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**TokenSets**

DeFi Project Deep-Dive

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## Research and Insights

DeFi Report



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# 1. Executive Summary

Welcome to our Deep Dive into DeFi, and in this article we focus on study of TokenSets

## Key Takeaways:

- TokenSets is a platform which provides a user-friendly interface to buy Strategy Enabled Tokens (Set tokens). All functions embedded in Set token like creation, issuance, redemption and rebalancing are supported by Set Protocol;
- Set tokens are ERC20 tokens and each Set token is a representation of a crypto portfolio. The underlying strategy is called “set” which is a basket of cryptocurrencies;
- Rebalancing Token is a wrapper of Set token that enables Set to perform rebalance to align with the previous determined strategy;
- The Set protocol proposed a modified Dutch Auction for bidder to bid the over-collateral tokens in the rebalancing phase. The auction price is predefined as a function of time which the price will increase with different manners based on 3 different stages;
- Liquidity providers are incentivized to provide capital for price spread or slippage during Set rebalancing. Liquidity provider is open to all participants which means that the general user can also get profit by taking part in Set rebalancing auction



## 2. Introduction

TokenSets is a platform that uses Set protocol to simulate the procedures of traditional portfolio management.

Set protocol is decentralized protocol based on the Ethereum blockchain and designed to strategically manage cryptocurrency assets. It abstracts a basket or portfolio of its underlying tokens (components) to a single token (Set Token) and provides functionalities for users to create, issue, redeem, and manage portfolios of ERC-20 tokens in a completely trustless way.

### 2.1 Motivation

As the development of blockchain and cryptocurrencies progresses, there has been an explosion in the number of new tokens. Portfolio management has become harder as investors need to monitor multiple tokens. In addition, transaction fees go up with more trading pairs. TokenSets aims to make asset management simple and trustless.

### 2.2 Set and Set Token

The Set protocol is a tool to automate algorithmic trading strategies on the Ethereum blockchain. Each trading strategy in the protocol is called “**set**”, representing a basket of cryptocurrencies that performs different functions.

The strategies are represented by Strategy Enabled Tokens (SETs or Set Tokens). A SET is actually an ERC20 token that represents a fully collateralized portfolio of other assets including Bitcoin (WBTC), Ethereum (WETH), and stablecoins (DAI). With a SET token, the procedure to set up your portfolio to automate a trading strategy or to perform asset allocation and rebalancing is as simple as acquiring an ERC20 token.

The process of realigning the underlying tokens’ weights based on a predefined strategy is performed via smart contracts with no required action from the holder. Typically, Sets tokens are used to build passive investment portfolios like Index / ETF funds but also include some crypto enthusiastic strategies.

## 2.3 Set Properties

**ERC20 Token:** Sets comply with ERC20, a standard interface of functions and events that an Ethereum token contract must implement. Theoretically, Sets can be traded just like any other ERC20 token among exchanges. But in reality, Sets are limited by liquidity and are not listed on exchanges.

**Collateralized:** Sets are collateralized by their underlying tokens (components), which are held inside of smart contracts. This allows users to trustlessly hold their assets inside the protocol.

**Redeemable:** Sets can be redeemed or traded for their components. This gives Set holders confidence that they can liquidate their Sets for the underlying liquid asset.

**Specified tokens and units:** Each set has a specific list of underlying tokens and their respective quantities. Each token minted from a Set contract cannot deviate from the specified tokens and ratios as defined during the construction of the Set contract. As long as the desired tokens issued or redeemed match the predefined Set weights, it is possible to issue and trade fractions of Sets.

**Composable:** As long as the Sets conform to the ERC20 standard, Sets can be composed of other Sets. This makes it possible to have a single token to represent a limitless number of other tokens without hitting the block gas limit.

**Trustless:** Set is open source collection of smart contracts and functions only as programmed. It has been designed so that only users who hold the corresponding Set can redeem it for collateral. In this way, users can have confidence when depositing collateral onto the platform.

## 2.4 Sets Classification

TokenSets offer two types of sets: robo sets with hard-coded strategies, and social trading sets with strategies executed by human traders. Each Set has its own criteria for when to rebalance the weight of its portfolio of assets. Currently, TokenSets support ETH, USDC, DAI, WBTC and LINK tokens.

### Robo Sets

Robo Sets are strategies that auto-execute by smart contract without human involvement. These strategies typically follow set rules, including trend trading, range trading, and buy and hold portfolios of multiple tokens.

Name	Description	Examples
<b>Trend Trading</b>	Trading strategy based on the widely used statistical analysis techniques and indicators	<ul style="list-style-type: none"> <li>• ETH RSI 60/40 Crossover (ETHRSI6040)</li> <li>• ETH 12 Day EMA Crossover (ETH12EMACO)</li> </ul>
<b>Inverse</b>	Track the inverse price movement of a benchmark and gains value when the benchmark Set declines	<ul style="list-style-type: none"> <li>• Inverse ETH 20 Day MA Crossover (iETH20SMACO)</li> </ul>
<b>Buy and Hold</b>	For holders who want to diversify risk by holding multiple tokens in a certain ratio	<ul style="list-style-type: none"> <li>• BTC ETH Equal Weight (BTCETH5050)</li> <li>• BTC ETH 75%/25% Weight (BTCETH7525)</li> </ul>
<b>Range Bound</b>	Range Bound strategy automates buying when prices go down and selling when prices go up to capture local highs and lows	<ul style="list-style-type: none"> <li>• ETH Range Bound Min Volatility (ETHMINVOL)</li> <li>• BTC Range Bound High Volatility (BTCHIVOL)</li> </ul>

