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The proposed change in ETH staking yields and its impact on different staker types

Dr. Matthias Hafner, Nicolas Oderbolz

Based on work in collaboration with Dr. Juan Beccuti, Thunj Chantramonklasri and Noé Arnold

Staking and the Ethereum Issuance Curve

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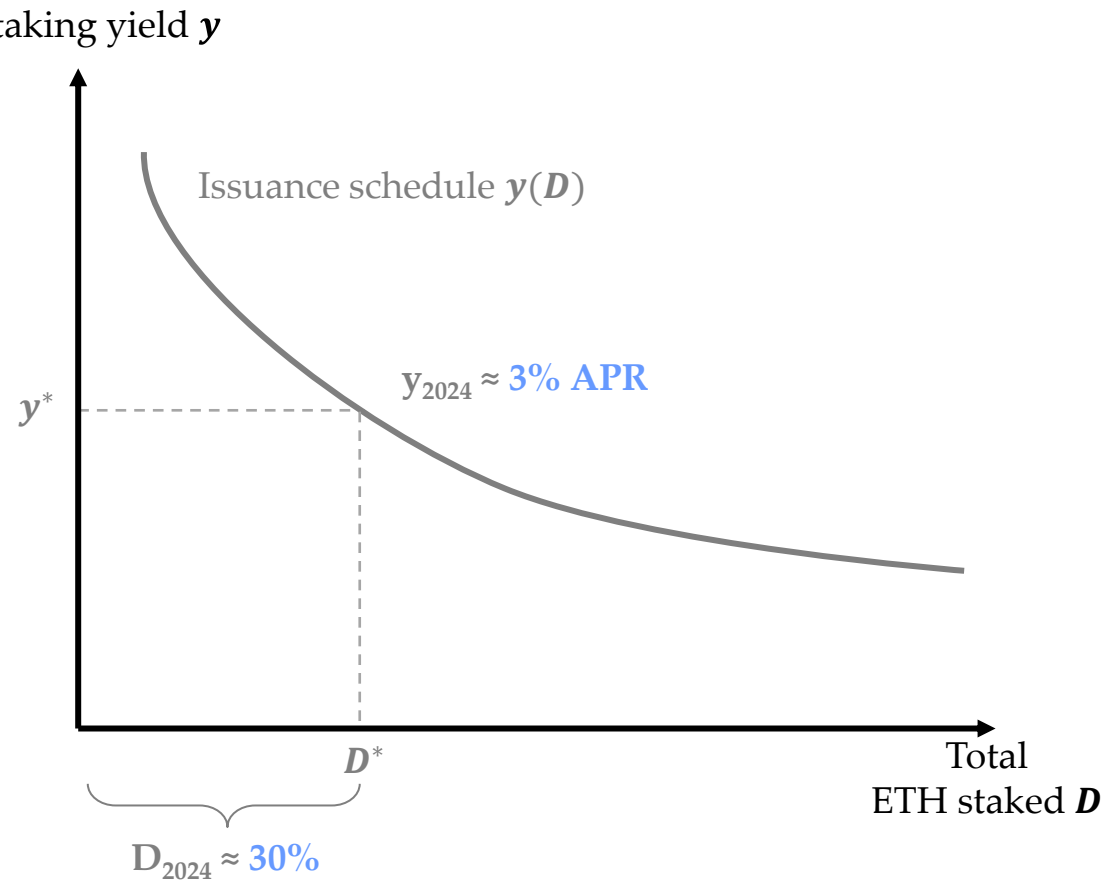
Currently: ~30% of ETH is actively staked

