Post-Shanghai LSDs and Bank Run Risks

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Disclaimers

- **NFA:** This talk is for intended solely for educational and research purposes. It should not be construed as financial or investment advice.
- **No financial ties:** I have no financial ties with any projects or tokens mentioned in this talk. I hold minimal amounts ($<$\$500) of LSDs.
- **Views are my own** and do not represent the views of my institutions or employers.
- **DYOR**

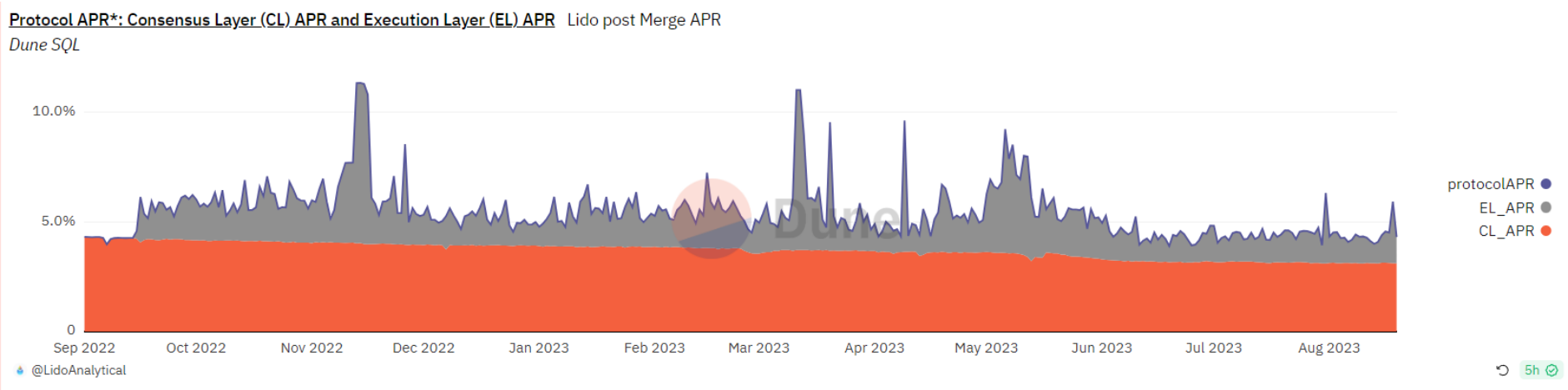
History of Ethereum Staking

- The Merge (Sep 2022): Ethereum migrated from PoW to PoS
  $\Rightarrow$ Now anyone can stake 32Ξ on mainnet and accrue rewards as a validator

- The Shanghai/Capella Upgrade (Apr 2023)
  $\Rightarrow$ Introduced option to withdraw staked ETH (unstake)