## Social Trading Sets

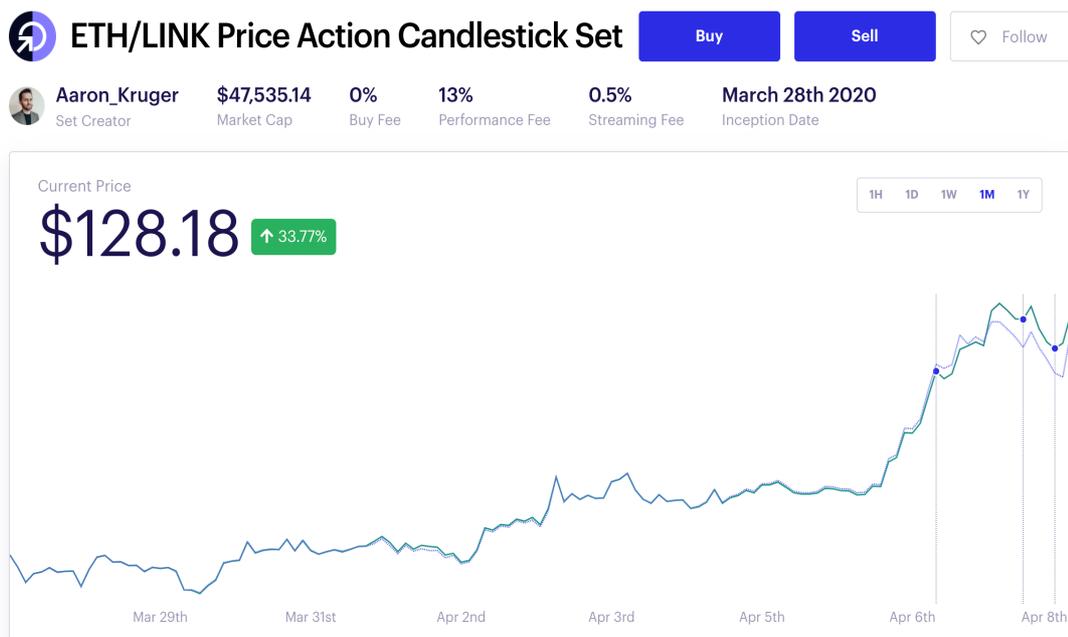
Set Social Trading is a marketplace and network that enables traders to create and manage their own Sets, giving the public instant, trustless, exposure to their trading strategies. Users can follow along with these strategies by simply minting a Set on TokenSets which copies every single action the trader enacts.

Through the use of social trading sets, users can not only use simple algorithmic trading strategies, but also those created by experienced traders.

Traders can set an entry fee between 0% and 5% for each of their Sets. These fees are paid to the trader in the form of Sets which means they are automatically reinvested into their own strategy.

Traders can enact a rebalance for their Sets by submitting an Ethereum transaction and publishing the reasoning/rationale behind their decision on TokenSets. Users who own a Set that follows these trades will have their positions automatically rebalanced.

The rebalance process is the same as any other Set — it kicks off a Dutch auction where third-party liquidity providers use the Rebalancing Dashboard to participate in the rebalance.



## TokenSets Interface

The Set interface below allows users to browse through different Sets and see their performance over multiple time frames. From this screen, users can click into the strategy and make trades.

## Explore

Explore the top performing Sets and Traders on TokenSets.

Social Trading Sets [Robo Sets](#) Traders Legacy Sets Become a Trader ETH - SET USD - SET

Name	Strategy	Market Cap	Price	1 Day	1 Week	1 Month	3 Months	Since Inception
ETH 20 Day MA Crossover Set		\$793,018.39	\$357.65	↑ +1.2%	↑ +29.3%	↓ -0.6%	↑ +63.6%	+16.2%
Inverse ETH 50 Day MA Crossover Set		\$132.51	\$124.87	↑ +1.2%	↑ +29.3%	↓ -16.0%	↓ -16.0%	-33.3%
ETH RSI 60/40 Yield Set		\$749,393.70	\$201.24	↑ +1.2%	↑ +29.3%	↑ +25.3%	↑ +99.9%	+101.7%
ETH RSI 60/40 Crossover Set		\$491,739.38	\$201.08	↑ +1.2%	↑ +29.3%	↑ +25.4%	↑ +99.9%	+100.6%
ETH 20 Day MA Crossover Yield Set		\$1,227,444.54	\$382.53	↑ +1.2%	↑ +29.3%	↑ +8.8%	↑ +81.3%	+85.2%

# ETH 20 Day MA Crossover Yield Set

The ETH 20 Day MA Crossover Yield Set automatically rebalances when the price of Ethereum crosses and stays below the 20-day moving average. This strategy automatically accrues interest on your cash when the market is bearish.