The Ethereum Staking Market



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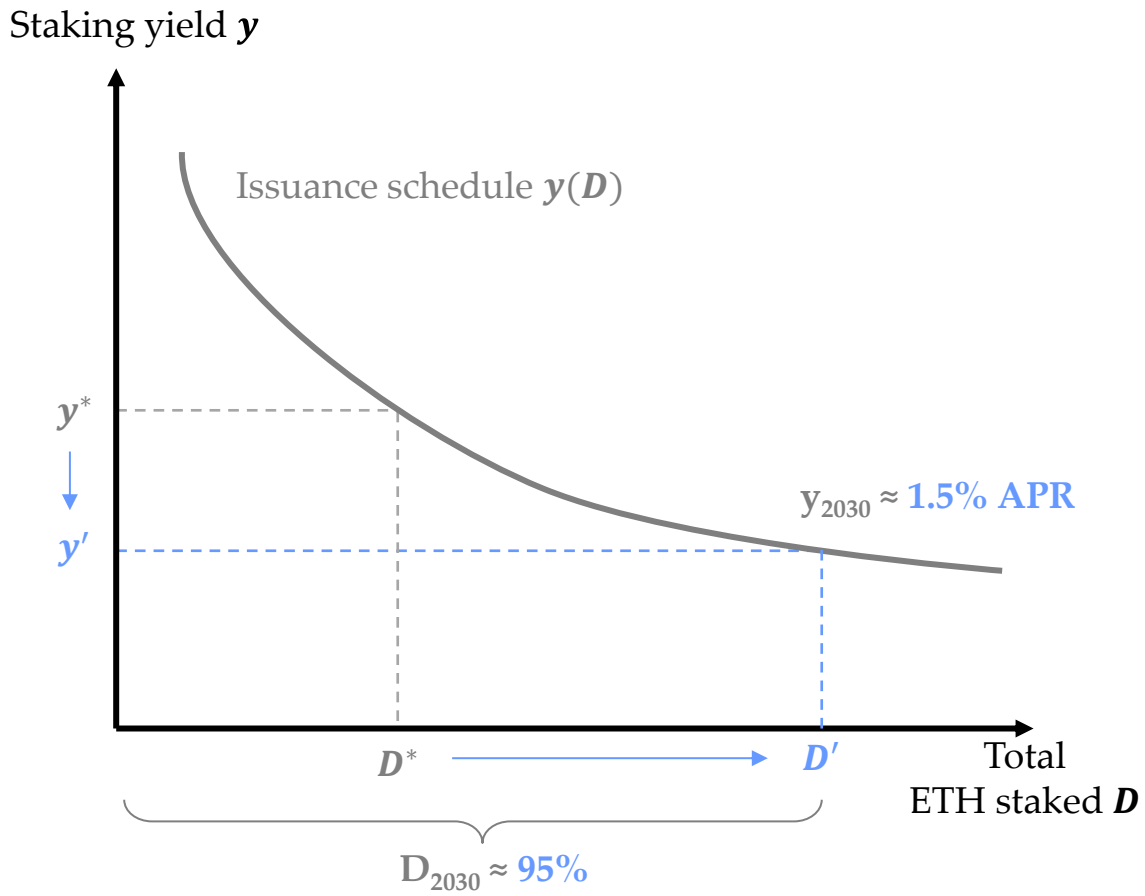

