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Liquid Staking Derivatives: Money Legos in DeFi

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Research and Insights



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Executive Summary

- Liquid staking is now the [second-largest sector](#) in crypto after decentralised exchanges, replacing DeFi lending. Today, the liquid staking narrative remains strong in anticipation of Ethereum's [Shanghai Upgrade](#), which will enable staked ETH withdrawals in the network.
- In liquid staking, native coins of a Proof of Stake (PoS) chain are deposited to a staking pool, which is delegated to one of many validators participating in the consensus protocol. The staking pool then issues a 'receipt' in the form of a liquid synthetic token that is often 1-to-1 pegged to the underlying PoS token.
- Ethereum staking is the largest staking market, with over [17.8 million](#) ETH (around US\$32 billion) deposited into the Ethereum Beacon Chain staking contract as of March 2023, constituting [14.8%](#) of the total ether supply.
- Liquid staking protocols represent a [US\\$14 billion](#) market today. Over a third of the total ETH staked is locked up in liquid staking. In the DeFi area, [Lido](#) dominates the liquid staking space. It makes up the majority of the total liquid staking deposits, followed by Rocket Pool and Frax Finance.
- In combination with other DeFi protocols, liquid staking can be viewed as a type of building blocks or 'money legos', which can be combined or stacked on top of each other to create more financial applications, typically through liquidity mining and/or lending and borrowing.
- In general, there are several risks to consider regarding liquid staking, like slashing, centralisation, and depegging.
- A case can be made that the Shanghai Upgrade will ultimately contribute to de-risking ETH staking and driving the development of the liquid staking derivatives (LSD) market.

1. Overview

The emergence of the [Proof of Stake](#) (PoS) consensus mechanism introduced us to the concept of staking. For the uninitiated: In PoS networks, all transactions are verified by validators, who are the main participants of PoS networks. As an incentive to them for keeping the network securely running, validators receive a staking reward — from the protocol (for producing blocks), plus a portion of the transaction fees.

To participate in the validation process, validators are required to stake an amount of the blockchain's native token, which gives them the chance to append new blocks to the blockchain. The amount staked is generally proportional to their chance of getting chosen in the [selection process](#).

Staking is crucial to securing PoS blockchains and contributes to the wider adoption of blockchain technology. By requiring validators to stake their own tokens, it forces them to act in the best interest of the network and keep it as secure as possible.

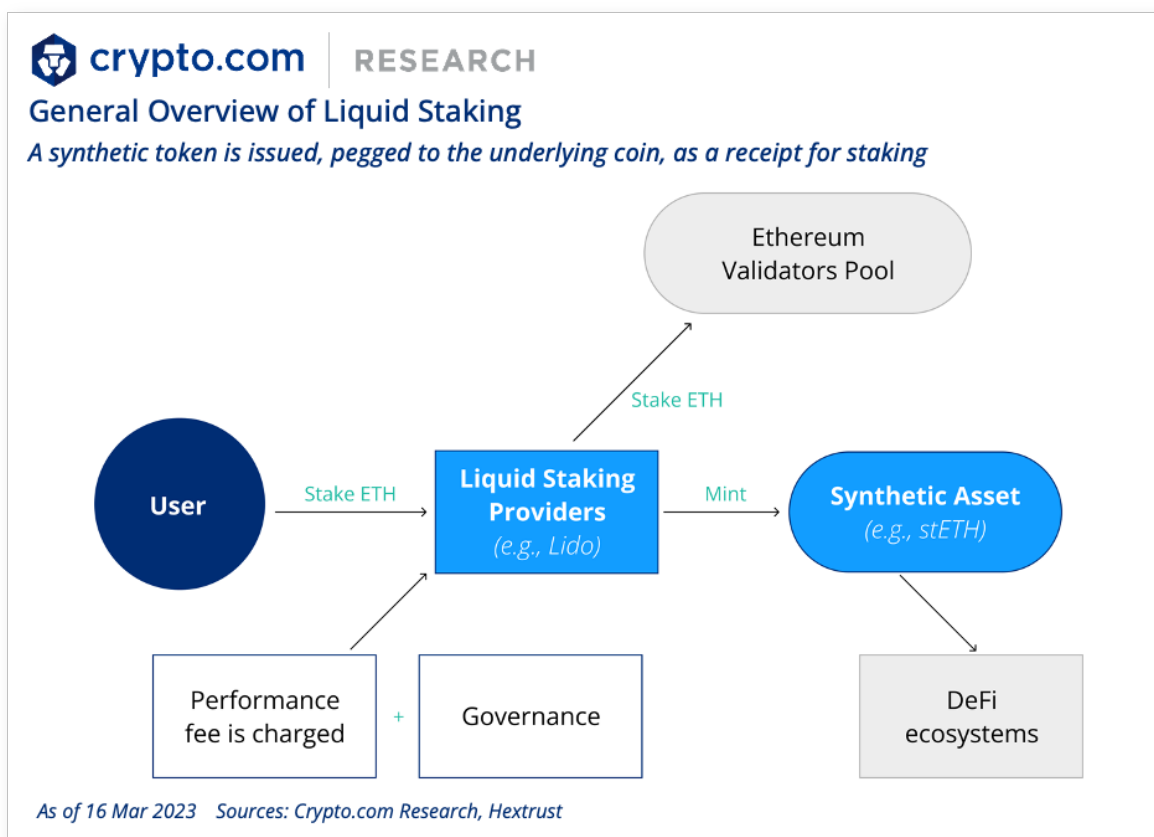
Additionally, staking makes it easier for individuals to participate in the network, promoting decentralisation in the process: As the number of active nodes in the network increases, the concentration from the hands of a few reduces. A high staking ratio in a network is important to a network's security, as many PoS protocols provide governance rights proportional to the user's staked tokens, creating a more democratic system in the network's operations.

1.1 Liquid Staking

Staking requires locking up tokens by default, which often means that stakers have to give up liquidity for staking rewards. Liquid staking attempts to solve this problem by letting the stakers enjoy the best of both worlds — receiving rewards from staking while maintaining some degree of liquidity.

In liquid staking, native coins of a PoS chain are deposited to a staking pool, which is delegated to one of many validators participating in the consensus protocol. The staking pool then issues a 'receipt' in the form of a liquid synthetic token that is often 1-to-1 pegged to the underlying PoS token.

The user could later redeem the underlying token with the synthetic token. For example, a token holder of ETH could stake ETH on a staking pool like Lido Finance to earn staking rewards from Ethereum, plus receive liquid stETH tokens in return, which could be used as collateral in the broader DeFi ecosystem.



Some of staking’s most evident benefits include the rewards and instant liquidity associated with liquid staking. Another main advantage is the **enablement of rehypothecation**: In traditional finance, this refers to the usage of assets as collateral in other venues. Much like how one can use their house as collateral to borrow a car loan from banks, liquid staking allows users to utilise their staked assets as collateral to borrow against, lowering the opportunity cost of staking.

