

## The DeFi IndexZoo Lite Paper V1

### The Most Innovative DeFi Crypto Assets Index

by Marshall Chang and Jeff Cherkin

## Overview

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We introduce the DeFi IndexZoo, a DeFi Index factory that produces index products to enable different investment strategy exposures to both the general and sophisticated crypto investors. The first two planned DeFi IndexZoo products solve 2 main problems in the DeFi space today. One is the lack of a systematic approach to benefit from the inevitable market downturn. The other is the lack of a tradable volatility product for investors to hedge against short-term risk. The DeFi IndexZoo will fill in these gaps by launching 2 product groups:

### 1. The Bear

The Bear is an inverse ETF product that short the indices tracking DeFi assets, enabling investors to systematically bet against the whole market or its sub-sectors.

### 2. The Fear

The Fear is a VIX index that measures volatility in the DeFi space, and the tracking ETN products that enables investors to speculate on, or hedge against short-term volatility.

The Bear and the Fear will be the IndexZoo's upcoming products, and each will develop into different groups of products which are customized for different risk/return profiles, timeframe, and active/passive trade-offs.



These are the two frequently used hedges in traditional markets such as the U.S. stock market. They are not currently available neither in cryptocurrency nor the DeFi space. The IndexZoo is created by quantitative traders who are searching for such products while trading the markets.. [DeFi Pulse](#) has been well known to the industry as a leaderboard of DeFi. While DeFi Pulse is a great tool to look for statistics such as TVL and market cap, it is not known to the market yet for an index with hedging and shorting functions. In order to achieve the wide adoption of cryptocurrency trading and investing, such infrastructure needs to be in place.

Initially, the AICM founding team will develop the products. Our team comes from extensive FX trading background, with a core quant strategy built with the powerful Reinforcement Learning algorithm. Going forward, we will transform our A.I. capability to the IndexZoo, such as in the form of Intelligent ETF or more actively managed products, distinguishing ourselves in the growing DeFi index issuing space.

In the long term, we will be creating an ecosystem in which everyone can create and issue tools and products that help with portfolio management. We plan to decentralize the governance of the IndexZoo and create a platform that uses blockchain technology to be both transparent and fair in its treatment of all participants. In 2020, the TradFi ETF industry's total AUM has grown to \$7.7 trillion in the U.S. alone<sup>1</sup>, and we believe that it is just a matter of time before the DeFi overlay ecosystem catches up.

## Portfolio Hedging in the TradFi Markets

Within the short span of cryptocurrency's history, there have been prolonged bear markets and flash crashes more than one can count in one hand. Just recently on May 19<sup>th</sup>, 2021, in one day alone, \$460 billion worth of crypto market<sup>2</sup> cap was wiped away, which is more than 20% of the total market. Any investment involves risk, and a market downturn will happen. Having a sound investment strategy can help smooth out the turbulence portfolio return and save investors from getting caught up in the herd mentality of selling low into a down market. Here we discuss traditional hedging strategies with inverse exposures in the stock markets.



<sup>1</sup> Statista: <https://www.statista.com/statistics/224579/worldwide-etf-assets-under-management-since-1997/#:~:text=In%202020%2C%20the%20assets%20managed,approximately%207.74%20trillion%20U.S.%20dollars.>

<sup>2</sup> Yahoo News: <https://news.yahoo.com/crypto-market-loses-460b-ether-143032976.html>

A hedge, in its simplest form, is an investment intended to move in the opposite direction of the asset in the portfolio that is considered to be at risk. A hedge provides inverse exposure, designed to increase in value and offset potential losses should the at-risk investment decline in value.

Hedging strategies are flexible. Investors can apply it broadly in an effort to minimize loss across entire asset classes, or hedge narrowly to help shield individual sectors or even specific assets. In the stock markets, there are a number of hedging strategies available, serving investors' specific needs, goals and tolerance for risk.

Strategically deployed portfolio hedging can become part of a long-term investment strategy. Deployed tactically, a hedge can be applied and removed as needed, without disturbing the core strategy or long-term goals, helping provide short-term shelter from adverse market events. Hedging tools can provide investors with an alternative to selling in a down market, not only realizing losses but also incurring fees, transaction costs and tax consequences. Of course, hedging strategies have unique risks, costs and consequences of their own (product management fee, rebalancing costs, taxable events etc.).

Here are the 4 TradFi ways to hedge with inverse exposure:

## 1. Short Selling

Borrowing securities from a lender, typically through a margin account with a financing fee, with the intent to buy back at a lower cost and return to the lender.

## 2. Buying Put Options

A contract between two parties in which the buyer of the put has the right but not the obligation to sell a security at an agreed-upon price to the seller of the put, regardless of its market price. Used as a hedge, if the value of the security falls below the specified price, the owner of the put can sell the security for a profit and offset losses in the original position.

## 3. Selling Futures Contracts

An agreement, facilitated through a futures exchange, to buy or sell an asset at a predetermined price on a predetermined date in the future. Used as a hedge, selling a futures contract allows investors to offset the risk of a decline in the price of the asset.