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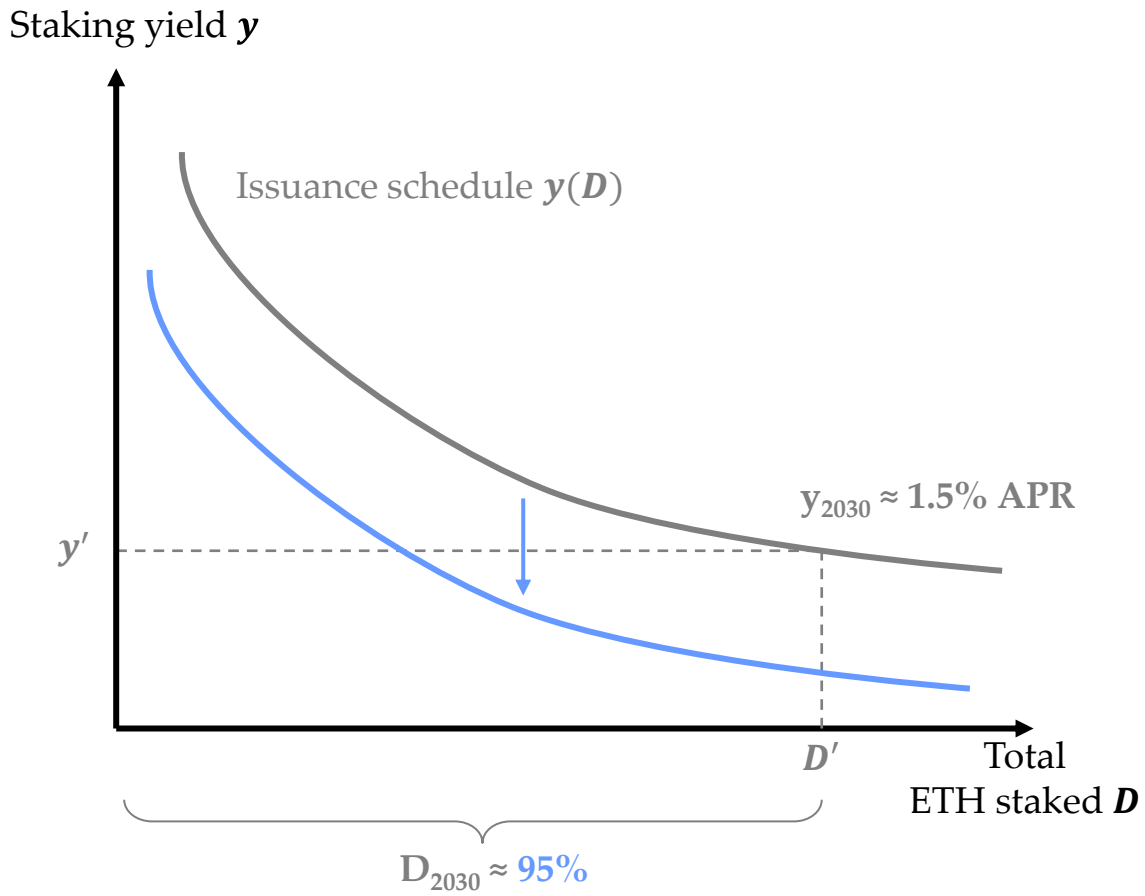

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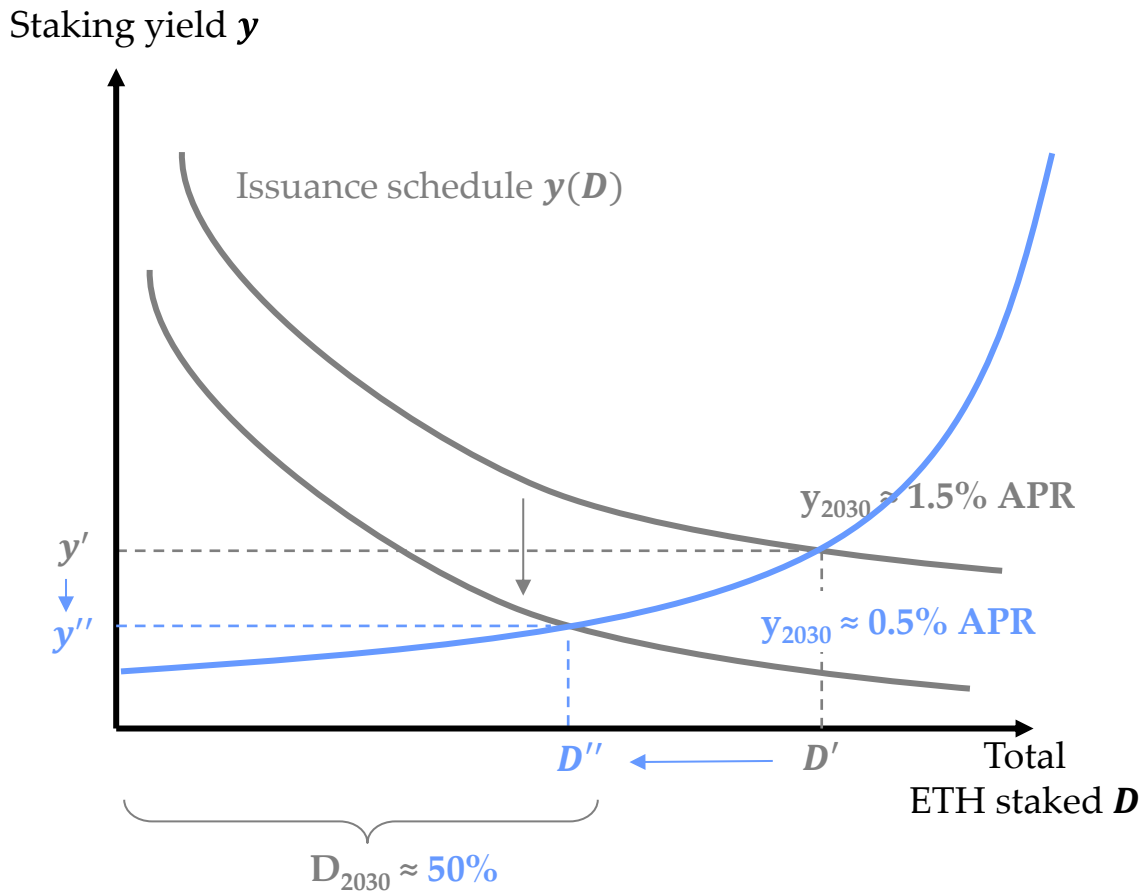