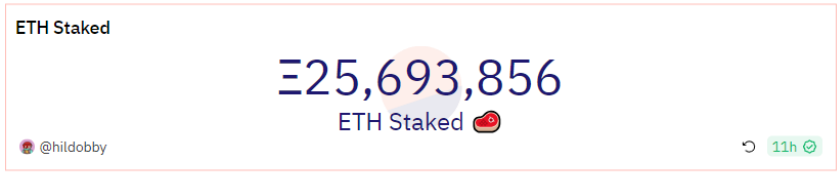
Breakdown of Ethereum Staking Rewards

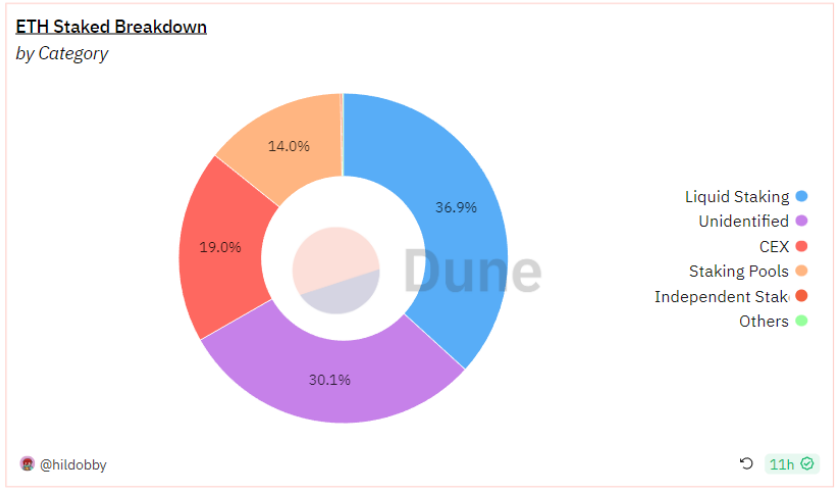
- Consensus layer rewards: Attestation, block proposal, sync committee
- Execution layer rewards: Txn fee (EIP-1559), MEV



source: @LidoAnalytical on Dune

ETH Staking Landscape

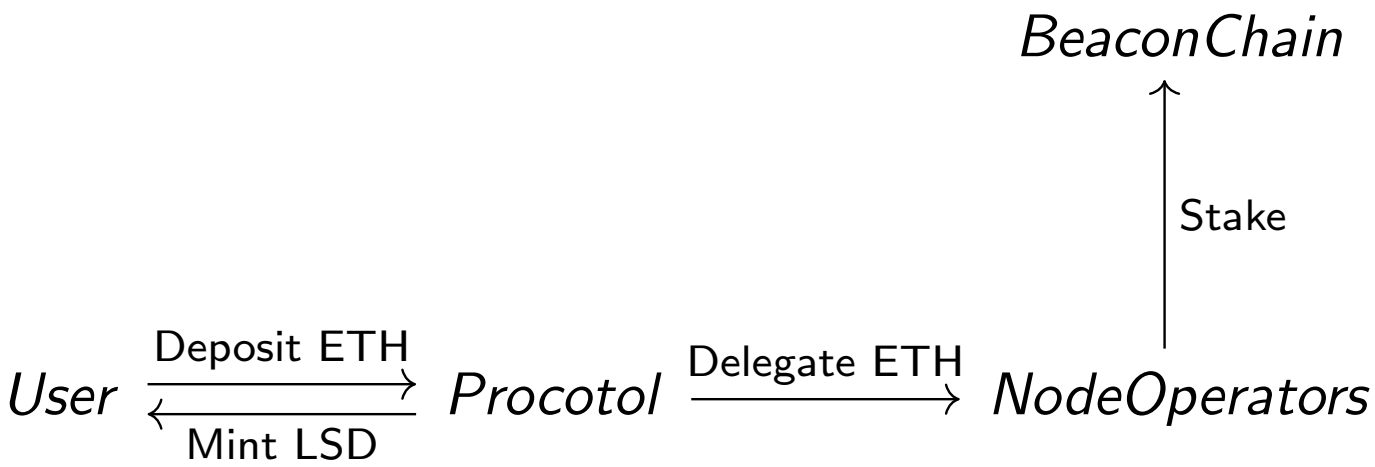




source: @hildobby on Dune

Liquid Staking Derivatives (LSDs)