## 4. Using Inverse ETFs

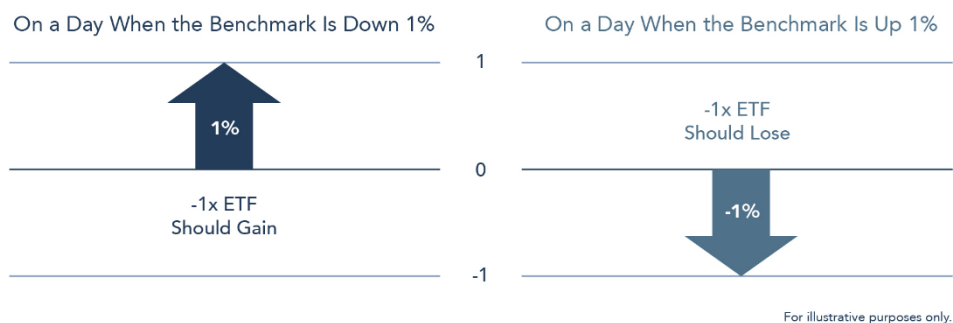
Inverse ETFs are designed to move in the opposite direction of a benchmark or index, by the inverse (x-1) or by multiples of the inverse (x-2, x-3). Used as a hedge, if an investment based on an index declines 1% on a given day, a -1x inverse ETF is designed to rise by 1% that day (before fees and expenses), thereby offsetting the loss.<sup>3</sup>

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<sup>3</sup>[https://www.investopedia.com/terms/i/inverse-etf.asp#:~:text=Key%20Takeaways-,An%20inverse%20ETF%20is%20an%20exchange%20traded%20fund%20\(ETF\)%20constructed, having%20to%20sell%20anything%20short.](https://www.investopedia.com/terms/i/inverse-etf.asp#:~:text=Key%20Takeaways-,An%20inverse%20ETF%20is%20an%20exchange%20traded%20fund%20(ETF)%20constructed, having%20to%20sell%20anything%20short.)

## Pros and Cons of Different Hedging Strategies

While the first three strategies are widely used hedging techniques, they are quite sophisticated and have drawbacks that may place them beyond the reach of many investors. All three may involve the need for margin accounts, and they generally require special brokerage approval that not all investors can qualify for. There are strict collateral and other requirements that may necessitate sizable cash reserves. Furthermore, these strategies can come with substantial costs and risks. The most significant drawback of short selling and selling futures is that one can lose more than invested. In fact, the potential for loss is unlimited. This is particularly true for the Cryptocurrency markets, where liquidity, transaction fees, execution quality for derivatives contracts are still subpar to traditional financial markets.



ETF investors, on the other hand, aren't required to set up a special account or meet any collateral requirements. Investors also can't lose more than the value of the ETF invested. Further, since TradFi inverse ETFs range from specific asset classes down to ones based on a smaller segment of the markets, a wide array of investments can be hedged this way. Nevertheless, there are disadvantages and risks with inverse ETFs too.

## A Closer Look at Inverse ETFs

The concept behind inverse ETFs is straight forward. Take S&P 500 for example, an inverse S&P 500 ETF is designed to move directly opposite the market on a daily basis. A -1% market return will result in 1% of the ETF's return. Of course, a 1% market return will result in -1% of the ETF's return. For investors with greater risk tolerance, using an inverse ETF with -2x or -3x multiples will achieve the same level of hedge using less capital, or to magnify the effects of hedges both up and down. (See the different mechanism of long and short ETF in Appendix)

Unlike conventional index funds which are designed to track the performance of an underlying index over any time period, most inverse ETFs, however, are designed to meet its investment objective for a single day only. This is to ensure that no matter when one invests, an inverse ETF can be expected to deliver its stated multiple for that day. (See the effects of compounding and rebalance in the appendix)

This is due to the necessary daily rebalance of ETF's exposure. Without the daily objective and rebalance, gains and losses may result in compounded returns, causing the ETF's exposure to its benchmark to float unpredictably. This is the reason why inverse ETFs in the stock markets are known

to track daily return well, but terribly with long-term return. In trending periods, compounding can enhance returns, but in volatile periods, compounding may hurt returns.

## Rebalancing Strategies for Using Inverse ETF Longer-Term

Rebalancing involves periodically increasing or decreasing an investment in a fund. For investors seeking to use Inverse ETF longer than a day, there are two common rebalancing strategies: trigger-based and calendar-based. In a trigger-based approach, the rebalance is triggered anytime the difference between the desired hedge exposure and the ETF's current value reaches a predetermined amount or percentage. Several factors determine the frequency of trigger-based rebalance:

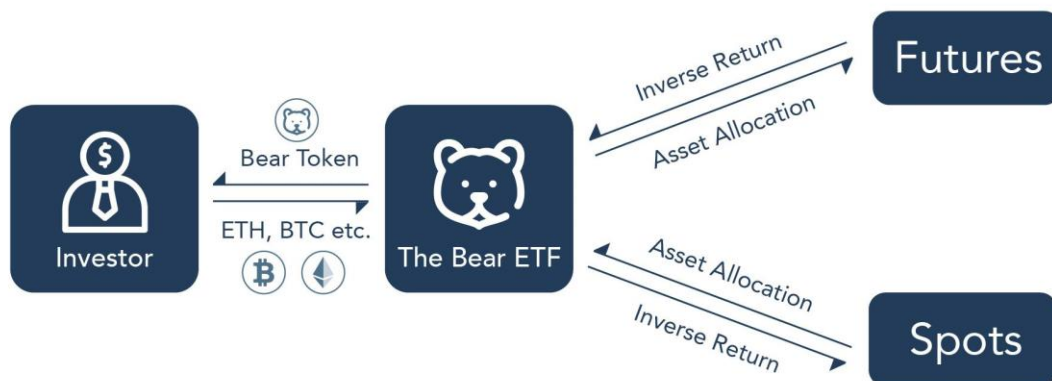
- **ETF Multiple:** The greater the ETF multiple, the more frequent the need to rebalance.
- **Volatility:** An inverse ETF with a more volatile underlying index may require more frequent rebalancing.
- **Percentage Trigger** In general, a larger percentage trigger will require less rebalancing than a smaller one.

For investor hedging over a significantly longer term, a calendar-based technique is preferred. In this case, investors would rebalance at a set time interval (weekly, monthly, quarterly, etc.), regardless of the difference in exposure between the investment and the hedge.

Different from the TradFi inverse ETF product, our DeFi overlay will be built on smart contract. An open source rebalance strategy can be coded in the tokenized product to achieve automatic rebalancing in accordance to the investor's goal.

## The Bear: Tokenized Inverse Defi ETF Protocol

Although DeFi total value locked is making all time high nearly every month (the most cited DeFi Pulse is at \$66 billion as of April 2021), it is hard to comprehend that inverse ETF as an alternative asset class is still missing.



## Product Design

The Bear is a token designed to fill in this gap, providing a return profile similar to the stock market inverse ETF. Like the S&P 500 inverse ETF, the Bear will track indices such as the DeFi Pulse index (DPI). As a conventional index, the DeFi Pulse Index achieves its tracking performance by holding a capitalization weighted basket of DeFi tokens. Due to the lack of index swap or index futures in the DeFi space, the Bear will hold a combination of short spot and short futures positions for the basket of DeFi tokens to achieve the mandated inverse multiple. Instead of rebalancing monthly like the DPI, the Bear rebalances daily to avoid compounding exposure as discussed previously for stock inverse ETF

DeFi Pulse Index **decreases** 10% today



DeFi Pulse Index **increases** 10% today



At the end of each day's clearing, the token holder will get the distributed return as denominated in ETH. For investors seeking to use the Bear as a long term hedge, we may create a separate token that automatically reinvest the remaining amount into the next day, after each day's rebalance. For customized calendar-rebalance strategies, the community can vote using the IndexZoo's governance token to launch and issue new token products.

## Community Driven Products

Perhaps a more useful feature of the Bear protocol is to customize Inverse ETF strategy and short customized portfolio of tokens. A general approach is to design inverse ETFs that short each DeFi sector. Currently there are 115 different sectors listed on Coinmarketcap. The community can also purpose and launch their own Bear product, shorting hence hedging their discretionary portfolio of tokens. Due to the lack of available futures contracts on less capitalized tokens, we foresee that the Bear's ability to hold short spot position and rebalance daily to be an integral part in the early days.

DeFi Pulse Index **decreases** 10% today



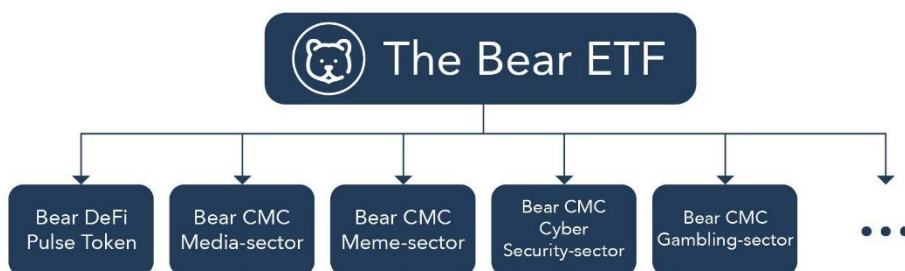
DeFi Pulse Index **increases** 10% today





## Intelligent Bear ETF

With the infrastructure of the Bear inverse ETF, the door to intelligent ETF is opened. Intelligent or smart ETF in TradFi are actively managed fund vehicles that follow a set of rules when constructing and changing its portfolio. The tokenized Bear ETF, with its operating logic built-in the smart contract, is one step away from intelligent ETF. We can design product actively managed algorithms that have the same transparency and ease of access as traditional ETF, enriching DeFi space with a variety of risk to reward profiles.



## Hedging Through Volatility Products

In 1993, Professor Robert Whaley created the Cboe VIX-index, which prices are designed to represent the S&P 500 30 days expected future volatility (Chicago Board Options Exchange [CBOE], 2019). The VIX index and its spot prices itself is not a tradeable asset because the prices are only derived from a basket of S&P 500 underlying index options. However, in 2004 the Chicago board of option exchange (Cboe) launched VIX futures contracts of the VIX spot prices. Since VIX futures inception, volatility as an asset has gotten more attention among traders and scholars, and there has been a large increase in tradable products for VIX as an underlying instrument. The VIX index has been proven to generate returns with a negative correlation to the stock market, which has led to an alternative way for investors to hedge their equity portfolio if one does not want to use derivatives linked directly to the stock market.

