

Liquidity Unleashed: A Research-driven Analysis of Post-Shanghai LSDs

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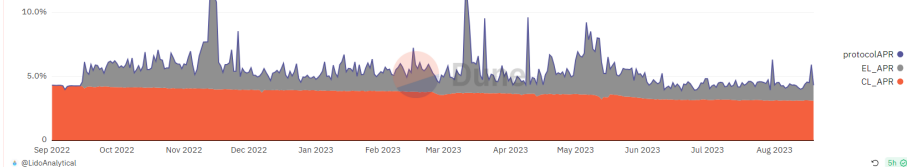
History of Ethereum Staking

- The Merge (Sep 2022): Ethereum migrated from PoW to PoS
⇒ Now anyone can stake 32Ξ on mainnet and accrue rewards as a validator
- The Shanghai/Capella Upgrade (Apr 2023)
⇒ Introduced option to withdraw staked ETH (unstake)

Breakdown of Ethereum Staking Rewards

- Consensus layer rewards: Attestation, block proposal, sync committee
- Execution layer rewards: Txn fee (EIP-1559), MEV

Protocol APR*: Consensus Layer (CL) APR and Execution Layer (EL) APR Lido post Merge APR
Dune SQL



source: @LidoAnalytical on Dune

ETH Staking Landscape

ETH Staked

Ξ25,693,856

ETH Staked 🍷

@hildobby

11h

Percentage of Staked ETH

21.60%

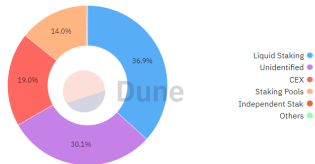
Staked Share of ETH Supply 🏠

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ETH Staked Breakdown

by Category



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source: @hildobby on Dune

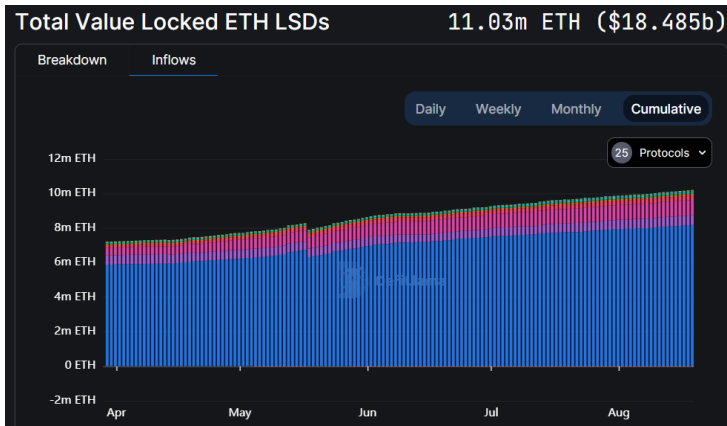
Liquid Staking Derivatives (LSDs)

ERC-20 tokens that represent ETH tokens locked in PoS contracts.

- Benefits: yields staking rewards & has liquidity
- Use cases: borrowing/lending, trading portfolio collateral, etc.
- LSDs are redeemable for ETH at any time
- Most LSDs accrue rewards automatically i.e. **holding LSDs is equivalent to staking ETH in the pool**

LSDs saw huge growth after Shapella

Currently LSDs are the #1 DeFi sector and Lido is the #1 DeFi protocol by TVL.



source: DeFi Llama

Liquid Staking Protocols as Banks

¹Banks are financial intermediaries which create liquidity by:

- Gathering liquid funds (e.g. customer deposits) as liabilities
- Holding illiquid investment projects (e.g. loans, bonds) as assets

Similarly, LSD protocols create liquidity by:

- Gathering liquid funds (ETH) as liabilities
- Holding illiquid investment projects (Ethereum staking) as assets