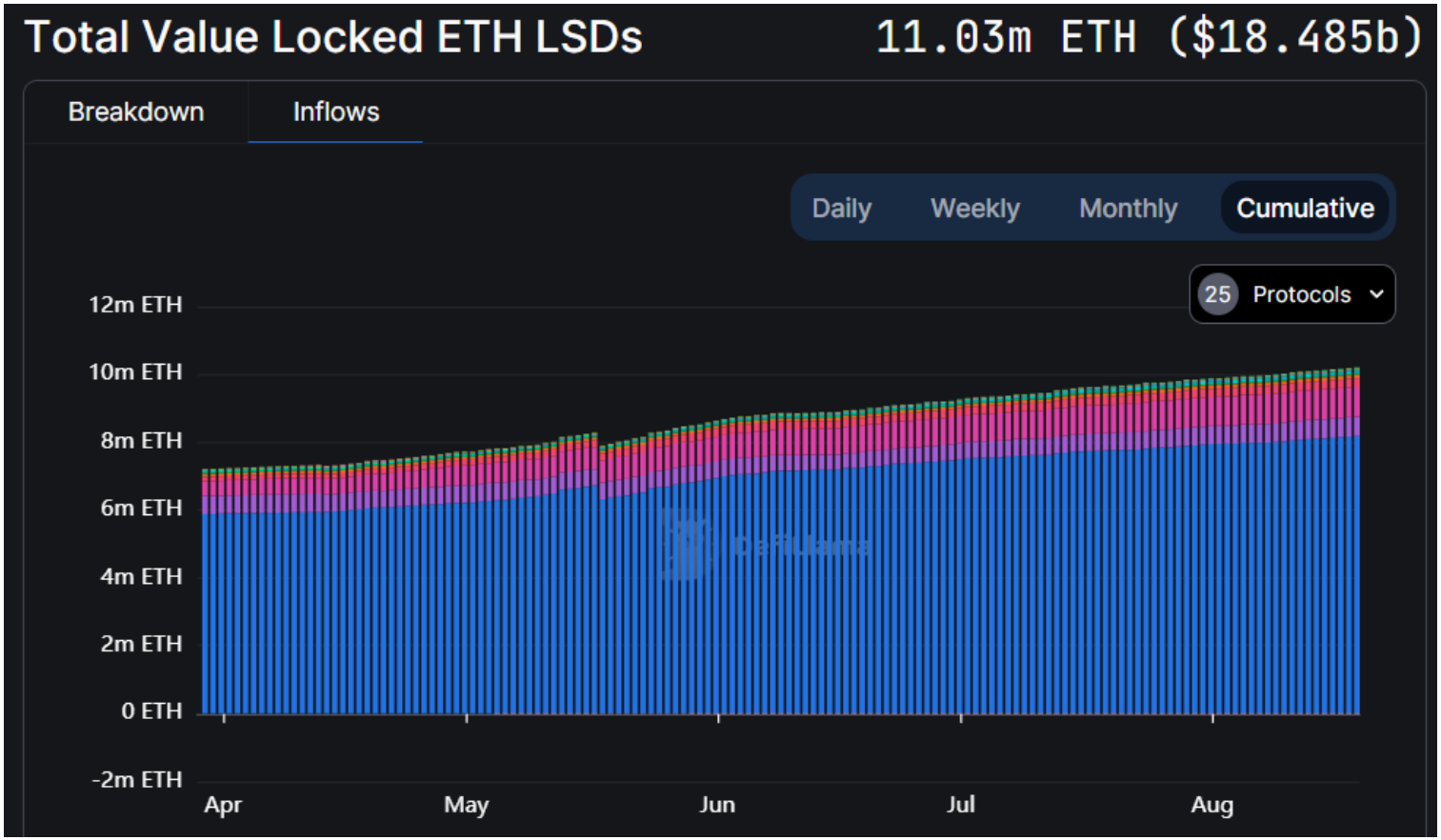
ERC-20 tokens that represent ETH tokens locked in PoS contracts.
A simplified model:



- Benefits: 1. staking rewards 2. retail-friendly 3. 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

[1]Banks 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:

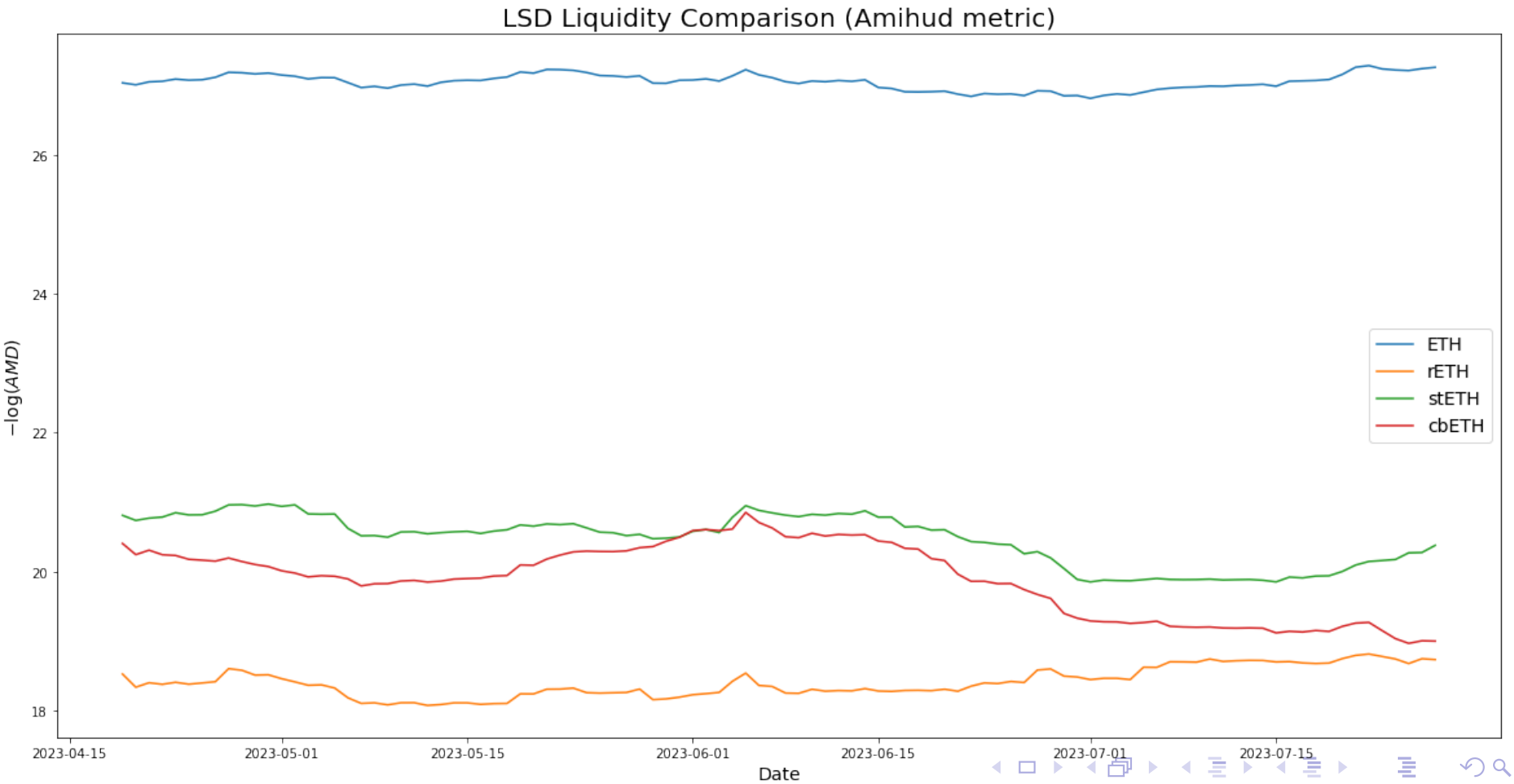
- Gathering liquid funds (ETH) as liabilities
- Holding illiquid investment projects (Ethereum staking) as assets