Other than the lack of ways to directly long/short VIX, the other three TradFi ways to get exposure with volatility are all available:

### 1. VIX Options

CBOE offers VIX option as a non-equity index option that uses the VIX as its underlying asset. Call and put VIX options are both available. The call options hedge portfolios against a sudden market decline, and put options hedge against a rapid reversal of short positions on the S&P 500 index.

### 2. VIX Futures Contracts

A popular contract is the VIX Weeklys futures, which provide market participants with additional opportunities to establish short-term VIX positions and to fine-tune the timing of their hedging and trading activities.

### 3. VIX Tracking ETF/ETNs

VIX ETFs are a bit of a misnomer since its structure resembles more of a commodity pool. VIX ETFs most commonly track VIX futures indexes. This has introduced the opportunity for a variety of different types of products within the VIX ETF category. Furthermore, most VIX ETFs are, in fact, exchange-traded notes (ETNs), which carry the counterparty risk of issuing banks.

#### A Closer Look at VIX ETF/ETNs

The long VIX products are generally designed for knowledgeable investors who seek to:

- Profit from increases in the expected volatility of the S&P 500, as measured by the prices of VIX futures contracts.
- Reduce U.S. equity portfolio risk, since changes in the VIX Short-Term Futures Index have historically been negatively correlated to S&P 500 returns.

However, they are intended for short-term use; investors should actively manage and monitor their investments, as frequently as daily. The return profile does not track the performance of the VIX index and can be expected to perform very differently from the VIX.

The reason for this is in the structured product's mechanism. One of the most popular VIX ETFs is the iPath S&P 500 VIX Short-Term Futures ETN (VXX). This product maintains a long position in first and second month VIX futures contracts, which roll daily. Therefore, the product measures the returns of a portfolio of monthly VIX futures contracts instead of the VIX index itself. Nonetheless, due to its historically negative correlation to the underlying S&P 500 return, the VIX ETF product group is still widely popular for stock investors to hedge day-to-day volatility. Brexit offers a good recent example:

An investor could have bought shares of the iPath ETF the day before the U.K. vote to protect against a possible market crash if the results favored "leave." In this case, the S&P 500 lost 3.6% on the following trading day, while the ETF gained 24% on the spike in the volatility, which would have helped investors to offset their losses.<sup>4</sup>

In addition, there are also inverse VIX ETFs available that allow investors to profit from the opposite move of VIX, hence from the decrease of volatility. One example of a popular inverse VIX ETF is the ProShares Short VIX Short-Term Futures ETF (SVXY). Based on VIX short-term futures as an index benchmark, this ETF provides an 0.5x inverse exposure to the underlying index, meaning that it is not a leveraged ETF. For 2017, SVXY returned a whopping 191.12%. However, just as volatility itself can be highly volatile, so too can VIX ETFs; in 2018 through mid-July, the SVXY product had returned -91.68%.

In short, VIX as a benchmark for measuring volatility have matured into a tradable asset class, with multiple avenues of products suiting different investor needs. Cryptocurrency, as a young market that is often known for its volatility, has a strong demand for a benchmark VIX index and its related tradable instrument.

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<sup>4</sup> <https://www.investopedia.com/investing/use-vix-etf-in-your-portfolio/>



## Measuring Volatility in Cryptocurrency markets

We have seen effort in the past year to develop the DeFi VIX index in both centralized and decentralized exchanges.

For CEX, Deribit, the world's largest crypto options exchange by trading volume and open interest, has recently launched a bitcoin volatility index called DVOL to help traders assess the market's mood. DVOL uses the implied volatility smile of the relevant expiries to output one number that gives a gauge of the 30-day annualized implied volatility.

For DEX, the startup Volumex Lab has launched the ETHV Index, an index designed to measure the 30-day implied volatility of Ether (ETH), is soon to be live on the Ethereum mainnet. Volmex.finance is designed to be a family of volatility indices and non-custodial trading platform built on Ethereum. Instead of holding underlying futures/options contracts, Volmex.finance mints an equal amount of long and short VIX tokens, and allows users to gain exposure to the index by betting against each other.

It is not surprising that BTC and ETH tracking VIX index are first introduced, as options contracts are still only abundant for the leading cryptocurrencies. The field is still at infancy, with no systematic tradable approach to offer portfolio hedging to investors. We at IndexZoo believe that the best way for wide adoption of any VIX indices is through VIX tracking ETF/ETNs. The simple benefit of not using futures/options accounts is enough for the public to gain exposure to volatility. Plus, the concept of VIX is already well-known in the stock market, a tradable DeFi VIX in the form of a tokenized ETF, conveys and fulfills the investment mandate directly.