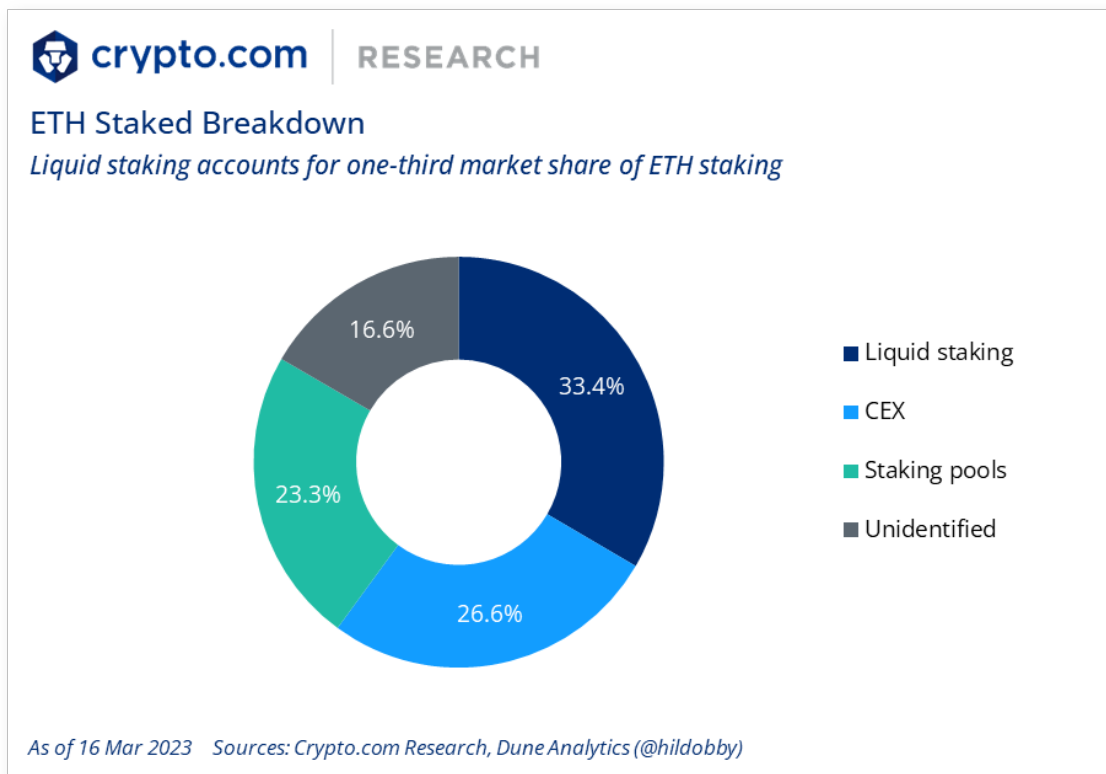
This has a second-order effect on crypto ecosystems, as it stimulates DeFi activity, opens secondary markets, and helps increase demand for the underlying crypto assets. For token holders, liquid staking promotes capital efficiency by providing new avenues where they can optimise for returns and maximise their yields.

Liquid staking is now the [second-largest sector](#) in crypto after decentralised exchanges (DEXs), replacing DeFi lending. Today, the liquid staking narrative remains strong in anticipation of Ethereum’s [Shanghai Upgrade](#), which will enable staked ETH withdrawals in the network. In this report, we provide an overview of the current market, key market players and their features, and what the upcoming Shanghai Upgrade entails for LSDs.

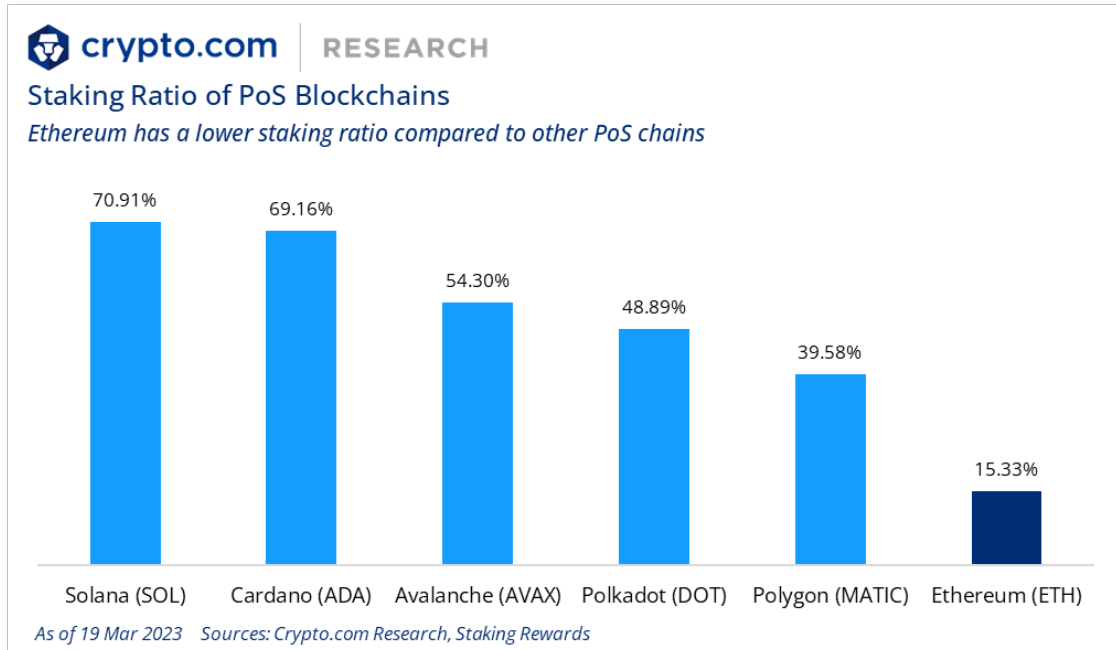
2. Market Players

2.1 Players on Ethereum

In March 2023, Ethereum reached a new milestone: Over [17.8 million ether](#) (ETH) have been deposited into the Ethereum Beacon Chain staking contract, constituting [14.8%](#) of the total ether supply. Liquid staking protocols represent a [US\\$14 billion](#) market today. Over a third of the total ETH staked is locked up in liquid staking.