Current Price **\$382.18**    24HR Price Change **↑ \$4.12**

ETH. ETHMACOAPY automatically triggers a trend reversal. If the price of Ethereum crosses and stays below the 20-day moving average, this strategy automatically accrues interest on your cash when the market is bearish.

APR **0.40%**

Buy  ETHMACOAPY

Pay  ETH

Balance ⓘ
0.0000 ETH  
\$0.00

Preview Buy

## 3. Mechanism

In this section, we would like to highlight the key ideas on how the Set protocol works, and the mechanisms behind each Set's operation.

Initially, a Set is designed and created through the Core smart contract. Sets are then funded and issued through the standard Issuance Flow if the user has all the underlying components. Users who wish to have their Sets updated can choose to do so by issuing a Rebalancing Set Token. Finally, a Set can be redeemed by burning the owner's Set token and retrieving the components.

### 3.1 Set Token and Rebalancing Set Token

A "Set" is a token fully collateralized by its underlying tokens (e.g. BTC, ETH and etc.). Sets allow users to group together different tokens and synthesize them into a single higher-order tokens that represent its underlying parts. The reverse process, redemption, allows users to split a Set back into its underlying parts.

A Set defines procedures of creating, issuing, rebalancing, and redeeming Set tokens using a collection of smart contracts and integrations with liquidity pools. Set's architecture has been inspired by Ox Protocol and dYdX. Set adopts modular design that includes a collection of independent smart contracts where additional components can be seamlessly integrated or removed.

Rebalance Tokens are different ERC20 token generated by a wrapper contract around a Set Token. The wrapper contract defines what oracle solution to use for identifying the new Set to rebalance into and the rules for rebalancing.

## 3.2 Rebalancing

Rebalancing is the process of realigning the weights of a portfolio, which involves periodically purchasing and selling portfolio components (underlying collateralized tokens) to maintain a certain allocation. Historically, the act of rebalancing was cumbersome, as users had to do it manually. They had to review their portfolio, calculate the optimal allocation, and then trade their excess tokens for the missing tokens needed to create the new portfolio.

The rebalancing of Sets works in three stages:

### 1. All rebalancing criteria are met

**Rebalancing Interval:** The amount of time a Set needs to wait in order to execute a rebalance. This can avoid rebalancing too frequently which would result in excess transaction costs. Furthermore, since Sets cannot be bought or redeemed during rebalancing, doing so too often would create extra downtime of buy, sell, issuances, and redemptions.

**Price Movement:** The underlying tokens' prices must have moved by at least a predetermined amount in order to justify a rebalance (i.e. +/- 1%).

### 2. A rebalance is proposed

Once the rebalancing conditions are satisfied and the next allocation is determined, it enters the proposal phase. This period is set at 8 hours for the current Sets listed on TokenSets. The proposal period is there to allow users to redeem their tokens in case they wish to opt out. All actions such as buying, selling, issuing, and redeeming are all available during this period.

### 3. A rebalance is executed and settled

Once the proposal period ends, the Set enters the rebalancing phase. During this time, all related transactions are paused, and the over-collateralized token(s) are traded for the under-collateralized token(s) in a Dutch auction by liquidity providers.

Before going into the detail of rebalancing, there are some terms

that should be clarified.

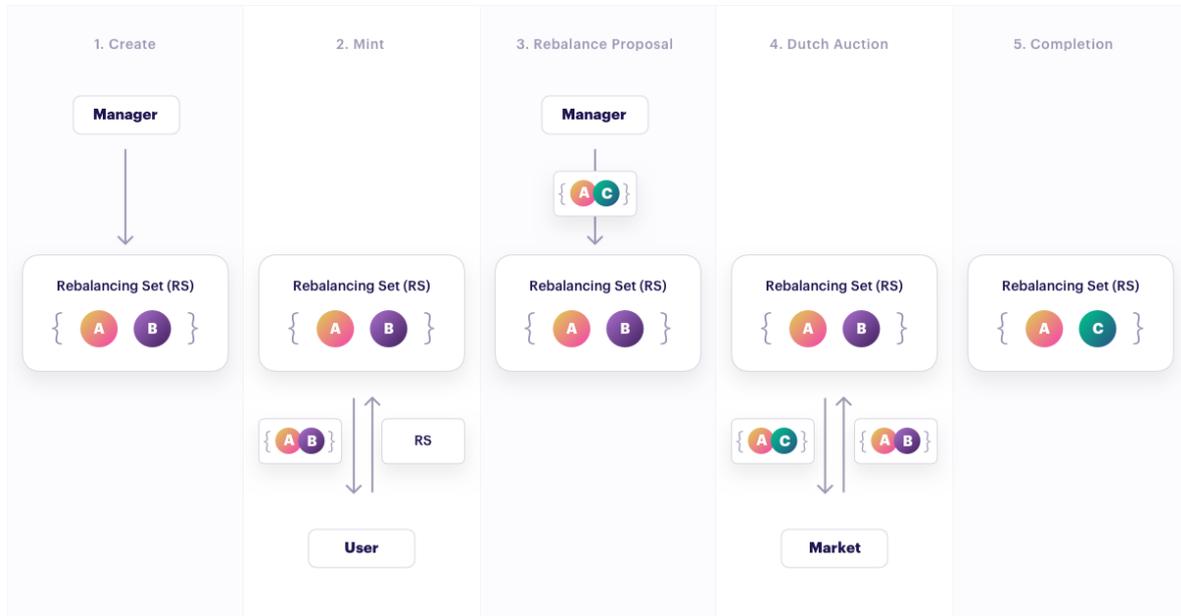
**Oracle:** Oracles tell the protocol what the intended weights of any given Set are. Currently, the system implements the solution by a Manager (an external account) that decides what the next Set is. Any user that doesn't agree with the rebalance can opt out before the rebalance occurs.