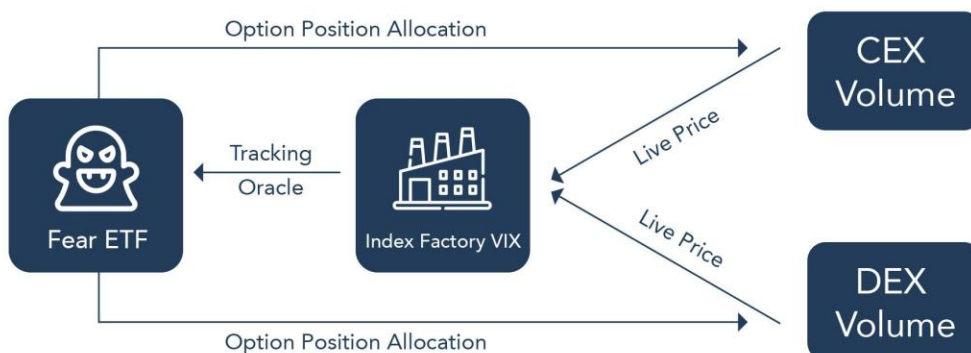
## The Fear VIX ETF: Volatility as a Tradable Asset for DeFi

The Fear offers an easily accessed vehicle for any investor to trade volatility. Following a similar tokenized design as the Bear, the fear provides its token holder direct exposure to DeFi market volatility, in the form of daily balanced ETFs.

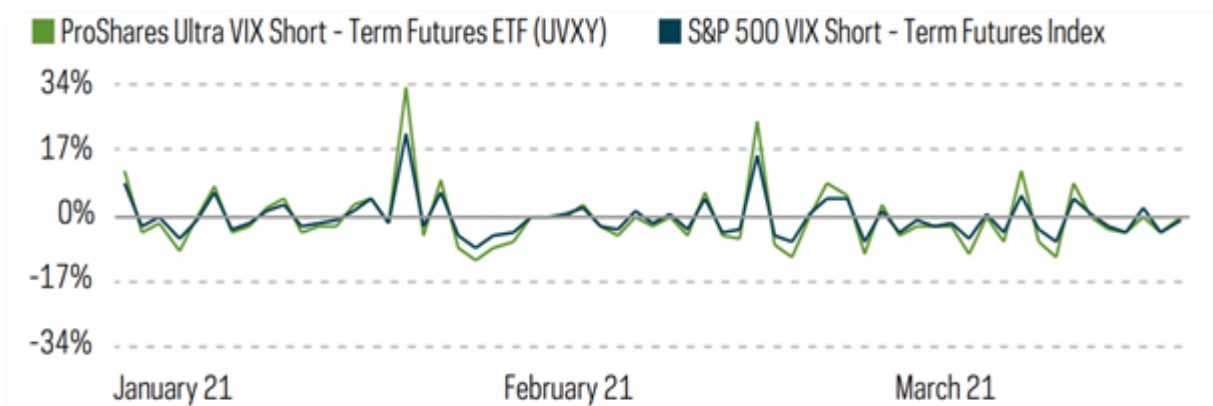


## Product Design

At launch, the Fear will first track BTC and ETH through both CEX and DEX traded options, mirroring the manner of the iPath S&P 500 VIX ETN<sup>5</sup>. Since there is not a universally recognized VIX Index for either the BTC and ETH market, we will create our own index, the IndexZoo VIX Indices, monitoring options that the Fear tracks. Since derivative trading volume is mainly through CEX, the Fear will be connected to exchanges and aim to monitor current volatility as frequently as the API allows.



Unlike the CBOE VIX which has a suite of VIX futures and options contracts available, the BTC and ETH VIX are themselves new concepts not to mention the derivative contracts that derive values from them. Without VIX futures contracts available, our best bet to create exposure to the volatility itself is through holding the option contracts directly. The Fear will automatically build options positions on available CEX and DEX, and operate with daily rebalance and clearing, aiming for perfect tracking of daily volatility. The return profile of the Fear ETF will be correspondent but not perfectly tracking the IndexZoo VIX index. This resonates with the return profile of the stock market overlay, as in the daily return graph below.



The S&P VIX ETF/ETNs are flawed contracts, in that they almost never track the index accurately and are near certain to be at loss when holding beyond daily. The Fear, with an ambitious plan to derive

<sup>5</sup> <https://www.proshares.com/>

exposure directly from the underlying options contracts, is in no doubt meant to be an experimental product in the beginning. The advantage, however, is that the Fear's option positions will be the options that constitute our IndexZoo VIX index, providing theoretically a perfect tracking of the index.

As VIX index becomes standardized, such as the DVOL on Deribits, VIX futures contracts will inevitably be created on CEX and DEX. By then a better VIX ETF product can be built and the ecosystem of volatility assets will mature in DeFi. Compared with current solutions from Volumex Lab, which is essentially creating a competition ground for investors longing and shorting the index, we believe that the future of volatility products will mirror that of CBOE, with the underlying futures and options contracts held in ETF/ETNs.

## VIX Indices for DeFi

Due to correlation of BTC and ETH return to the broad cryptocurrency market, a BTC or ETH VIX may seem enough for today's market. However, as different DeFi ecosystems start to gain in user base and market share, we believe that going forward more VIX Indices may be created, and the related Fear ETF product created as well to provide investors a comprehensive suite of hedging products. As with the Bear products, the future issuing of more Fear products will be in the hands of the community, depending on demand and trading volume.

## IndexZoo's Smart Contract Logic - The Habitat Protocol

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TokenSets and Balancer Pool are the 2 most used asset management protocols in the DeFi space. Using these protocols, various long-only indices products are built, including the most recognized DeFi Pulse index. However, both Sets and Balancer Pool lack the trading flexibility to achieve active and frequent rebalancing needed in creating our derivative products. The available liquidity aggregator on these protocols also do not cover the short-exposure we seek yet. Therefore, IndexZoo will launch its own ETF protocol that enables flexible trading algorithms and smart rebalancing designs, named the Habitat Protocol.