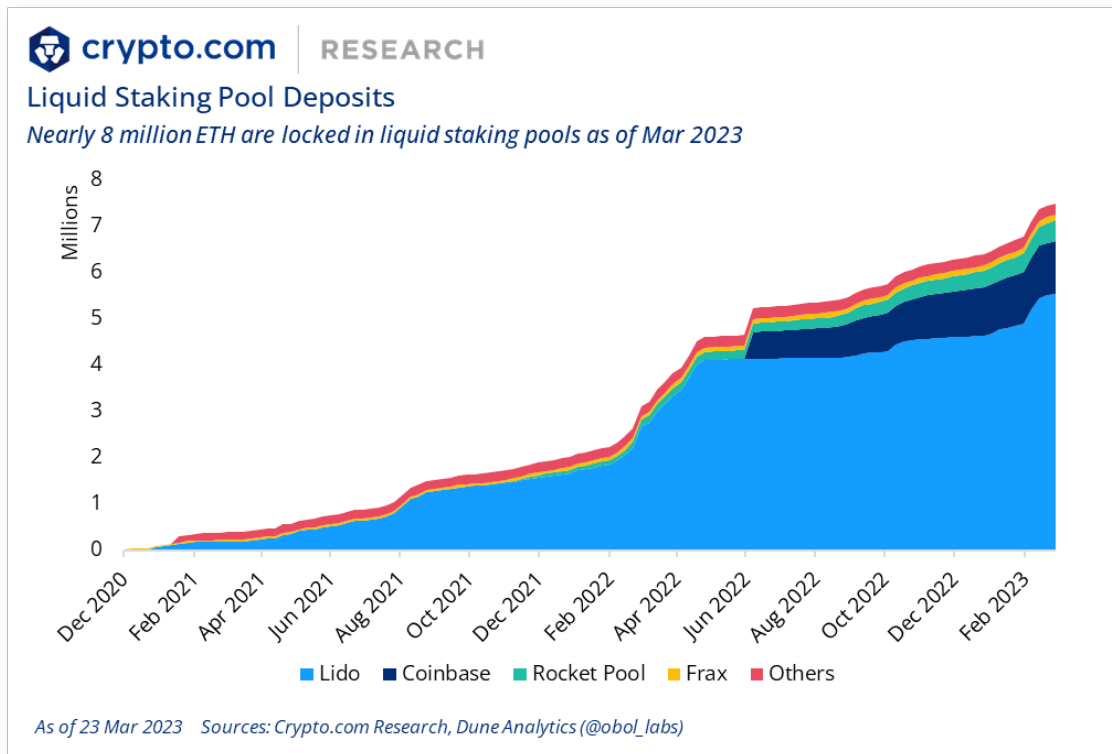
However, Ethereum currently has only a 15.33% staking ratio, which is significantly lower compared to other PoS blockchains. This is likely because it can't be unstaked yet and has more economic utility than the others within the wider DeFi ecosystem.



Over 97% of the market share in ETH liquid staking pools is held by the top four platforms (by amount of ETH staked): Lido, Coinbase, Rocket Pool, and Frax.

Lido Finance

[Lido](#) dominates the liquid staking space, making up the majority of the total liquid staking deposits with [29 active node operators](#) as of the end of Q4 2022. Lido alone holds [31.36%](#) of the market share for staked ETH across both centralised and decentralised players in the sector. As of 16 March, it is also the largest DeFi protocol in terms of total value locked (TVL), [overtaking MakerDAO](#) by a significant margin.

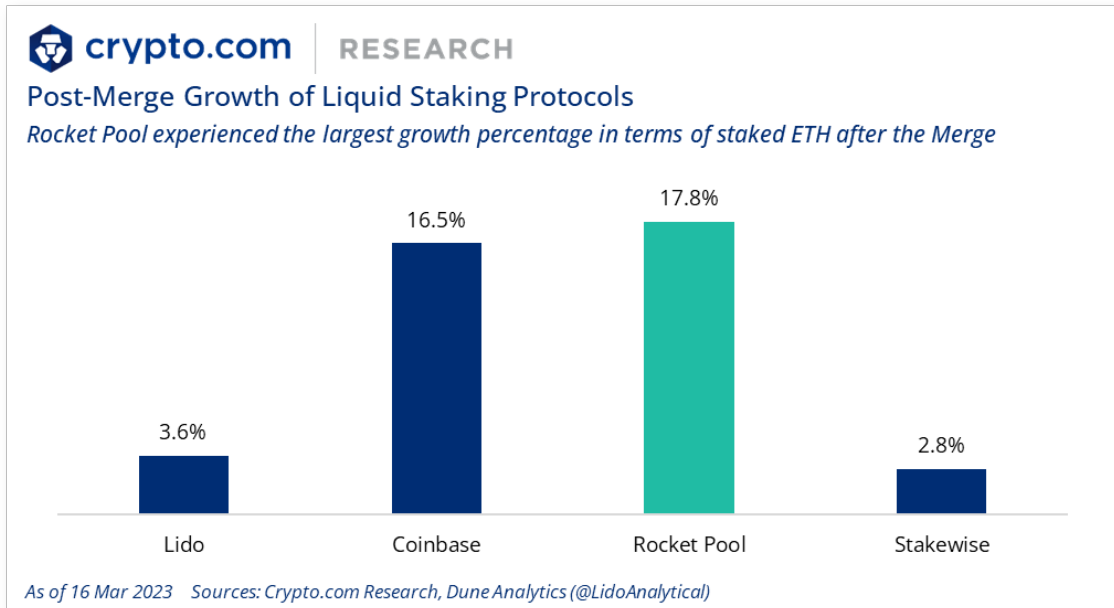


Staked ETH in Lido, represented as stETH, is a [rebasing token](#), meaning that the underlying balance increases as yield accumulates relative to the underlying staked ETH. It can be utilised in, and is supported across, a [growing number of DeFi protocols](#), such as Curve and Aave. While some DeFi protocols are not suitable for rebasing tokens and require a constant balance mechanism, Lido also created wstETH — a wrapped version of stETH that keeps its balance fixed and makes it more composable across the wider DeFi space.

Recently, Lido introduced two new features: **Turbo and Bunker Modes**, both aiming to improve the efficiency and security of the protocol as a preparation for the Shanghai Upgrade. In [Lido V2](#), Turbo Mode is Lido’s default mode, enabling withdrawals to be processed as relatively quickly as possible (estimated ~2 to 7 days). Under this mode, the protocol will fulfil withdrawal requests once it has enough ETH to do so. In the instance of unusually high network activity or an unforeseen catastrophic event, Bunker Mode will be enforced to ensure that withdrawals are processed in an orderly fashion.