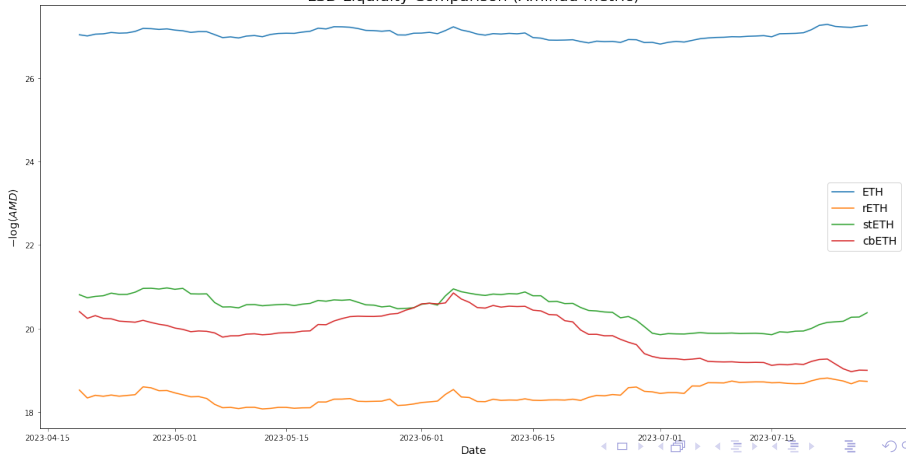
¹Diamond and Dybvig (1983) Theory of Banking

How Much Liquidity do LSDs Provide?

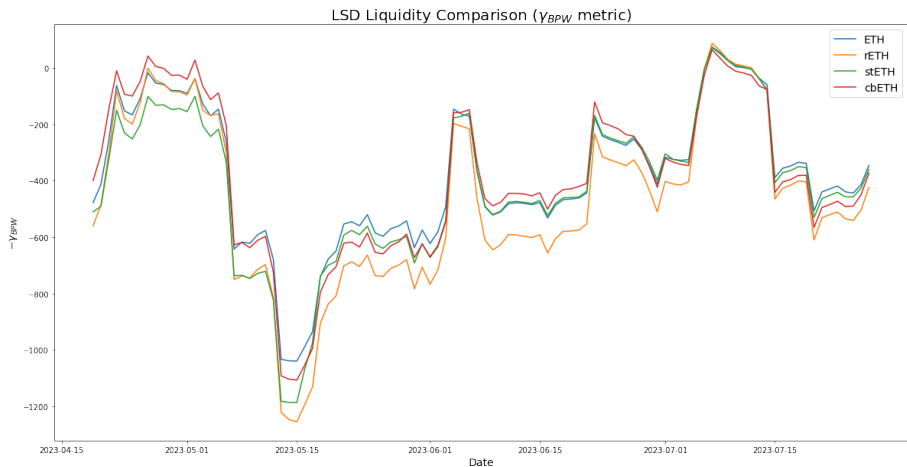
Introducing two quantitative measures of (il)liquidity:

① Amihud (2002): $AMD_{id} = \frac{1}{N_{id}} \sum_{t=1}^{N_{id}} \frac{|r_{it}|}{V_t}$

LSD Liquidity Comparison (Amihud metric)



② Bao, Pan, and Wang (2011): $\gamma_i = -Cov(\Delta p_{it}, \Delta p_{it-1})$



Are LSD Bank Runs Possible?

Bank runs are typically triggered by 1. sudden increase in demand for liquidity 2. expectation of protocol insolvency.

- Liquidity shortage: e.g. CRV exploit July 2023 where multiple liquidity pools were drained
- ETH price drop
- Regulatory crackdown: e.g. SEC deems LSDs as securities
- Large-scale slashing or penalty of validators
- Bugs/exploits/hacks stealing protocol funds

During a LSD Bank Run:


Two main methods of converting LSDs back to ETH:

- Direct redemption from protocol (deposit pool / POL)
- Through DEX pools/aggregators

What happens after these run out?

Withdrawing Staked ETH from Validators

- Step 1: Exit queue – only 10 validators can exit per epoch (≈ 2225 validators or 0.5% circulating supply per day).
- Step 2: Withdrawal queue – same queue with partial withdrawals but is processed much slower

VALIDATOR SET OVERVIEW ⓘ	
METRIC	VALUE
Active validators	744,777  +2,014 validators
Activation queue length ⓘ	24d 19h 54m 59,921 validators
Exit queue length ⓘ	32m 8 validators
Withdrawal queue length ⓘ	7d 7h 55m 37,737.3 ETH