**Dutch Auction:** To execute the rebalancing process, TokenSets employs a Dutch auction to exchange outdated Sets for the updated version. Sets use Maker and Chainlink oracles in order to get on-chain price data for rebalance auctions.

Each auction has different parameters depending on how active the strategy is, i.e. indexes have more conservative auction parameters compared to moving averages. The auction parameters in the current Sets are:

- **Auction start price:** this is the price ratio at which the auction starts as determined by MakerDAO's price feeds. For more active Sets such as the ETH20SMACO, the auction starts at 12% below fair value.
- **Price step:** The price ratio updates slightly every block. For more active Sets such as the ETH20SMACO this averages to 1% every 10 minutes. This means that the auction is expected to hit fair value after 120 minutes (1% price step starting at 12% below fair value)
- **Minimum bid size:** The minimum number of units of outflows that can be bid at one time (this is fractions of a cent).

The idea behind the rebalancing can be shown as below:



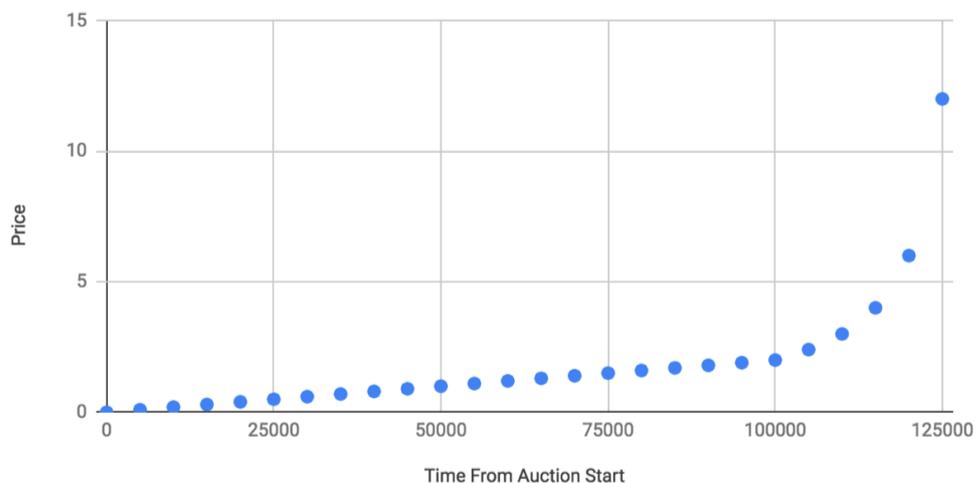
Step	Description
1	The RebalancingSet token is created by a SetManager that is initialized to a particular Set (e.g. {A,B}) and a quantity of Set per RebalancingSet.
2	Users can acquire a stake of the RebalancingSet by contributing the {A,B} Set itself or ETH (through purchasing the {A,B} Set using a decentralized exchange).
3	At a future time, the manager decides to propose a new Set to rebalance into. The proposal process lasts a predefined number of days. If any users disagree with the proposal during the proposal period, they can redeem their RebalancingSet tokens for the tracked SetToken.
4	When the proposal period has concluded, a Dutch auction is initiated, creating sell orders for the old {A,B} Set for the buy orders for the new proposed {A,C} Set. Market forces dictate the price of the rebalance itself.
5	Once the auction is complete, the RebalancingSet now tracks the new Set.

### 3.3 Bid Price Determination

In the Dutch auction, bidding is the act of executing a rebalance. When users bid, they inject the under-collateralized token to facilitate a rebalance. In return, they immediately receive the over-collateralized token. Bidders are incentivized to transact when there is a spread between the cost of acquiring the injected tokens and the received tokens. Bidding is open to anyone, and multiple parties can transact as long as the auction is running.

Currently, TokenSets utilizes a Linear Auction Price Curve to autonomously determine token bid prices. The price curve is shown below (Feng & Weickmann, Set: A Protocol for Baskets of Tokenized Assets, 2019):

Price vs. Time (priceDenominator=1000, pivotPrice=2000, timeToPivot=100000)



The price curve has 3 stages:

**Stage 1:** A linear curve starting at zero with manager defined end price and elapsed time. This is the only section of the curve that the manager's input is need. However, the inputs are limited to an acceptable range. In this stage, the price increase with a fix slope and will pass to the fair value of the underlying token (say time = t). Start from t, the bidding actually begins.

**Stage 2:** Here the protocol takes over to attempt to hasten an end to the auction. The curve is exponential and lasts for 500 minutes, losing price granularity as the auction continues.

**Stage 3:** The final stage is also protocol-driven and is just an extension of Stage 2 where the price moves linearly but at a rate equal to the pivotPrice (i.e. if pivotPrice is 2000, the slope of the curve will be 2000).