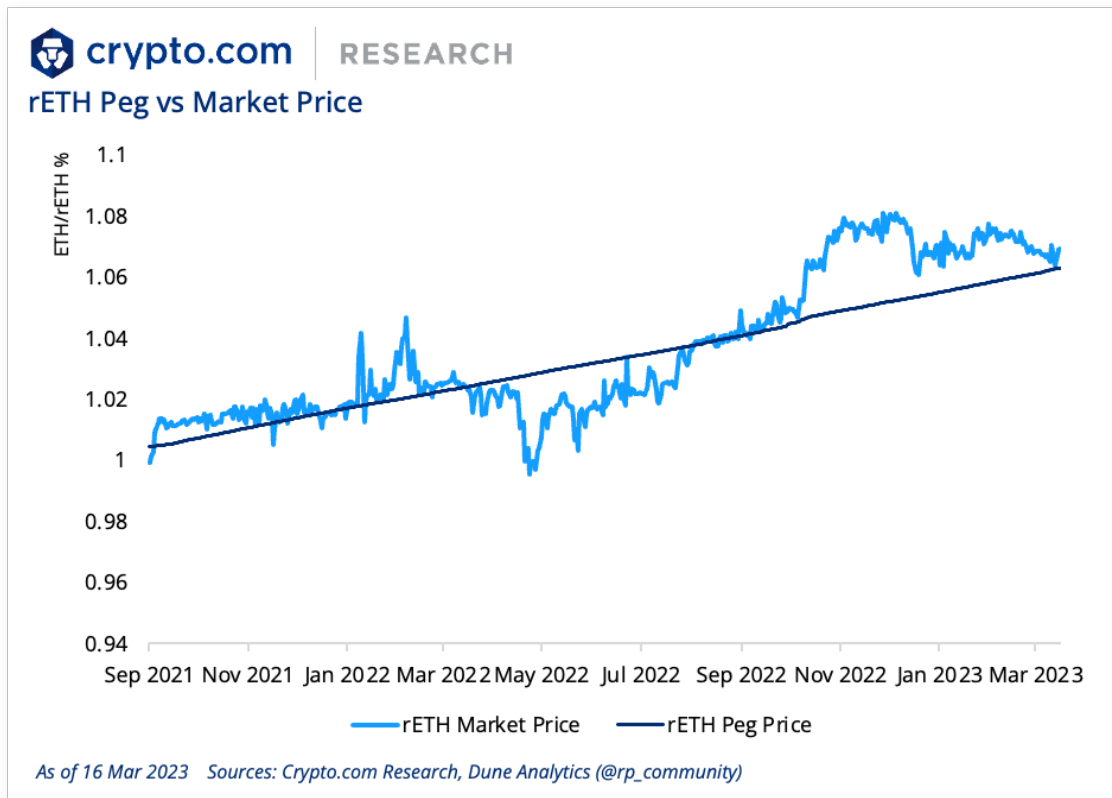
Rocket Pool

[Rocket Pool](#) is the third-largest liquid staking protocol for ETH. Since ‘[The Merge](#)’, it has enjoyed the largest percentage of growth in terms of ETH deposits across top protocols.



Rocket Pool’s liquid staking derivative token – rETH – is issued to those who have staked ETH on its platform. Unlike stETH, rETH is a yield-bearing token, meaning its underlying balance stays the same despite its backing increasing (via staking rewards earned in the Rocket Pool smart contracts).

While most liquid staking tokens were trading at a discount in 2022, rETH has consistently traded at a premium: It traded heavily discounted after some [market setbacks](#) in 2022 until October, when it began to recover. At the time of writing, rETH is back trading at a premium of about +1.07% above its implied fair value rate.



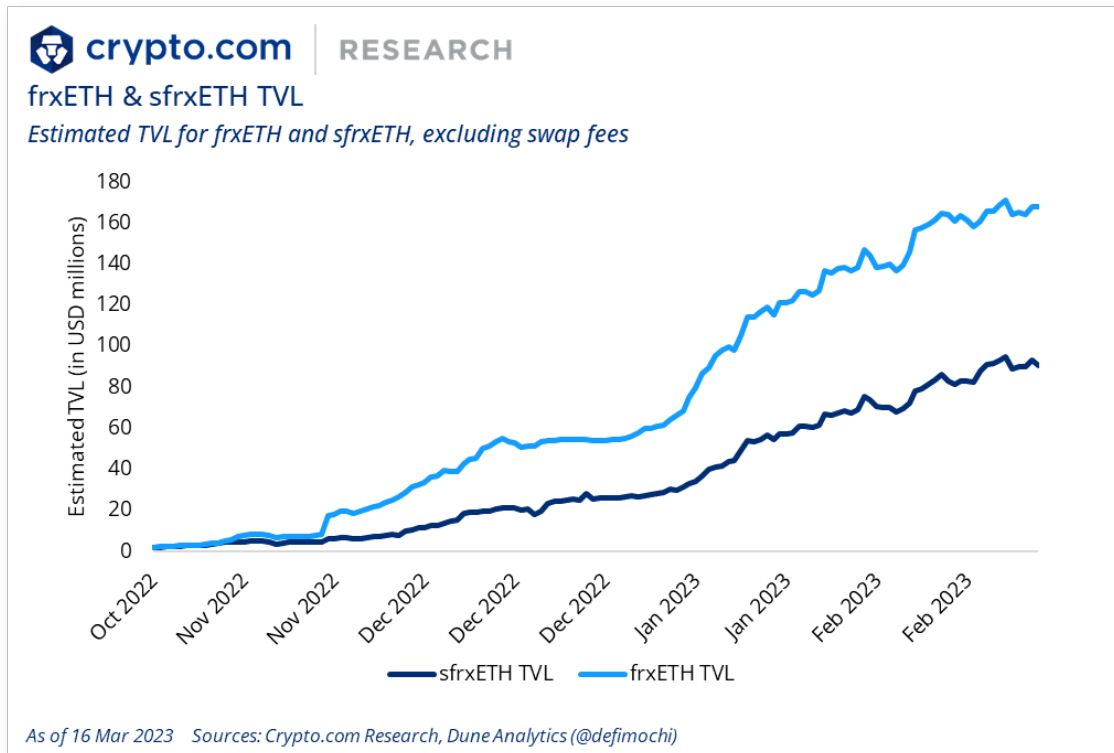
Across all liquid staking protocols, Rocket Pool ranks highly in terms of decentralisation, boasting around [2,209 active node operators](#), with a total of [433,400 ETH staked](#). Rocket Pool allows anyone to permissionlessly operate a node through minipools, which reduce the capital requirements of operating a validator node by 45%, from the usual 32 ETH down to 17.6 ETH (16 ETH bond and 1.6 ETH worth of RPL collateral).

However, the protocol has faced issues with scaling. Historically, Rocket Pool has seen instances where its rETH deposit pool has reached a max capacity of 5,000 ETH, forcing potential stakers to wait until new minipools are activated or buy/stake their rETH somewhere else. Rocket Pool aims to resolve this with its upcoming [Atlas Upgrade](#), which will reduce the minimum bond requirement of its minipool operators to 8 ETH (and 2.4 ETH worth of RPL); thus, lowering the barrier to entry for prospective node operators.

Frax Finance

[Frax Finance](#) has recently seen the most notable growth across decentralised liquid staking protocols: New addresses holding frxETH have rapidly increased since October 2022, according to [IntoTheBlock](#). Its TVL has now grown to [US\\$213 million](#) from the US\$55 million reported at the beginning of 2023.

