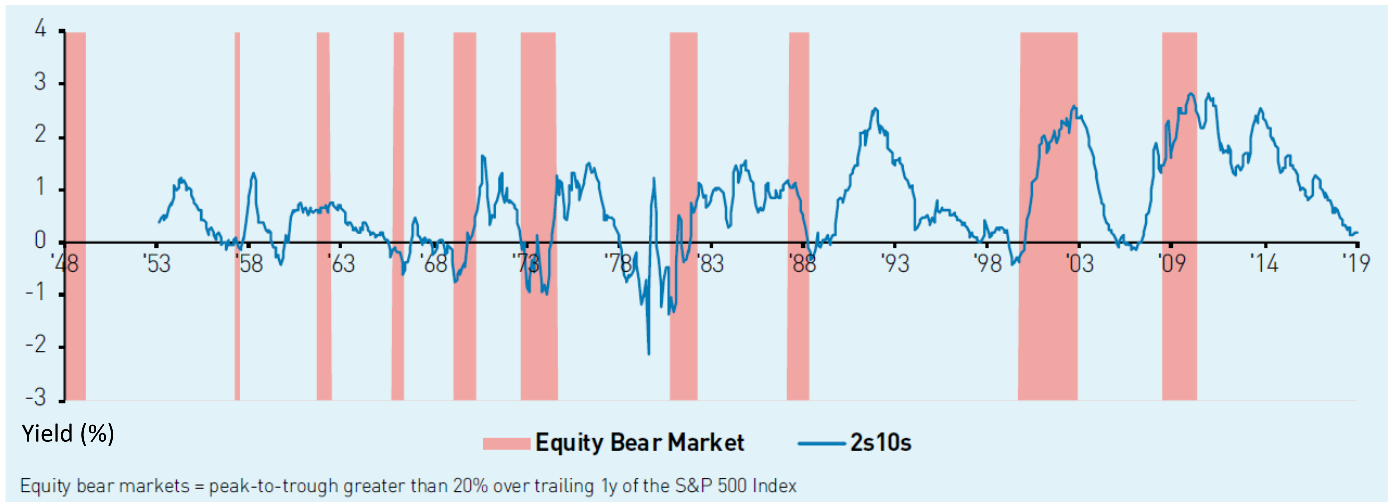
After the past decade's tremendous asset returns, there are very few assets available today that could be considered inexpensive. Investors who expect "Risk On" to continue must hunt for value in other places. Interest rate volatility is one such place, and currently IVOL is the only ETF available that owns it. Because interest rate volatility and inflation expectations are so low, these options are incredibly inexpensive. Investors who don't want to fight the Fed can use IVOL as a way to benefit if the Fed is successful in resetting inflation expectations. They can also use it to access one of the few potentially inexpensive asset classes left.

IVOL during Periods of Recession ("Risk-Off")

Other investors are convinced that the post-crisis boom is near an end and the next move for risk assets is down, perhaps significantly. If the Fed is not successful and we enter into a recession, IVOL offers a potential hedge against corrections in equity and real estate as the prices of these assets tend to fall during times of increased fixed income volatility and/or a steepening of the interest rate curve.

Investors unfamiliar with the over-the-counter rates market are sometimes surprised by its application as a hedge against equity price declines. But 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. The types of options owned in IVOL were one of the very few safe havens during that time. In fact, they rallied significantly as volatility increased and the yield curve steepened. IVOL seeks to benefit from this increase in yield curve steepness and thus may work as a potential hedge against equity losses.

[3] Testifying before Congress on Feb. 26, Fed Chairman Jerome Powell called inflation expectations "the most important driver of actual inflation". https://www.bloomberg.com/news/articles/2019-03-15/fed-puts-inflation-expectations-at-heart-of-major-policy-review



Source: Goldman Sachs and Quadratic Capital as of Q1 2019.
2s10s is defined as the difference between the 10y and the 2y swap rates.
Past performance does not guarantee future results

A similar relationship exists between the steepness of the yield curve and the price of real estate. Higher rates increase the all-in cost of buying a home or other property and can therefore lower buyers' budgets and depress demand. Additionally, increased rate volatility can reduce mortgage lenders' appetite for new loans, causing them to insist on higher down payments or to restrict lending to more creditworthy borrowers. Lastly, demand for commercial space is likely to suffer in any sustained "Risk Off" environment.

These effects may have a profound impact on the prices of residential and commercial property. The options portfolio held by IVOL has the potential to perform well under these conditions and may help homeowners, commercial property owners or investors in mortgages and REIT's preserve value during what might be very difficult times for real estate.