[1]Diamond and Dybvig (1983) Theory of Banking

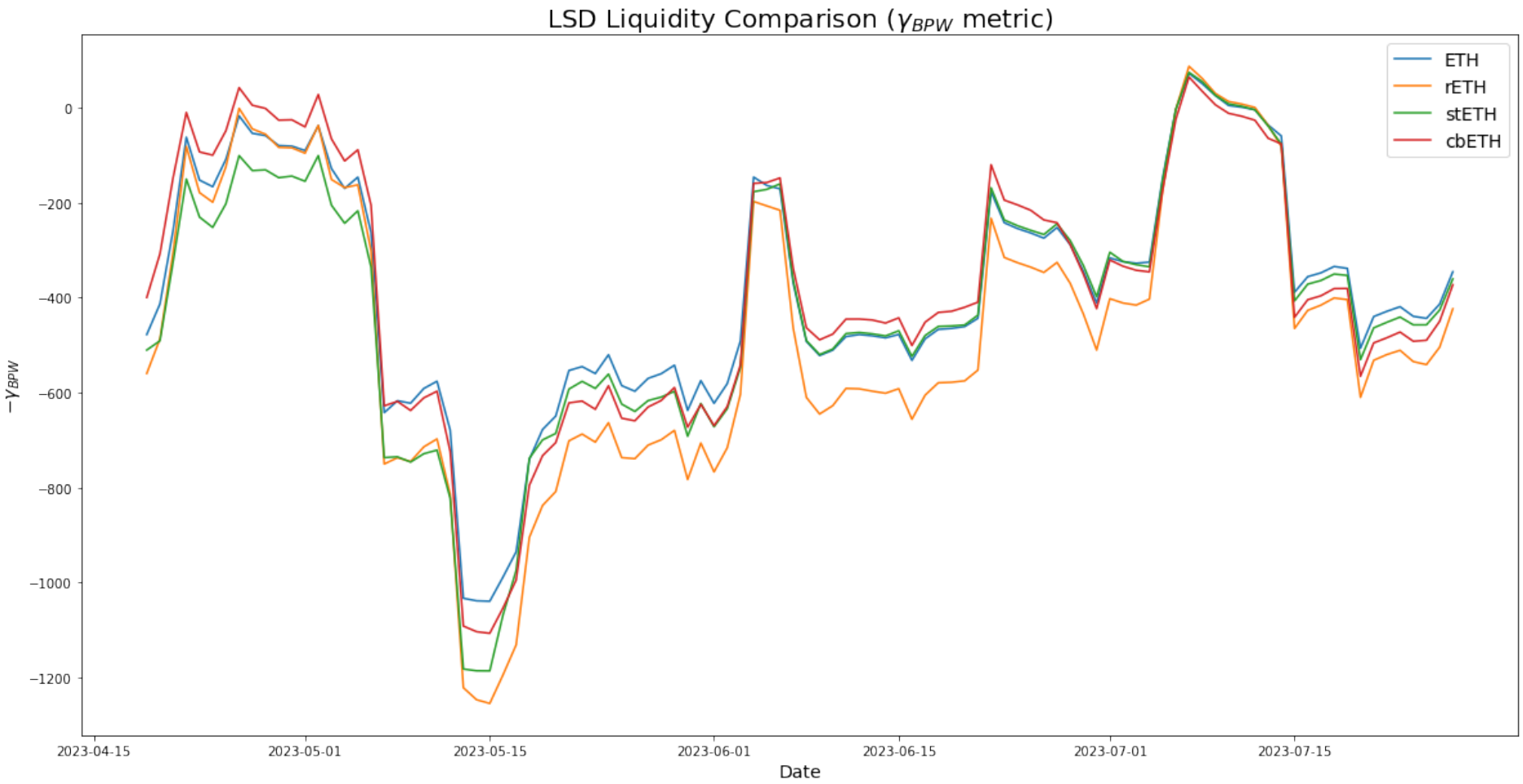
How Much Liquidity do LSDs Provide?

Introducing two quantitative measures of (il)liquidity:

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



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

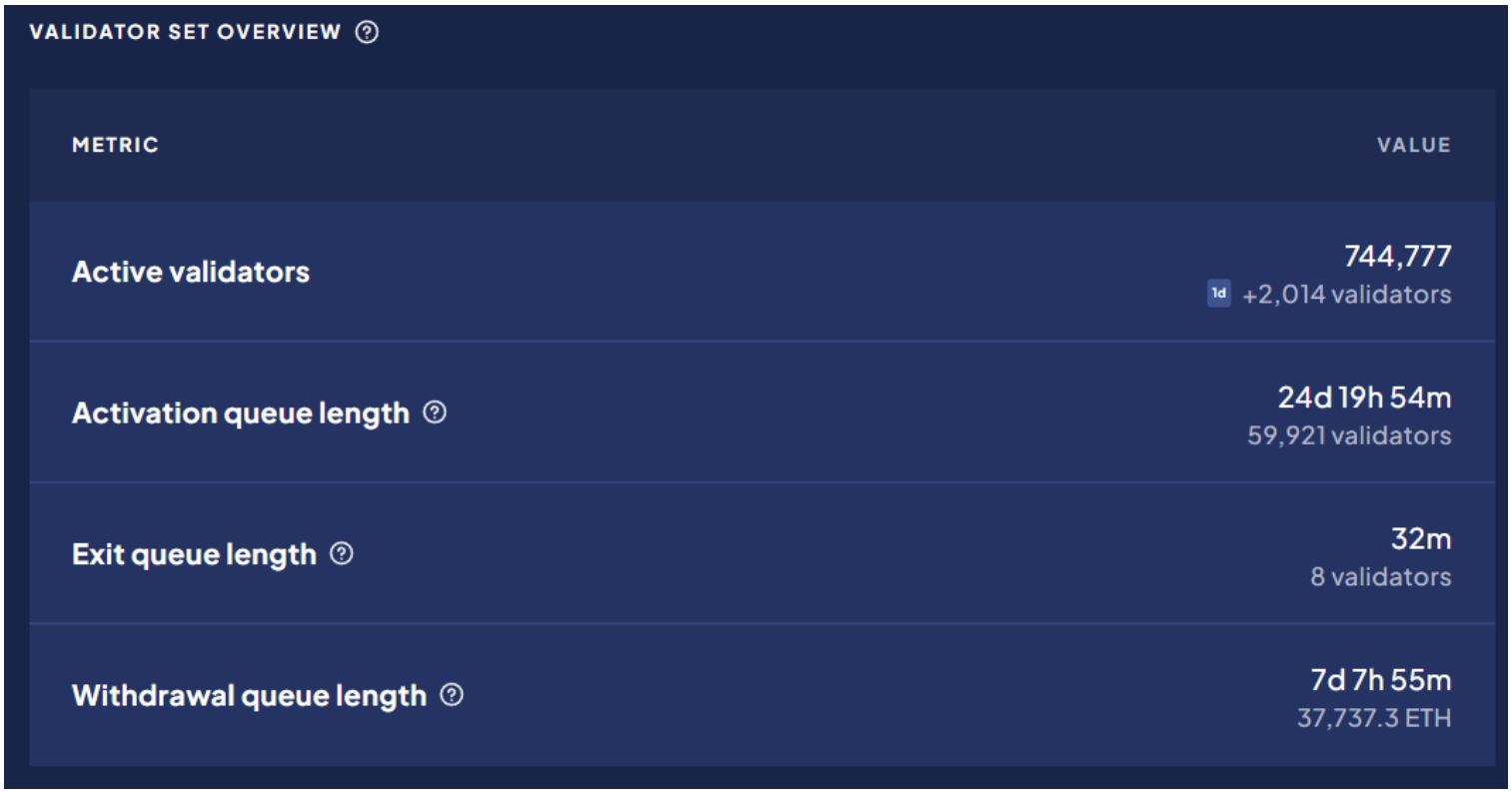
Two main methods of converting LSDs back to ETH:

- Direct redemption from protocol
- Through DEXes

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: Withdrawl queue – same queue with partial withdrawls but is processed much slower