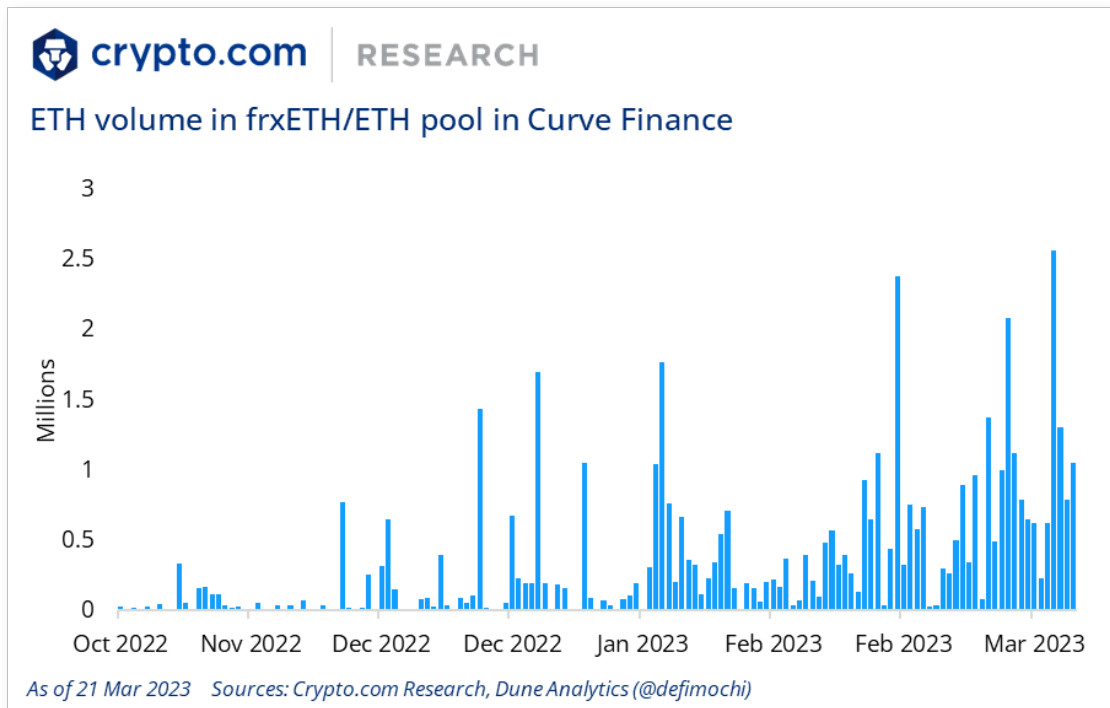
Despite only recently launching post-Merge, both frxETH and sfrxETH tokens are already seeing significant adoption thanks to frxETH’s relatively high staking APY (~[10% to 11%](#), compared to Lido’s 5%).



Frax’s liquid staking system uses two separate tokens: sfrxETH for staking, and frxETH for farming and withdrawing back to ETH. Frax Ether (frxETH) is an ETH-pegged stablecoin that does not earn staking yield. However, it’s eligible for farming rewards within Curve (CRV) and Convex (CVX) ecosystems. Staked Frax Ether (sfrxETH) complements frxETH with its yield-bearing mechanism that works similarly to rETH. **This dual-token model combined with Curve provides market-leading rates on staked ETH.** Meanwhile, Frax’s governance token, FXS, is also added as rewards to the staking pool through Convex.

frxETH currently has [12 trading pairs](#) in Curve, which has helped drive Curve’s trading activity. More importantly, frxETH is being staked in exchange for sfrxETH, which can yield around [12%](#) in estimated APR (as of 16 March).

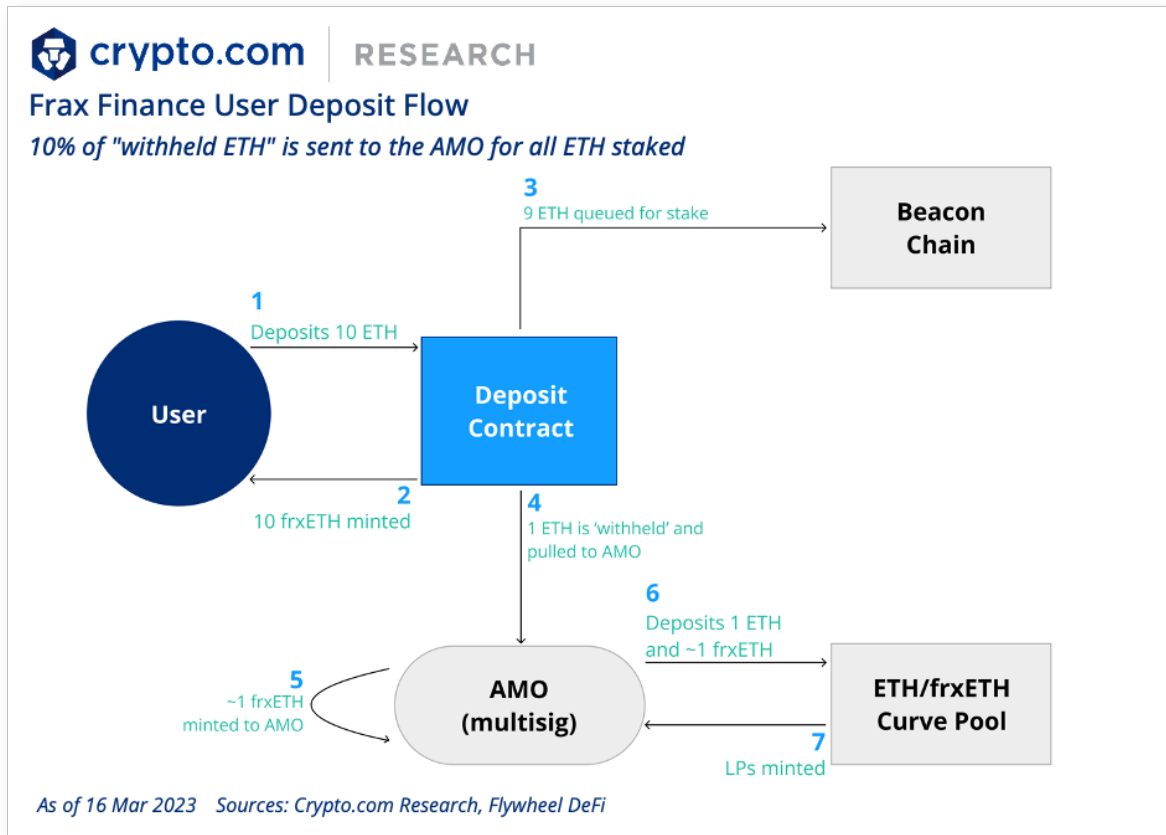
Frax can direct CRV and CVX rewards to its frxETH/ETH Curve pool, which provides stakers with a [~6.7%](#) APR paid out in CRV, CVX, or FXS tokens.



Frax is also a fractional-algorithmic stablecoin protocol, wherein a part of its supply is backed by collateral, while some parts are unbacked and stabilised algorithmically. Part of Frax's design is to send 10% of all deposited ETH to the Algorithmic Market Operations ([AMO](#)) controller, a self-executing contract that enforces arbitrary monetary policy and stabilises the protocol via an algorithmic mechanism. Because the collateralised to unbacked supply ratio is set by market forces, the AMO controller enables flexibility around them. For instance, it can pause market operations and dynamically rebalance the collateral ratio (CR) if de-collateralisation (decreasing CR by expanding money supply) or re-collateralisation (increasing CR by minting FXS) is required. A detailed account of how AMO works can be found [here](#).

This 10% of 'withheld ETH' can be considered as idle capital, but is available for users when they exit the system. The AMO has unlimited minting power and mints an additional frxETH for each ETH withheld. In theory, this mechanism can help generate a significant amount of liquidity and farming rewards for stakers. However, some [concerns](#) around its parity to ETH supply are also being discussed within the community.