Last resort

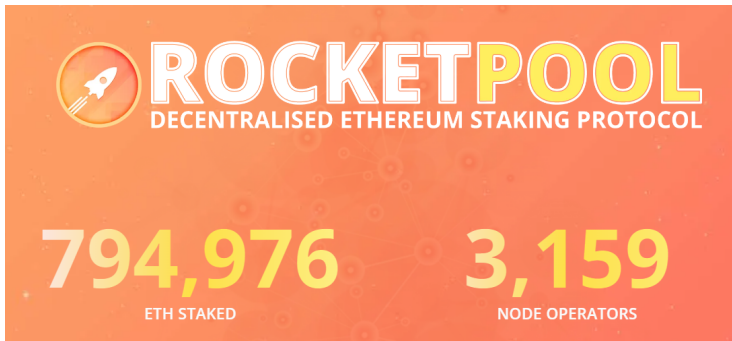
- Pause/delay withdrawals (e.g. Lido's Bunker Mode)
- Sell protocol assets (e.g. gov tokens) !! Might cause self-fulfilling prophecy of insolvency!!

Systemic Risks

- Centralization of stake (esp. Lido): Nethermind Research and Lido are collaborating to solve this²! Also DVT
- APR drop from excessive staking (block rewards do not scale linearly with ETH staked)
- ETH supply inflation if staking \gg usage (ETH minted \gg burned by EIP-1559)

²See “A Path to Permissionless Liquid Staking” by Nethermind & LidoDAO

Rocket Pool (rETH)



Rocket Pool is the 3rd largest LSD protocol by TVL and the largest **permissionless** LSD protocol.

rETH Liquidity Analysis

(Data as of Aug 26, 2023)

Balancer v2 rETH-WETH pool	12,893Ξ
Balancer v2 rETH-wstETH-sfrxETH pool	11,307Ξ
Curve v2 rETH-ETH pool	2,238Ξ
Uniswap v3 rETH-ETH pool	1,007Ξ
Total DEX Liquidity	27,445Ξ
Protocol Owned Liquidity (Deposit Pool)	18,000Ξ
Total Liquidity	45,445Ξ

This is only 5% of rETH supply issued (902,768Ξ), or 4% if not counting other LSDs as liquidity.

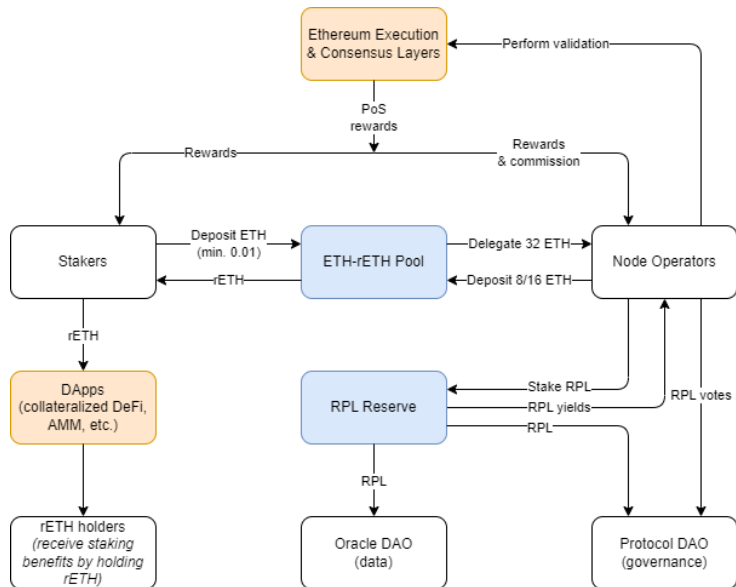
v.s. US banks 10% reserve requirement + Fed loans available

Rocket Pool Agent-Based Model & Simulation

Together with Joel Kahil at Nethermind, I've been building an agent-based simulation model for Rocket Pool to study and improve their protocol design. We focus on:

- rETH and RPL tokenomics
- Behavior of node operators
- Response to external shocks
- Bank run simulation

We plan to use the model to evaluate several proposed changes in RPL's tokenomics by the protocol DAO. Stay tuned for more updates!



Thank You!

Connect with me on Twitter/Telegram @MingXDynasty, and LinkedIn!

- Check out mingxuanhe.xyz for more research in DeFi & tokenomics
- I'm on the job market for 2024!

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