The Habitat will borrow existing architecture that is battle tested in TokenSets and Balancer Pool, and enhance upon the trading functionality and liquidity selection. Just like in the Balancer smart pool protocol, users can instantaneously issue our animal token with ETH, and the tokens are fully backed by the assets they represent, safely stored in our non-custodial treasury and instantly redeemable at any time.

On the trading side, the protocol is open to a wide range of liquidites providers on both DEX and CEX. For the Bear Inverse ETF to recreate short exposure of the DeFi Pulse index, opening the short position of the basket of its DeFi token holding is required. The Bear will have access to each token's short exposure through both margin trading and perpetual futures contracts on DEX such as DyDx. The Bear will automatically calculate the required exposure needed to achieve its mandated return profile (x-1,x-2,x-3), and short the basket of tokens in accordance to DeFi Pulse's market cap weighting, to create the exact inverse return. Due to the liquidity constraint on such exchanges, the token issuance will have upper constraint and may be offered on batches going forward.

## The Bear in the Habitat

The rebalancing mechanism for the Bear Inverse ETF will be on an active basis. For example, to reach a -2x tracking of a token's return, the Bear elects to use a 10x leveraged short perpetual futures contract on DyDx. The bear will need to maintain a used margin ratio of 20% of its total NAV to achieve the aimed 200% return tracking. When the token's price goes down by 5%, the Bear's NAV will increase to 110% from its starting position, resulting in a margin ratio of  $20/110 = 18\%$ , which translates to -x1.8 leverage ( $18\% * 10x$ ). It will then need to sell the excessive profit such that the resulting leverage ratio will be x-2 again:

X: amount needed to sell

Solve for X:  $(20 - x/10) / (110 - x) = 20\%$

X = 20

The same is true when the token's price goes up. The Habitat allows customized rebalancing strategies based on the product's mandate. The above example will be a balanced product that aims for a perfect tracking. A different product may adopt a non-periodic rebalancing schedule, and rebalance when a certain price level hits, hence reducing trading costs. We can also design the Bear to be discretionary, only gain exposure when the algorithm recognizes a market downturn, and hold cash when the market is going up, hence not a pure hedge but providing alpha (excessive return) in the downward markets. Here are a few Bear Inverse ETF products with different profile in our pipeline:

- **Brown Bear** - Designed to withstand seasonal and short-term downturns. The Brown Bear is meant for short-term hedging. This is the balanced product, using intra-day active rebalancing, and produces different leverage profile (x-1,x-2,x-3)
- **Polar Bear** - Designed to survive the harshest winters. The Polar Bear gradually appreciates as markets suffer. This product seeks a -0.5x inverse return and an infrequent rebalancing schedule (daily) that enables long-term holding and large profit in a long term bear market.
- **Giant Panda** - An actively managed Intelligent Bear that aims to create Alpha (Excessive Return) in the bear market. Holding cash and gaining exposure on discretion, powered by reinforcement learning algorithms that make calculated bets on market regime changes.

## The Fear in the Habitat

As a tradable volatility product, the Fear VIX ETF will first need its underlying tracking index. The IndexZoo VIX on BTC and ETH will be the first 2 indices created, tracking liquid near term option contracts' price on Deribit. Depending on liquidity on other exchanges, we may aggregate prices to the oracle going forward. Just like the S&P 500 VIX that represents the +/- percentage move annualized by 1 standard deviation, the IndexZoo VIX represents the same implied volatility of the underlying asset. The

exact calculation is below:

- 1, Retrieve the price of the underlying Index.
- 2, Find the first up and first down strike based on the index price, for Biweekly and Monthly contracts
- 3, Calculate the implied volatility for both calls and puts for those four strikes.
- 4, Calculate the implied volatility for strikes
- 5,  $\sigma_1^{X_{up}} = (\sigma_{c,1}^{X_{up}} + \sigma_{p,1}^{X_{up}})/2$   $\sigma_2^{X_{up}} = (\sigma_{c,2}^{X_{up}} + \sigma_{p,2}^{X_{up}})/2$
- 6,  $\sigma_1^{X_{down}} = (\sigma_{c,1}^{X_{down}} + \sigma_{p,1}^{X_{down}})/2$   $\sigma_2^{X_{down}} = (\sigma_{c,2}^{X_{down}} + \sigma_{p,2}^{X_{down}})/2$
- 7, Where  $X_{up}, X_{down}$  are strike prices,  $X_{up} > X_{down}$  then calculate Implied Vol for expires.
- 8,  $\sigma_1 = \sigma_1^{X_{down}} * \frac{(X_{up}-S)}{(X_{up}-X_{down})} + \sigma_1^{X_{up}} * \frac{(S-X_{down})}{(X_{up}-X_{down})}$
- 9,  $\sigma_2 = \sigma_2^{X_{down}} * \frac{(X_{up}-S)}{(X_{up}-X_{down})} + \sigma_2^{X_{up}} * \frac{(S-X_{down})}{(X_{up}-X_{down})}$
- 10, And then linearly interpolate VIX as
- 11,  $VIX = \frac{\sigma_1(N_{t2}-14)}{N_{t2}-N_{t1}} + \frac{\sigma_2(14-N_{t1})}{N_{t2}-N_{t1}}$