Rebalance Auction for

## ETH 26 EMA Crossover Set ● Live

Current Auction Price ⓘ **\$418.99**    Est. Time to Fair Value ⓘ **Now**    Progress ⓘ **0%**    Remaining Shares ⓘ **3**    Percentage To Fair Value ⓘ **1.21%**



Net Profit & Loss

# +\$0.195908

Supply	Amount to Supply	Balance
 <b>WETH</b>	0.000834	2.0250

Receive	Amount to Receive	Balance
 <b>USDC</b>	0.349500	0.0000

Shares ⓘ

Max

Place Bid



### How Rebalancing Works

Welcome to the Set Rebalancer. Rebalancing is the process of realigning the weights of tokens inside of a Set to the Set's target weights.

Taking part in a rebalance involves supplying undercollateralized component tokens to the Set and receiving over collateralized tokens in return. When you bid during the auction, you supply and receive tokens in the same transaction. Your funds are never locked in the auction.

## 3.4 Liquidity Providers

One of the major setbacks of decentralized exchanges is the lack of sufficient liquidity, so it would be a problem for a large rebalance size. To tackle this problem, TokenSets' rebalances make use of a Dutch auction to attract open market makers to help with rebalances. If the size of rebalances is larger, liquidity providers are more incentivized to help with the rebalances to conduct arbitrage.

## 4. Analysis

Now that we understand the mechanism of TokenSets, let's explore some of its advantages and disadvantages.

Below is a summary:

Advantages	Disadvantages
Highly Decentralized Simple to Create Strategy Eliminate Front Running Open Source User Friendly Interface	Auction Bid Price Is A Function Related to Time Smart Contract Risk Exist Rebalancing Slippage

## 4.1 Advantages of TokenSets

### Highly Decentralized

All procedures used in traditional portfolio management like creation, issuance, rebalance and redemption are all programmatically executed when criteria and strategies are met.

### Simple to Create Strategy

There is no limitation for the number of underlying components to form a Set as long as the Set has enough gas to perform operations.

### Eliminate Front Running

During auctions in the rebalancing phase, bids settle immediately or atomically, meaning that bidders receive the outflows tokens (e.g. USDC) in the same transaction as the injection of the inflows (e.g. ETH). Funds are never locked in the contract. This mechanism eliminates front running and bidders simply compete on time and gas.

### Open Source

TokenSets is a public, open-source application which is open to anyone.

### User Friendly Interface

The procedure is just like buying a token. All you need to do is to pick your favorable Set and transfer sufficient ETH required by the Set to the platform and buy it. You can redeem your funds at any time beside the rebalancing phase.

## 4.2 Disadvantages of TokenSets

### Auction Bid Price is A Function Related to Time

The implementation of the rebalancing price curve that is used to determine the bid price of outflow token (sell to bidder) is a function related to the auction time instead of the relationship between demand and supply. At the beginning of the rebalance, bidders need to wait until the price of bidding token reaches or passes the fair value. And the pivot time and price are hardcoded in the smart contract which is not flexible to updates.

### Smart Contract Risk

In general, TokenSets removes risks associated with portfolio management, namely custody risk. However, they introduce a new risk: smart contract risk. If the smart contracts that Set is built upon have any vulnerabilities, users and liquidity providers may suffer from loss, and they are irreversible due to blockchain's immutability.

### Rebalancing Slippage

It's important to note that users may incur a small amount of slippage during a rebalance under certain circumstances. Rebalancing slippage is a side effect of a Dutch auction mechanism used in a Set's rebalance. To put it simply, the more collateral there is to rebalance, the more time it will take to rebalance all the collateral.

As time passes in a Set Dutch auction, less under-collateralized tokens are needed in exchange for over-collateralized tokens in order for a Set to rebalance to its target weight. During this process, the changing ratio between under-collateralized and over-collateralized tokens naturally changes the net asset value of the Set as some of the value is either taken out or added in by liquidity providers. This change in net asset value is rebalancing slippage.

This is by design, and built to incentivize open market participants if they want to help with rebalances once rebalance sizes become larger.

## 4.3 Interactions with DeFi Protocols

### Use of Decentralized Oracles

Similar to other DEX, price information plays one of the most important roles in TokenSets as components' price in a Set determine the Set's price and when to trigger Set's rebalance.

Prices for Sets displayed on TokenSets are sourced from CryptoCompare to show the fair market value of a Set in USD across multiple exchanges. For buys and sells, pricing is sourced from various DEXs that provide liquidity to Set Protocol.

For ETH and BTC, Sets use MakerDAO's v2 oracles that also power the Multi Collateral Dai system.

For DAI, Sets utilize dYdX's oracle which takes the median of prices on Uniswap, Oasis Trade and \$1. Additionally, there are several protections against price manipulation and flash crashes.

For USDC, Sets assume a price of \$1 as it can be freely redeemed 1:1 with USD on Coinbase.

For Compound USDC, Sets utilize the on-chain Compound USDC to cUSDC exchange rate which factors in the interest accrued to the cUSDC token.

### Interaction with Other Protocols

TokenSet use Kyber and Ox as its liquidity providers when sets are bought and sold. Certain Sets are also listed on Uniswap.