Read our deep-dive report on Frax Finance and other decentralised liquid staking protocols in our latest Private report "[Deep Dive Into Liquid Staking Derivatives](#)".



Ankr

Unlike its competitors, which exclusively offer staking services, [Ankr](#) focuses more on blockchain development and staking infrastructure. Its liquid staking service allows users to stake and earn rewards for their PoS assets, including [ETH](#), [AVAX](#), and [MATIC](#), amongst others. Ankr initially operated on a dual-token system like Frax, but has since replaced it with one liquid staking derivative token called ankrETH, an updated version of aETHc (its previous reward-bearing token).

With the upcoming Shanghai Upgrade, Ankr's latest offering – AnkrETH v3 liquid staking – will help Ankr's infrastructure accommodate the changes the update brings. It incorporates Distributed Validator Technology (DVT) into its liquid staking protocol by collaborating with [ssv.network](#) and [Obol](#). This will allow Ankr to offer trustless liquid staking and directly stake users' tokens without any intermediary. DVT adds an additional layer of security and decentralisation to the staking process by allowing multiple validators to jointly validate transactions.

- When a user stakes their ETH, their validator key is split into multiple KeyShares using ssv.network's DVT. Each KeyShare is then distributed to four 'non-trusting' nodes, which operate the validator on behalf of the user. This design helps ensure that the validator key is secure and the validator cannot be compromised by a single node.

Restaking will be a key feature of AnkrETH v3. This feature will automatically reinvest staking rewards back to the staking pool, which helps increase the yield and incentivises stakers to hold their assets for longer. Near instantaneous unstaking will also be possible in AnkrETH v3 with its flash unstaking feature. This will dramatically reduce the unbonding period from several days — up to [28 days](#) on some chains — to mere seconds once users initiate the unstaking process.

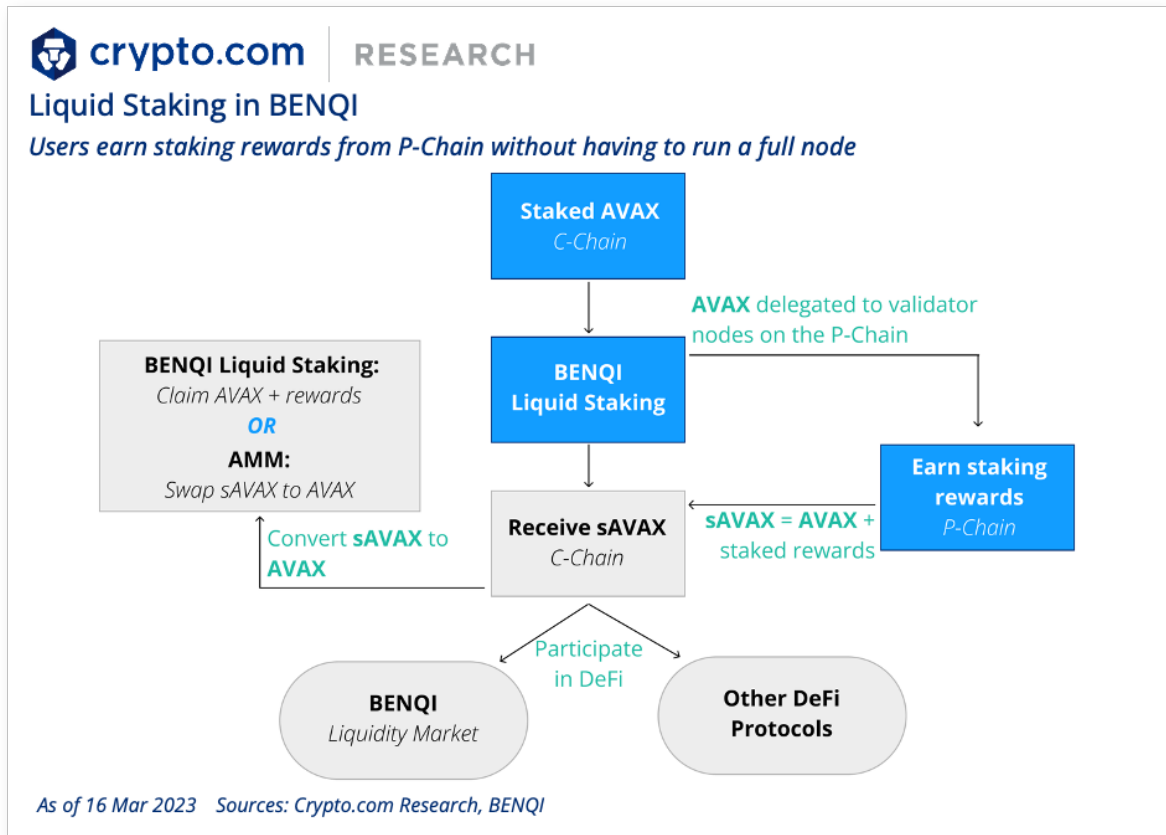
2.2 Players on Other Chains

BENQI

[BENQI](#) is a liquid staking protocol built on the Avalanche network. It allows users to receive sAVAX, BENQI's liquid staking derivative token, when they stake their AVAX tokens into BENQI's staking pool.

The protocol enables users to stake their AVAX on the Avalanche C-Chain without needing to stake on the Avalanche P-Chain, which allows users to earn validating rewards from the P-Chain without having to run a full node or lock up AVAX on a node.

- **Avalanche C-Chain:** The Avalanche Contract Chain is the default smart contract blockchain; the main blockchain is where applications are built on.
- **Avalanche P-Chain:** The Avalanche Platform Chain works as the metadata blockchain, where Avalanche Validating and Staking occur.