Investors who expect a "risk off" environment in the coming months have to be concerned about their exposure to equities, real estate and other risk assets. One option is simply to cut exposure to those assets and raise cash, but over the last decade that has been a one-way ticket to underperformance. Investors may be right that a crash is coming, but if they are wrong on timing, their performance may be even worse.

An allocation to IVOL allows cautious investors that are exposed to equity or real estate assets to retain their allocation and add to one of the few asset types that historically has performed strongly during sell-offs. Rather than dumping their risk assets and hoping not to underperform, investors may help mitigate their risk via allocations to IVOL.

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

Stagflation is a disastrous outcome for investors. Higher inflation coupled with lower growth is a potentially terrible environment to generate positive real returns. With the economic recovery

aging and monetary stimulus fading, the economy remains vulnerable. Investors should not dismiss stagflation as some banished relic of the 70's.

A trade war could be one possible catalyst. Tariffs could lead to higher prices while growth could decelerate due to market fear and policy uncertainty. Add in the possibility of a major trading partner dumping their holdings of US Treasuries in retaliation and we could see stagflation return with a vengeance.

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, investors could be hard-pressed to find a safe harbor. The type of options portfolio held by IVOL has the potential to benefit from this environment. As inflation picks up, overall prices increase and inflation expectations take hold, these options would be expected to do very well because the interest rate curve is likely to steepen in such an environment. The positive effect could be even further enhanced by any rate cuts the Fed could undertake to stimulate the economy. 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.

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. Now we will compare IVOL with other tools investors are currently using to achieve these goals.

IVOL Compared with Other Investments

Investors have been trying to deal with "Risk On," "Risk Off" and sideways markets since the crisis. They have used a number of tools to attempt to meet their objectives depending on which of these environments they expect to encounter next. The most common assets we have seen investors use to try to manage these risks are Treasury Inflation Protected Securities (TIPS), bonds, floating rate notes, real estate, "min vol" stocks, and volatility. Some of these trades have become so crowded that they no longer make sense. Others may work well in one scenario and poorly in another.

IVOL vs. TIPS

Investors in TIPS likely own them as a way to earn inflation-protected yield. This was the reason the Treasury created the security in the first place. IVOL is built using TIPS, but they are enhanced with long interest rate options. 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 and give investors a potentially better risk/reward profile than TIPS alone.

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,* because it is these expectations for the future which really impact the rate sensitivity of their bond portfolios. IVOL's options on the yield curve are similar to options on inflation, because the yield curve is largely a result of inflation expectations. As such, IVOL gives investors another way to potentially profit from inflation rather than just waiting for their TIPS to reset.

Adding IVOL to a portfolio of TIPS 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.

IVOL vs. Bonds

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 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.

Additionally, many investors use bonds in 60/40 portfolios as a hedge to their equities, because in general bonds tend to appreciate when equities move down. But given the already low level of rates, this relationship may not hold. Investors using this strategy may find their bonds and their equities falling together.

Owning IVOL alongside a portfolio of bonds allows investors potentially to benefit from increases in interest rates, or a steepening of the yield curve, whether from the Fed cutting short rates or investors selling off the long end, or just generalized market volatility. IVOL might be very useful in cushioning the blow of these moves on investors' bond portfolios.

IVOL vs. Floating Rate Notes

Unlike standard bonds, the price of **floating rate notes** ("floaters") have almost no sensitivity to interest rates. Because of this, investors have piled into floaters in hopes of earning yields now

while also benefiting from an eventual rise in rates. But floating rate notes now suffer from several drawbacks.

Depending upon the frequency and magnitude of the individual floaters reset, they may not profit right away when interest rates rise. They may reset only periodically and gradually. Given their popularity, investors seem to have shrugged off this potential downside.

Currently 77% of the bonds trading in the floating rate index [4]commonly used by ETFs are trading above **par**. This indicates that they were issued at a **spread** higher than the prevailing one. Investors cannot treat these instruments as risk free. If the perceived credit risk of issuers increases, the spreads on the floating rate notes are likely to widen, reducing the price of those instruments and consequently causing a loss for investors in what some expect to be one of their "safe havens." Typically credit spreads widen when equities fall. Investors who buy them may be seeking to reduce their exposure to interest rates might be better off with a more direct exposure using IVOL.

IVOL seeks to accomplish many of the goals investors have for their floating rate notes without these drawbacks. IVOL's options portfolio has the potential to appreciate when the interest rate curve steepens and long dated inflation expectations move higher, giving investors a similar benefit to the one they are expecting from their floating rate notes. But IVOL does so without the defined reset periods.

IVOL vs. Real Estate / REITs

Investors who own real estate – either through REITs, commercial property, mortgages or homes – are often looking for diversification and yield. These investors may consider IVOL as a potential hedge. The options held by IVOL are utilized to potentially generate positive returns in interest rate environments that historically have been very challenging for property. Mortgage investors are particularly exposed, as they are by definition short volatility and sensitive to increases in longer-dated yields.