Besides, TokenSets cooperate with the Coinbase wallet, Trust wallet and imToken to smooth out the crypto transfer process. It uses Fortmatic as the platform log in / register service provider. TokenSets gains exposure from the other portals like Zerion, Multis and DeFiprime.

## 5. Summary

### 5.1 Conclusion

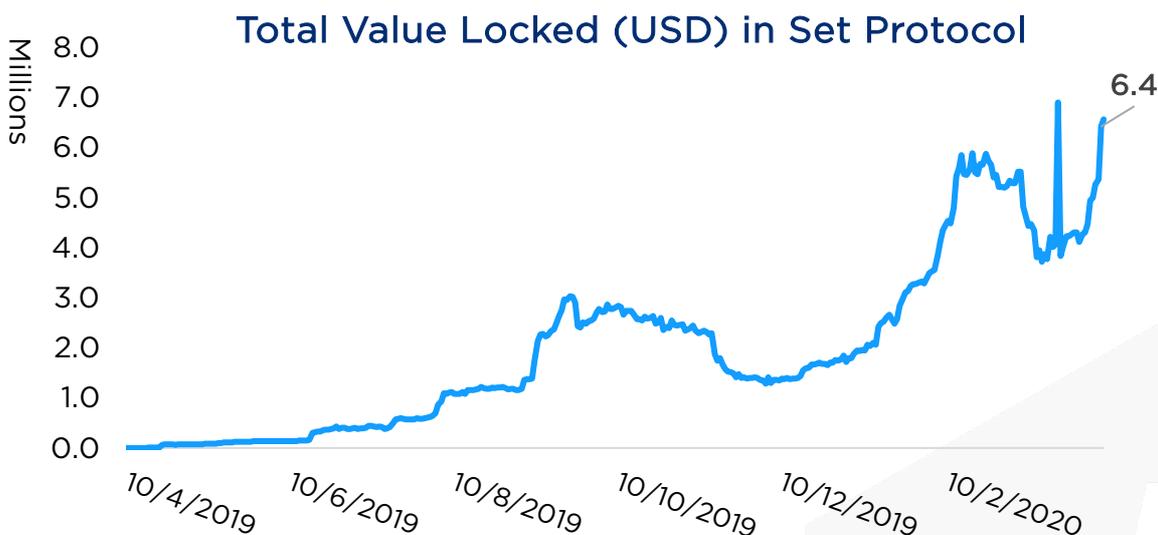
In conclusion, TokenSet allows casual users to gain access to crypto trading strategies. The process becomes as simple as buying a token.

#### Key Takeaways:

- TokenSets is a platform which provides a user-friendly interface to buy Strategy Enabled Tokens (Set tokens). All functions embedded in Set token like creation, issuance, redemption and rebalancing are supported by Set Protocol;
- Set tokens are ERC20 tokens and each Set token is a representation of a crypto portfolio. The underlying strategy is called a “Set” which is a basket of cryptocurrencies;
- The portfolio rebalancing process can be performed trustlessly since it incentivizes external actors to participate;
- The Set protocol proposed a modified Dutch Auction for bidder to bid the over-collateral tokens in the rebalancing phase. The auction price is predefined as a function of time which the price will increase with different manners based on 3 different stages;
- Liquidity providers are incentivized to provide capital for price spread or slippage during Set rebalancing. The liquidity provider role is open to all participants which means that the general user can also get profit by taking part in a Set rebalancing auction

## 5.2 Statistics

Below are some numbers to put TokenSets' scale into perspective. The amount of Ethereum pooled on TokenSets contracts as of March 2020 was more than 40,000 ETH, or US\$ 6.6 million. This puts it at 12<sup>th</sup> place on DeFi apps, [according to DeFi Pulse](#).