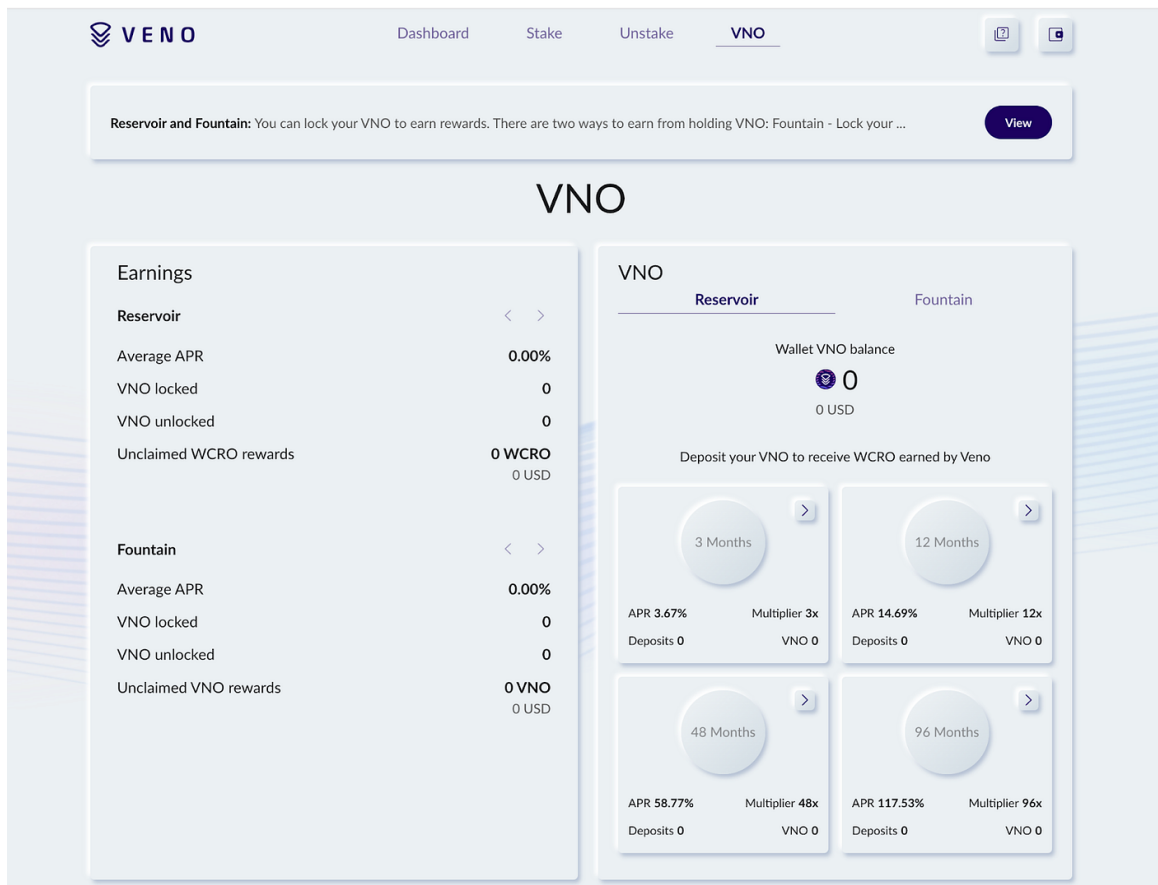


Veno Finance

[Veno Finance](#) is a liquid staking protocol built on the Cronos blockchain that aims to provide a one-stop solution for all CRO staking needs.

With Veno, users can stake their CRO tokens and, in return, receive liquid CRO (LCRO), which represents the staked CRO. LCRO is an auto-compounding yield-bearing token, where its internal exchange rate on Veno will increase over time. It can be used to trade, sell, or earn additional rewards, whether by providing liquidity on Veno Finance or borrowing against it on lending platform Tectonic.

[Reservoir](#) is Veno’s participation and insurance reward module: Through Reservoir, users can stake their VNO (Veno’s native token) here to receive CRO rewards. Veno aims to reward a 50% share of validator revenue, paid out in CRO, to VNO stakers via the Reservoir. [Fountain](#) is another venue in Veno where users can lock in their VNO for additional VNO rewards. Overall, this system aims to reward long-term holders in the platform.



Source: [Veno Finance](#)

Crypto.com Exchange also introduced its new [on-chain staking experience](#), providing staking solutions to VIPs, as well as advanced and institutional traders.

The platform supports staking ETH, DOT, and SOL tokens. In addition to the usual staking rewards, traders can also expect other features, such as:

- **Customised solutions:** Traders can enjoy the potential for higher staking rewards, as well as their preferred liquidity period, and more.
- **Preview of new assets:** Users of the platform will be the first to know about upcoming assets available for on-chain staking, along with new product rollouts.
- **White-glove service:** Traders can easily get in touch with sales representatives anytime, and through their preferred communication method.

Head over to [Crypto.com](#) for full details.

3. Money Lego in DeFi

In combination with other DeFi protocols, these liquid staking derivatives (LSD) can be viewed as building blocks, or ‘money legos’, that can be combined or stacked on top of each other to create more financial applications. By layering these protocols together, DeFi ecosystems can create new financial products that are not always possible with traditional finance.

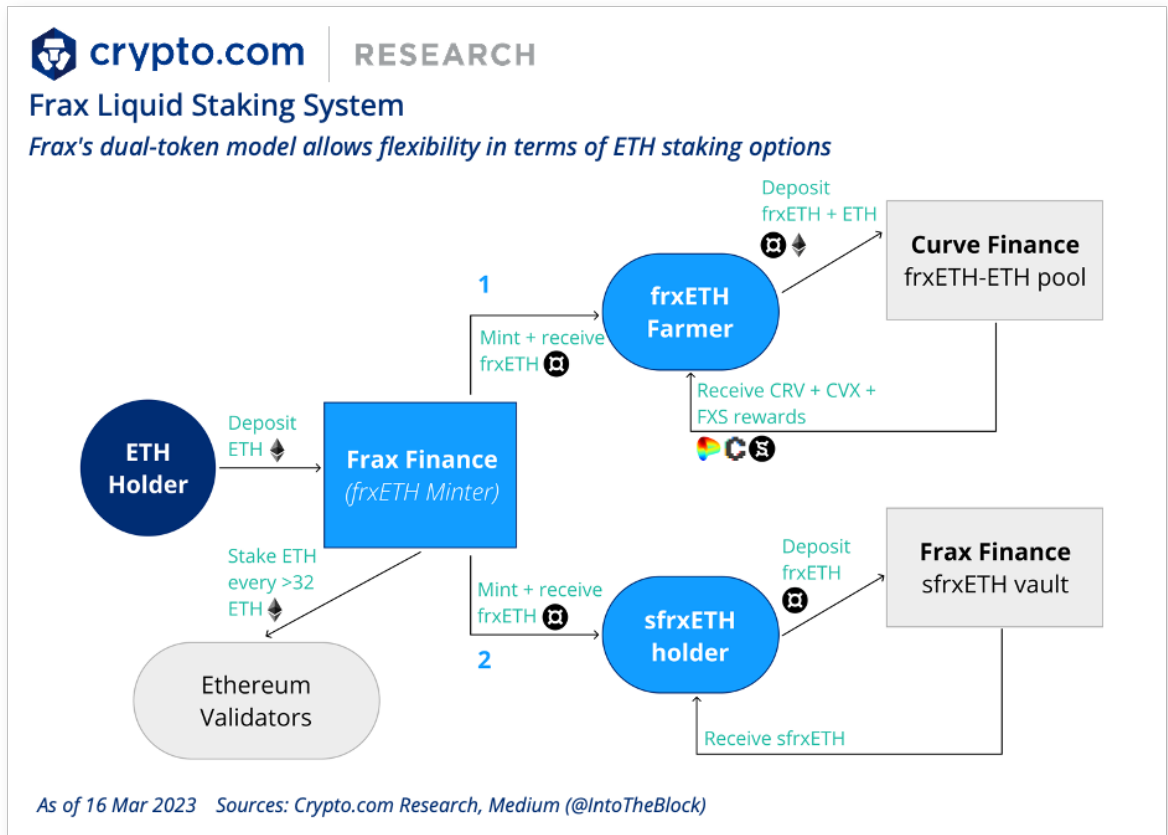
Liquid staking can be considered as ‘yield leverage’: Users can easily earn 4% to 5% by delegating their staked ETH. But by staking ETH on a liquid staking platform, they could earn the same 4% to 5% on top of additional yield unlocked by their liquid staking derivatives tokens.