source: Rated Network

Last resort

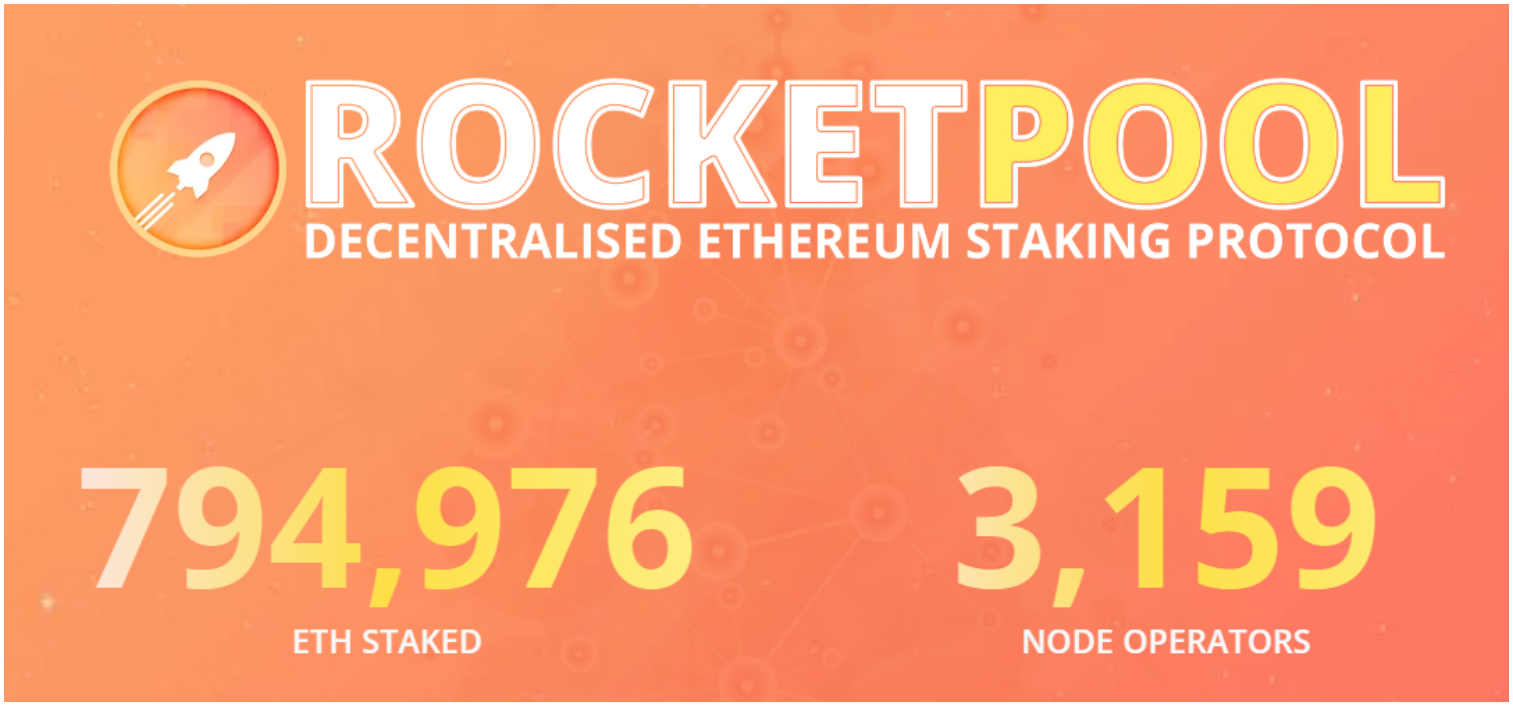
- Pause/delay withdrawals (e.g. Lido's Bunker Mode)
- Sell protocol equity (e.g. gov tokens) !!Might cause self-fulfilling prophecy of insolvency!!

Systemic Risks

- Centralization of stake (esp. Lido): Nethermind Research and Lido are collaborating to solve this[2]! Also DVT
- APR drop from excessive staking (block rewards do not scale linearly with ETH staked)
- ETH supply inflation if staking >> usage (ETH minted >> burned by EIP-1559)