Other owners of real estate may want to consider if IVOL could accomplish their objectives of diversification and increased yield, but with better inflation protection, much more liquidity and far greater ease of ownership.

IVOL vs. "Min Vol" Stocks

Investors own these dividend-paying stocks to be "defensive" and to generate yield while taking what they hope will be less equity risk than the broader market. But with most major indexes near all-time highs, investors are often overpaying for "safe" names. These stocks have nothing to do with owning "volatility." They are just less volatile than other stocks.

IVOL's strategy has the potential to provide yield and also to be able to benefit in a "Risk On" environment, when all equities are appreciating. Just like "min vol" stocks, IVOL may from

[4] Source: Quadratic calculations based on the Bloomberg Barclays Capital US Floating Rate Note < 5 Years Index as of 6/7/19

certain conditions that also may cause stock prices to rise, including Fed rate cuts and increasing inflation expectations which would accompany a growing economy. Yet IVOL does not have any exposure to equities and investors can enjoy these possible benefits without taking equity risk. In fact, the type of options held by IVOL have historically done very well during times of equity market stress (see "IVOL during Risk Off: Recession" above).

IVOL vs. "Volatility"

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. With the exception of IVOL, all other ETFs available today use equity volatility, which is limited only to options on US equities. Like equity options, IVOL's options on the shape of the yield curve have a limited downside and asymmetrically positive upside potential. So why did we build IVOL using options on the shape of the yield curve instead of equity options?

First, as discussed, interest rate options may hedge investors against a wider range of negative scenarios than other instruments used to hedge risk including especially equity options.

Second, we believe that the structure of our options allows for an even more attractive risk/reward relationship. Depending on the prevailing 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. When the curve is upward slopping (when the forward rate is lower than **spot**), then the rates rolldown benefits and improves the **carry** on the options. One of the major drawbacks of equity options is the negative carry.

Additionally, the cost of buying any option depends on the level of **implied volatility**. Interest rate implied volatility, the type used to buy the options in IVOL, currently sit close to generational lows. Jeffrey Gundlach has called interest rate volatility potentially his best suggestion in global markets.[5] To our knowledge, IVOL is the first and, as of this writing, only ETF in which it is available.

Conclusion and a Discussion of Potential Risks

IVOL's unique structure and defined strategy make it a long-term asset allocation diversifier that can outperform in several, very different market environments, including both "Risk On" and "Risk Off" scenarios. It can be used in conjunction with or as a substitute for a number of assets that investors currently use to attempt to navigate today's confusing markets, while often accomplishing these goals with less risk. IVOL can be used as a potential yield generator, a low correlation allocation, a value play and as a hedge against inflation or market corrections in risk

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[5] Speaking Monday May 6th, 2019, at the Sohn Conference in New York, Jeffrey Gundlach said his best suggestion is on volatility in long-term rates. https://www.cnbc.com/2019/05/06/jeff-gundlach-says-investors-can-get-rich-off-interest-rate-volatility.html

assets depending on how an investor combines it with their existing portfolios. And it offers all these benefits with the liquidity and transparency of an ETF.

IVOL's Risk Profile

Since IVOL owns volatility in the portfolio when the curve is inverting or flattening, interest rate volatility may be increasing. IVOL's options portfolio may benefit from this increased interest rate volatility, however, 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 U.S. interest rate curve flattens or inverts, perhaps significantly.

Additionally, the OTC options used by the 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 investor to understand how OTC options work. OTC options generally have more flexible terms negotiated between the buyer and the seller. As a result, that 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 swap curve flattens, the Fund's investments will generally underperform a portfolio comprised solely of the 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.

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).

Ms. Davis began her career at Goldman Sachs where she spent nearly ten years, the last seven at 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 where she managed $500 million of capital in a derivatives-only portfolio. She later served in a senior executive role at AllianceBernstein.

Ms. Davis writes and speaks frequently about markets and investing. She has been published in Institutional Investor, Absolute Return and Financial News, and has contributed papers to two books. She has been interviewed by The Economist, The Wall Street Journal, The Financial Times, New York Magazine and others. Ms. Davis also appears on CNBC, CNN, Reuters, Sina, and Bloomberg.

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.

Floating rate notes: A floating-rate note is a debt instrument with a variable interest rate. It is commonly based on a benchmark rate plus a spread. The most common benchmark is the London Interbank Offered Rate (LIBOR).

Par: Par value is the face value of a bond. It determines its maturity value. Par value for a bond is typically $1,000 or $100. In the market, bonds can trade above par (at a premium) or below par (at a discount).

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, the overall market sentiment is positive, and the 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.

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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