If LSDs can be used as collateral to borrow native tokens like ETH, they can also unlock demand to borrow more ETH for the purpose of leveraged staking. This can help push the rates up for supplying ETH, which in the long run can benefit ETH lenders with higher interest rates.

3.1 Liquidity Mining

One venue where users can generate additional yield with their LSDs is through liquidity mining within DeFi protocols. This involves using liquidity pools to earn rewards for providing liquidity to the network: By providing liquidity, the user becomes a market maker and can earn yield in the form of trading fees or liquidity provider rewards.

For example, ETH holders can stake their ETH in Frax to receive frxETH. These tokens can then be deposited into the ETH/frxETH Curve pool, and users can deposit liquidity pool (LP) tokens on Convex, which could earn rewards paid out in CRV, CVX, and FXS tokens. Alternatively, users can also stake their frxETH into an ERC-4626 vault to mint sfrxETH (which accrues all staking yield from validators).



3.2 Lending and Borrowing

Lending pools, by using looping, is another venue. Looping is a recursive strategy that refers to supplying an asset, borrowing against it, swapping the borrowed money for more of the original asset, and repeating the process. Through looping, stakers can lock their funds on one platform and use their LSDs as collateral for crypto-backed loans.

Consider a potential loop strategy with Lido and Aave, as an example, by taking the following steps:

1. Deposit 10 ETH in Lido, which will return 10 stETH (on a 1:1 exchange rate).
2. Deposit 10 stETH in Aave — this balance of 10 stETH will be used as the collateral for borrowing more ETH.
3. Borrow ETH at a maximum loan-to-value (LTV) ratio of 65%, which equals 6.5 ETH.

Dividing the amount borrowed with the amount supplied will indicate the loan-to-value (LTV) ratio. After the first loop, total assets will then add up to 16.50

stETH. As to how many loops can be made and the corresponding leverage, see the sample simulation below:

Loop	Supply (stETH)	Borrow (ETH)	Total Assets (stETH)	Total Liabilities (ETH)	Leverage Ratio
1	10.00	6.50	10.00	6.50	1
2	6.50	4.23	16.50	10.95	1.65
3	4.23	2.75	20.73	13.70	2.07
4	2.75	1.79	23.48	15.49	2.35
5	1.79	1.16	25.27	16.65	2.53
6	1.16	0.81	26.43	17.41	2.64
7	0.75	0.49	27.18	17.89	2.72
8	0.49	0.32	27.67	18.21	2.77
9	0.32	0.21	27.99	18.42	2.80
10	0.21	0.13	28.20	18.56	2.82
11	0.13	-	28.33	18.56	2.83

Assuming that the simulation above takes into account 65% of the available balance staked, the effective leverage after looping 11 times is $28.33/10 = 2.833$. Moreover, if we ignore the gas fee, the theoretical maximum leverage can reach: $1/(1-65\%) = 2.857$.

If given a 2.32% borrow rate (e.g., 'variable' rate in Aave), and a 5% stETH reward rate, the total annual yield comes down to: $(28.2*5\%-18.32*2.32\%)/10 = 9.8591\%$.

Outside of this recursive strategy, borrowed stETH can also be deposited on higher yield-bearing accounts, thereby providing more turnover on one investment on top of their staking yields.

3.3 Risks of Liquid Staking

Slashing

There are several risks to consider around liquid staking in general. For one, Proof of Stake (PoS) mechanisms generally work on a reward and penalty system, presenting validators with the risk of financial loss. While the staking incentives are

attractive, validators can also be penalised for bad behaviours that may affect network performance. This penalty is called slashing, which results in the validator's removal from the network and a portion of the validator's staked tokens taken away. As users stake their crypto assets to validators, their funds can also suffer the slashing risk.

Depegging

Depegging risks also exist because many LSD tokens depend on the market tied to the underlying asset. This can happen for a variety of reasons, including changes in market sentiment, network performance issues, or even a large sell-off of the LSD token, causing an imbalance in liquidity pools. When the derivative token depegs, it can lead to losses for token holders, as the token's value will likely fall to match the value of the underlying asset. The depegging risk could be higher in a system where the LSD tokens cannot be fully redeemed by the underlying assets.

Each protocol has its own design and attributes, which may present unique risks and challenges. It is therefore imperative for stakers to fully understand the mechanisms of the protocol and where the rewards and additional yield come from.

Centralisation

Liquid staking also presents systemic risks around centralisation. A single protocol that has a majority stake in a PoS network — with its own set of validators — will have a disproportionate amount of power over the network, which can lead to centralisation. For example, nearly a third of staked ETH is in Lido: if the protocol or its infrastructure goes down, validators will be affected; this can negatively impact the network. It also increases the probability of undesirable events occurring in the form of governance attacks, counterparty risks, and smart contract exploits. Developments like ssv.network's DVT are designed to mitigate centralisation risks by providing a decentralised network of validators and eliminating single points of failure within blockchain consensus layers.

4. Developments and Outlook

Other primitives and staking methods are making their way into the market, being built to work alongside liquid staking.

For example, [EigenLayer](#) is pioneering a new primitive called 'superfluid staking', which reverses the order of liquid staking by modifying the core consensus protocol, thus enabling the staking of liquidity provisioning (LP) tokens through a middleware platform like EigenLayer. An LP token represents a share of the total liquidity contained in a DeFi exchange, such as Uniswap or Curve. To compare, liquid staking can be thought of as stacking generated yield from the core protocol first, and then the DeFi layer; while in superfluid staking, the flow starts from the DeFi layer down to the core protocol, which opens up more yield opportunities in DeFi ecosystems.

Read our in-depth analysis on superfluid staking, restaking, and other liquid staking developments in our latest Private report "[Restaking: Eigenlayer](#)".

Liquid staking is undoubtedly one of the strongest narratives defining the industry today, and the growth of the liquid staking market will only be accelerated by the Shanghai Upgrade on the Ethereum network. Based on current trends, any of the following scenarios can potentially occur:

- **The liquid staking narrative will potentially remain, even after the Shanghai Upgrade.** If the update proves to be successful, it will [de-risk ETH staking](#), which will help drive participation by the market and unlock a new era for PoS staking blockchains.
- **The Shanghai Upgrade will likely increase the ratio of staked ETH in the market.** The percentage of staked ETH currently sits at 15.33%. This is considerably low when compared with other chains like Solana (70.91%), Avalanche (54.30%), and Polkadot (48.89%). A case can be made that token holders are hesitant to lock their ETH tokens given the restrictive lock-up conditions and risks involved. This may easily change once withdrawals are available, which can contribute to a potential uptick in the staking ratio. JPMorgan forecasts the ratio can move towards the [60% average](#), while Messari projects [30% to 50%](#) to be a more reasonable range.
- **Shanghai** de-risking the liquid staking market (by improving liquidity and reducing lock-up requirements) may also [propel institutions](#) to make long-term bets on Ethereum and view Ethereum staking — even ETH as an asset — in a more positive light.

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