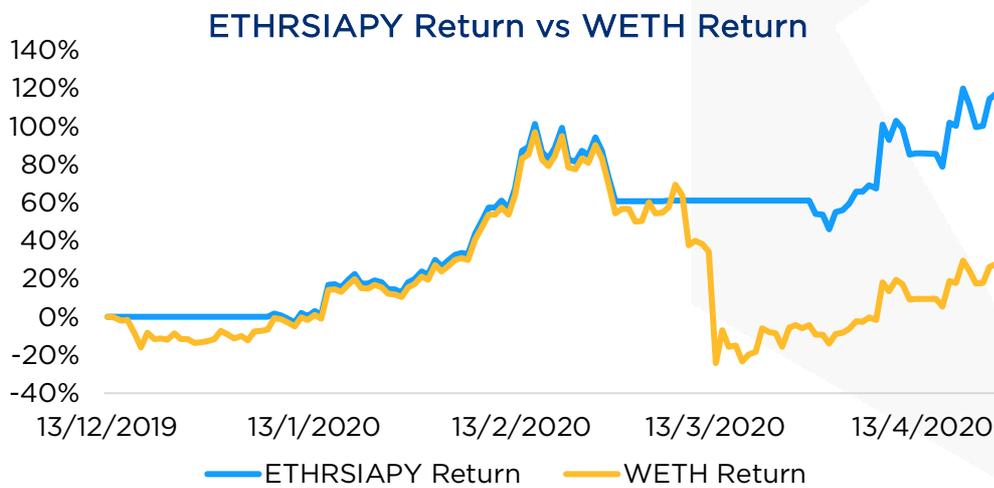
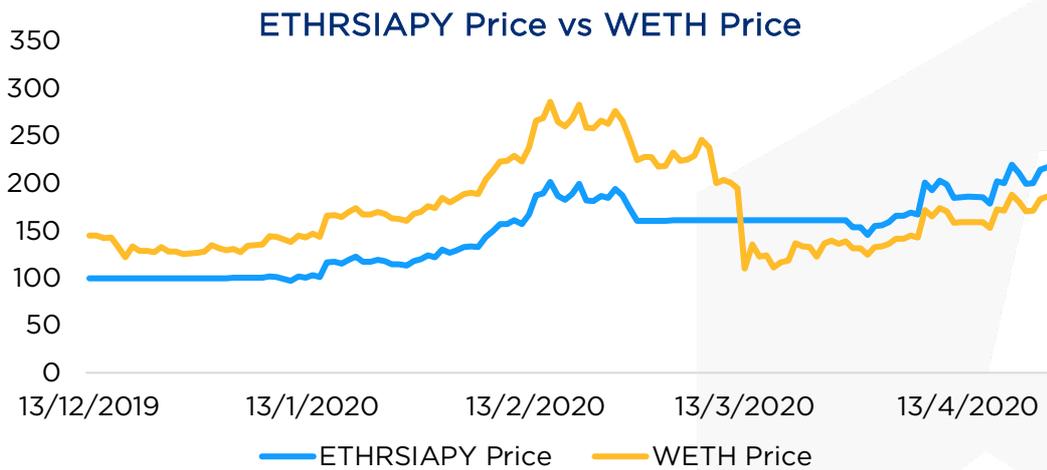
Below, we select some representatives among the listed sets. We plot the graphs of each set's price and return and compare them with WETH in the same periods (the returns are calculated based on the first day of set's launch).

### Performance of Robo Sets

"ETH RSI 60/40 Crossover Yield Set" and "ETH 20 Day MA Crossover Yield Set" are the two biggest Robo Sets in terms of market capitalization. These two sets utilize classical technical analysis to make rebalancing decisions.

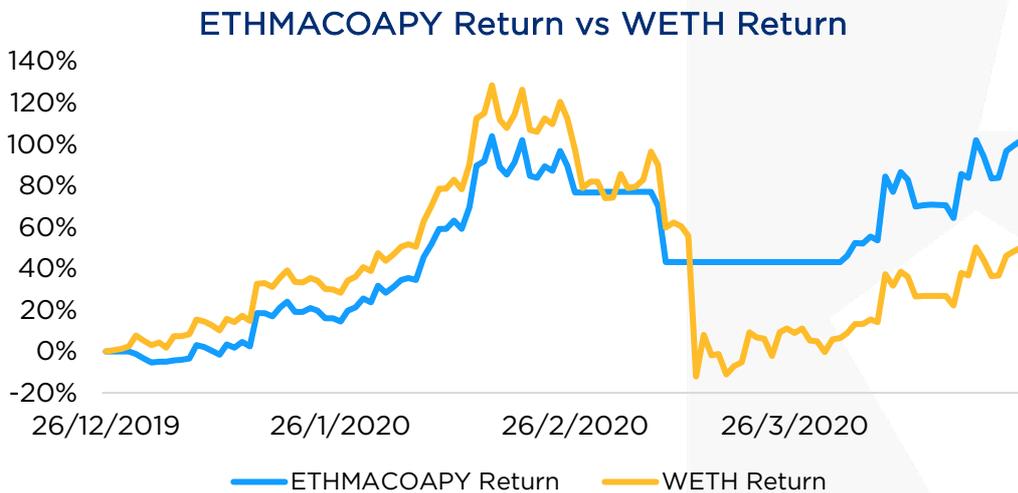
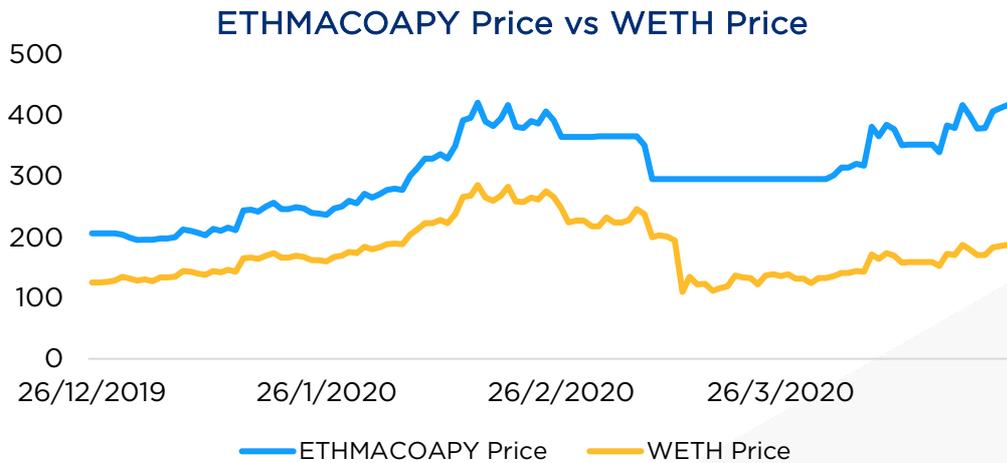
#### ETH RSI 60/40 Crossover Yield Set (ETHRSIAPY)

The strategy automatically triggers rebalances if the Relative Strength Index (RSI) crosses below support at 40 or above resistance at 60 to indicate price momentum. If the ETH RSI falls below 40, the Set will rebalance from ETH into Compound USDC and automatically accrues interest on your cash when the market is bearish.