With Habitat's flexibility in adding data providers in the oracle. Without available options and futures contracts on any Crypto VIX indices, the Fear uses underlying option contracts to create VIX-like volatility exposure to token holders. The specific options strategy used is called "iron condor":

<https://seekingalpha.com/article/4184256-best-way-to-trade-volatility>

In this strategy, a trader buys an out-of-the-money (OOTM) call option and an put option, having the same absolute value of delta, with  $\delta_n$  :

$$\delta_{call} = \delta_n, \delta_{put} = -\delta_n$$

and simultaneously sells a call option, having a higher strike price than the former call option, and a put option at a lower strike price, and both having a somewhat lower absolute value of delta:

$$\delta_f < \delta_n \text{ and } \delta_{call} = \delta_f, \delta_{put} = -\delta_f$$

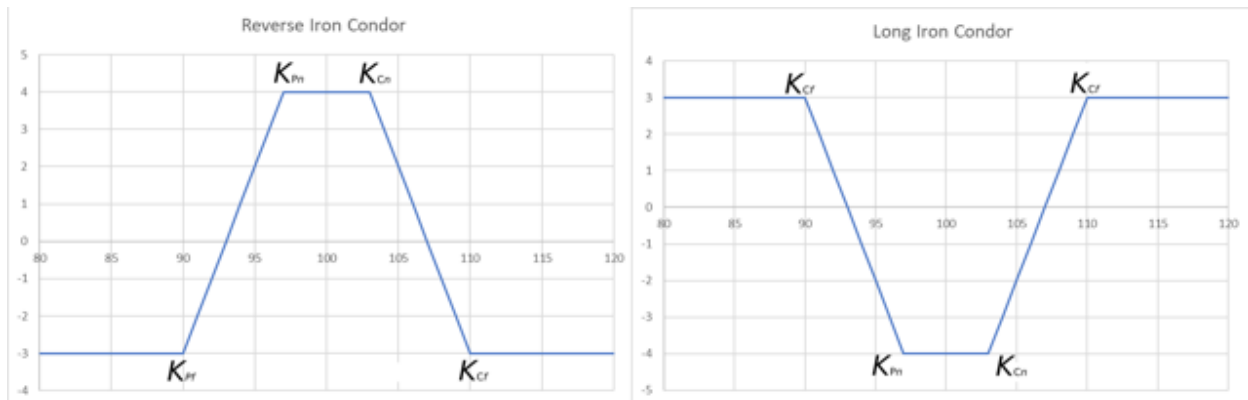
This position is a long iron condor (LIC) strategy: Buy near-call, buy near-put, sell far-call, sell far-put, or:

$$+C_n + P_n - C_f - P_f$$

The reverse position, "reverse iron condor" , is the exact opposite:

$$-C_n - P_n + C_f + P_f$$

The expiration payoff diagram for this strategy, for RIC (left) and LIC (right) are:



To better mimic the VIX options itself, we adapt the “iron condor” to be daily rolling. In a daily rolling condor strategy, the portfolio contains two iron condors - one for the nearest and one for the next expiration terms of the monthly options on the BTC or ETH. A daily rebalance is carried out to maintain an average of one-month expiration horizons for our portfolio. Also, the strikes are recalculated daily. Every day, at market close, the two nearest monthly option expiration dates are considered:

$T_1$  – nearest expiration date of monthly SPX options  
 $T_2$  – next expiration date of monthly SPX options

in general:  $\begin{cases} 0 < T_1 \leq 1 \text{ month} \\ 1 < T_2 \leq 2 \text{ months} \end{cases}$

A detailed description of the strategy is in the appendix. As with the Bear ETF's flexible trading functionality, the Habitat provides the Fear with the necessary contract features in the options market. As aforementioned, the Fear product will be rather bespoke at launch, hence will be limited to a cap supply of tokens. As the return of the products becomes predictable with our Zoo VIX index, we may issue new tokens in batches. Currently, based on exposure horizon, there are a few Fear products design in the pipeline:

- **The King Cobra** - Ultra-short VIX Futures ETF, the fastest attacking specie
- **The Black Mamba** - Short VIX Futures ETF, well, less fast
- **The Golden Python** - Mid-term VIX Futures ETF, kind of slow, but big and mighty

## “ZooKeeper - ZKP”, The Governance Token of the IndexZoo

The ZooKeeper Token is the native token of the IndexZoo. It grants holder:

- Zoo's future income
- Voting power in the IndexZoo's board
- Decide what new animals to house
- Discount when adopting your own animal

### “Group Tour” - Saving Gas by Pooling Users Traffic Together

IndexZoo allows users to pool their ETH together in our smart contract, adopting (minting) animals together instead of individually. Users deposit their ETH into the Group Tour pool. As soon as the



threshold is reached, the smart contract mints everyone's token together, lowering and sharing the costs.