[2] See "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

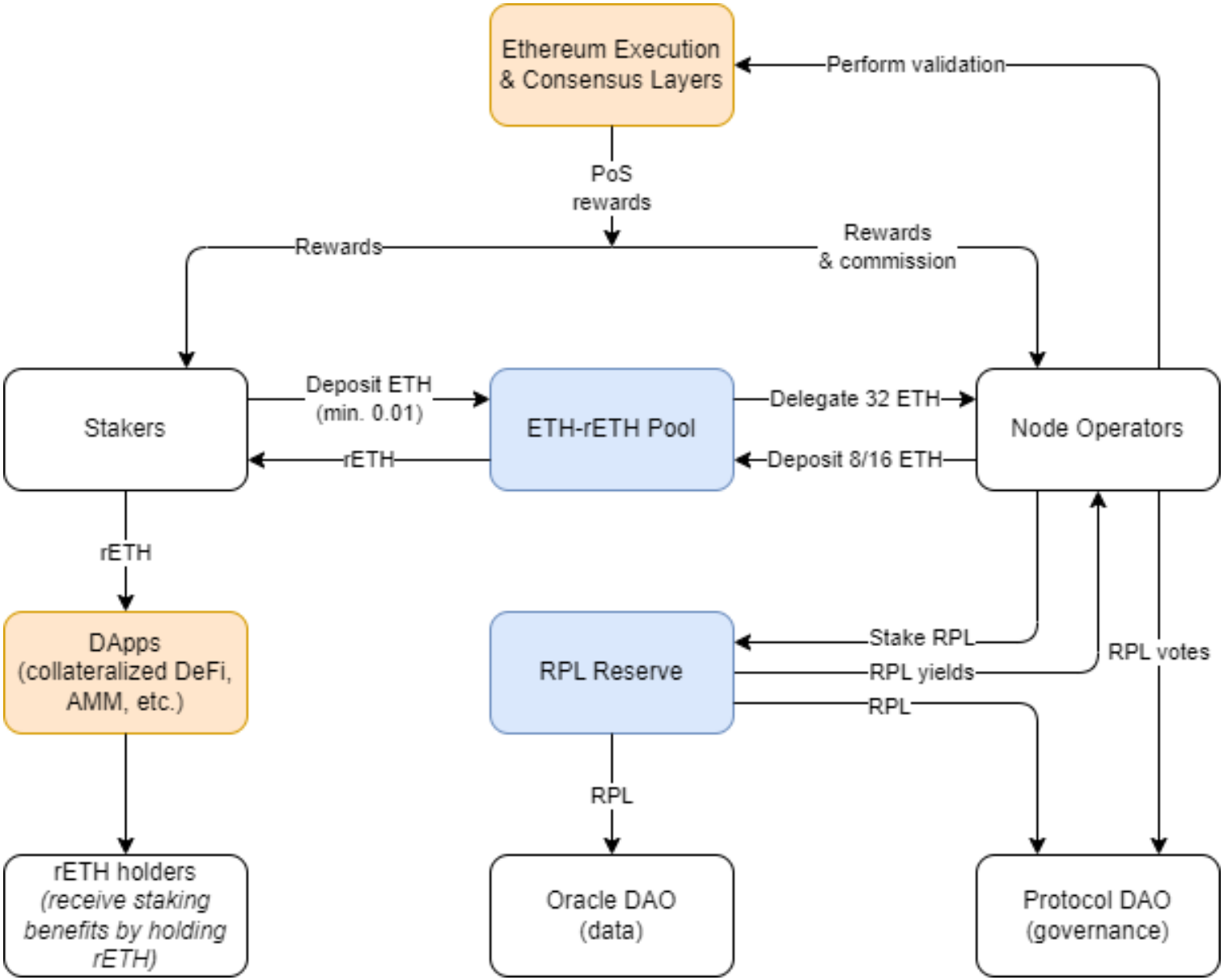
This is only 5% of rETH supply issued (902,768Ξ), or 4% if not counting other LSDs as liquidity.
v.s. US banks 10% reserve requirement + Fed loans available

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!


Ethereum Execution & Consensus Layers
Perform validation
PoS rewards
Rewards
Rewards & commission
Stakers
Deposit ETH (min. 0.01)
ETH-rETH Pool
Delegate 32 ETH
Node Operators
rETH
Deposit 8/16 ETH
rETH
DApps (collateralized DeFi, AMM, etc.)
RPL Reserve
Stake RPL
RPL votes
RPL yields
RPL
RPL
rETH holders (receive staking benefits by holding rETH)
Oracle DAO (data)
Protocol DAO (governance)

Thank You!

Slides available at https://github.com/mingxuan-he/ethchi-talks

Twitter/Telegram: @MingXDynasty

I'm on the job market for 2024!

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