### The ETH 20 Day MA Crossover Yield Set (ETHMACOAPY)

The strategy attempts to capitalize on shorter term trends and accumulate ETH. It automatically triggers rebalances when the price of ETH crosses the 20 Day Simple Moving Average (20 SMA) indicating a trend reversal. If the price of Ethereum crosses and stays below the 20 SMA, the Set rebalances from ETH into Compound USDC and automatically accrues interest on cash when the market is bearish.



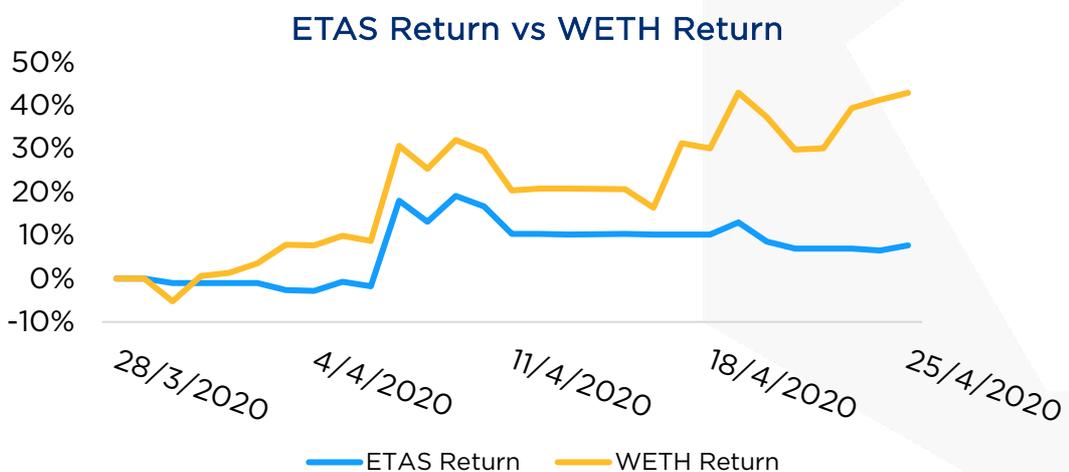
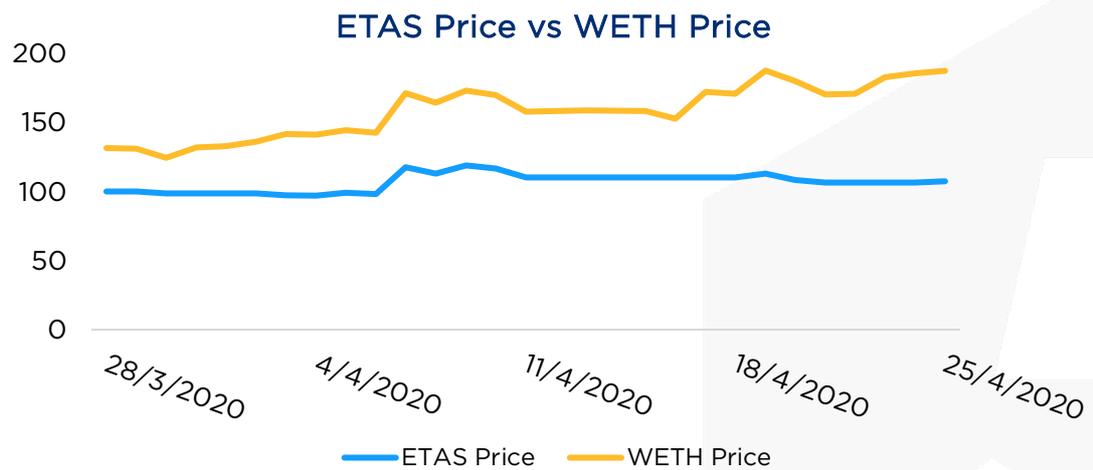
### Performance of Social Trading Sets

#### ETH Trending Alpha ST Set II (ETAS)

ETH Trending Alpha ST 2.0 was developed by Alphachain Capital which believes that trend-following strategies are best suited to cryptocurrency markets. ETAS is an adaptable short-term systematic

trend following strategy which uses statistical analysis and technical indicators to identify and exploit short-medium up trends. It's the largest set in terms of market capitalization among the Social Trading Sets.

The strategy uses EMAs and RSI to identify up-trends with a volatility metric for confirmation. It is optimized for shorter time frames and developed to be adaptable to varying market cycles, enabling it to assess the current market structure (e.g. trending, sideways, trend strength) and adapt its trading parameters. It is long-only, rebalancing into ETH when the strategy identifies an up-trend and rebalancing back to cUSDC when not in the market (e.g. flat or bear markets). Furthermore, all cash USD balances earn interest via Compound enhancing returns. The short-term nature of the strategy results in approximately 10 trades per year, each held for an average of 12 days.



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