## Appendix

### Comparing the balance sheet of leveraged long and short ETF

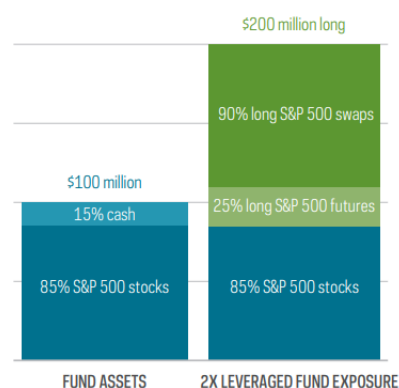
Here we analyze how a long and a short ETF generate 2x and -2x exposure tracking the S&P 500 index. Each fund has \$100 million total asset, seeking \$200 million exposure, using a combination of equities and related derivatives.

#### S&P 500 Long Fund

The long fund might invest 85% of its underlying assets in S&P 500 stocks, and the remainder 15% of the assets in cash.

The fund might then use a portion of its cash to purchase S&P futures contracts, enough to provide \$25 million of index exposure. This would bring the portfolio's index exposure to 110%.

In the stock markets, the fund might also employ a long equity index swap agreement tied to the S&P 500, with the notional value of \$90 million. The fund would receive the index's total return on the \$90 million notional value in return for interest payments on the same amount. The index return and interest payment would be accounted for on a daily basis.

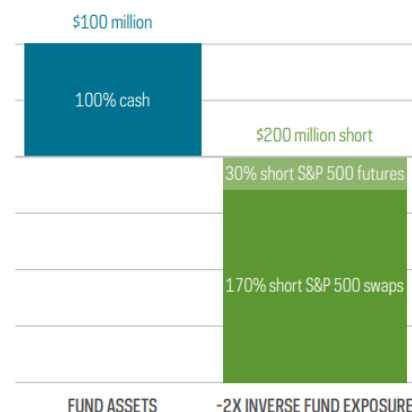


#### S&P 500 Short Fund

The short fund might keep nearly all of its assets in cash.

The fund might then use some of its cash to open short positions on S&P 500 futures contracts, enough to provide about 30% of inverse index exposures.

The fund might also employ short equity index swap agreements tied to the S&P 500 with a notional value of \$170 million. The fund pays the index's total return on the \$170 million notional value and receives interest payments on the same amount. The index return and interest payment would be accounted for on a daily basis.



### Return Divergence

Individual investors often do not understand that beyond a day, leveraged and inverse ETFs returns might diverge from index returns

- Example: Consider a double-leveraged ETF ( $x = 2$ ) with an initial NAV of \$100
  - Index starts at 100, falls 10% one day and then goes up 10% the subsequent day.
  - Over the two-day period, the index declines by -1% (down to 90, and then climbing to 99).
- While an investor might expect the leveraged fund to decline by twice as much, or -2%, over the two-day period, it actually declines further, by -4% to \$96
  - Doubling the index's 10% fall on the first day pushes the fund's NAV to \$80.
  - The next day, the fund's NAV climbs to \$96 upon doubling the index's 10% gain.

## Dynamics of a 2 long ETF

- Day 0
  - Assume AUM = \$100; index value = 100
    - With NAV = \$100, required notional total return swaps is long the index \$200 (or, equivalently, \$100 long plus \$100 swap)
- Day 1
  - Suppose index falls 10%; index drops from 100 to 90
  - Swap value =  $(1 - 10\%)200 = \$180$  for a \$20 loss
  - With AUM now at \$80, the required notional amount of swaps = \$160 (= \$80 \* 2)
  - Swap reset = -\$20 (= \$160 - \$180)
  - Fund reduces its exposure by selling \$20

## Dynamics of a 2 inverse ETF

- Day 0
  - Assume AUM = \$100; index value = 100
  - With NAV = \$100, swap position is short \$200
- Day 1
  - Suppose index falls 10%; index drops from 100 to 90
  - Swap gain is \$20 on short position

- With AUM now at \$120, the required notional amount of swaps =  $-\$240 (= -2 \times \$120)$
- Current swap exposure is  $-180 = -290$
- Required swap reset =  $-\$60 (= -\$240 - \$180)$
- Fund reduces its exposure by selling \$60

## Mechanics of Leveraged Return

### Notation:

- $S_n$  = index level on day  $n = 0, 1, \dots, N$
- $r_{n-1,n}$  = return on underlying index from date  $n-1$  to  $n$
- $A_n$  = Leveraged ETF's NAV on day  $n$
- $L_n$  = Notional amount of total return swaps required before  $n+1$
- $x$  = Leverage factor ( $x = -3, -2, -1, 2, 3$ )
- $E_{n+1}$  = Exposure of total return swaps on day  $n+1$

### Derivation:

#### End of day rebalancing flows:

- Hedging term is non-linear and asymmetric
- Always positive (except when  $x = 1$  for linear, traditional funds)
- Reset or re-balance flows are always in the same direction as the underlying index's performance, for both long and short
- Inverse ETF rebalance trades do not offset the corresponding long rebalance trade
  - For example, it takes the value 6 for triple-leveraged ( $x = 3$ ) and double-inverse ( $x = -2$ ) ETFs
- Need for daily re-hedging is unique to leveraged and inverse ETFs
  - Traditional ETFs that are not leveraged or inverse, whether they are holding physicals, total return swaps or other derivatives, have no need to re-balance daily