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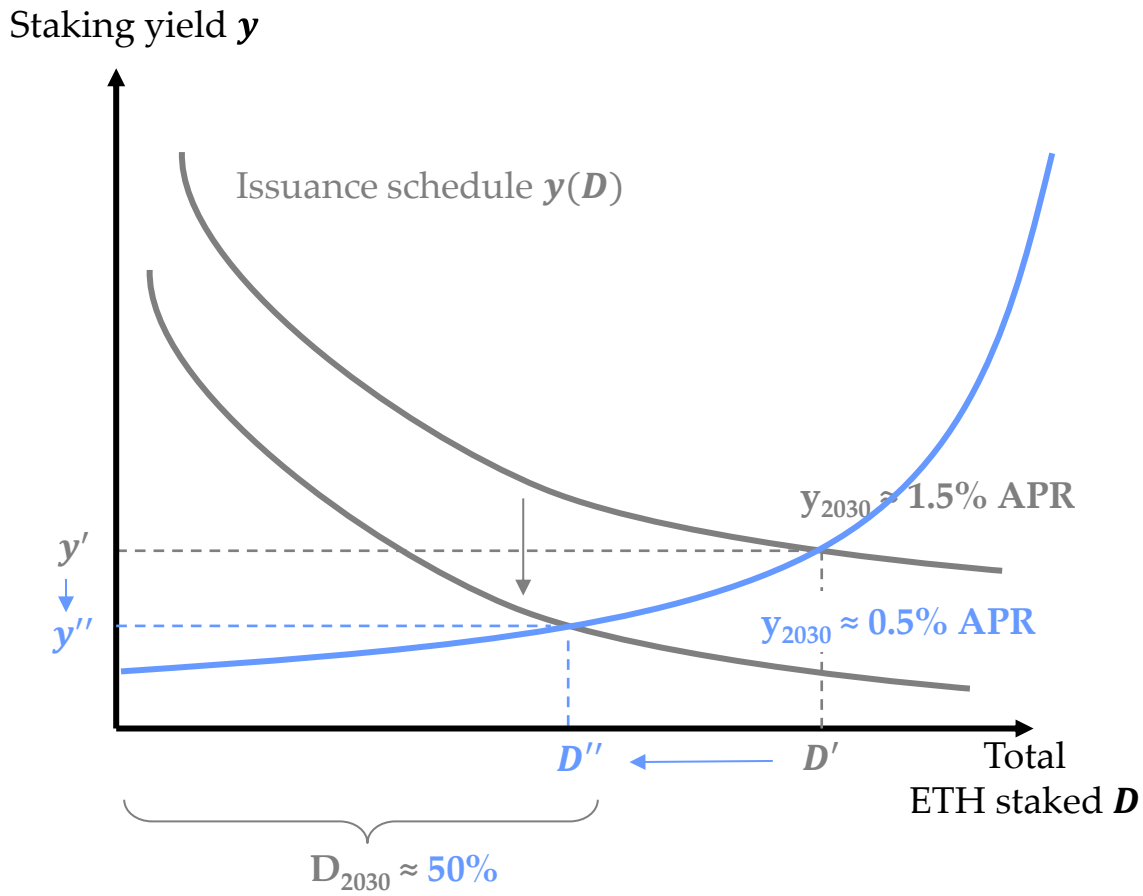

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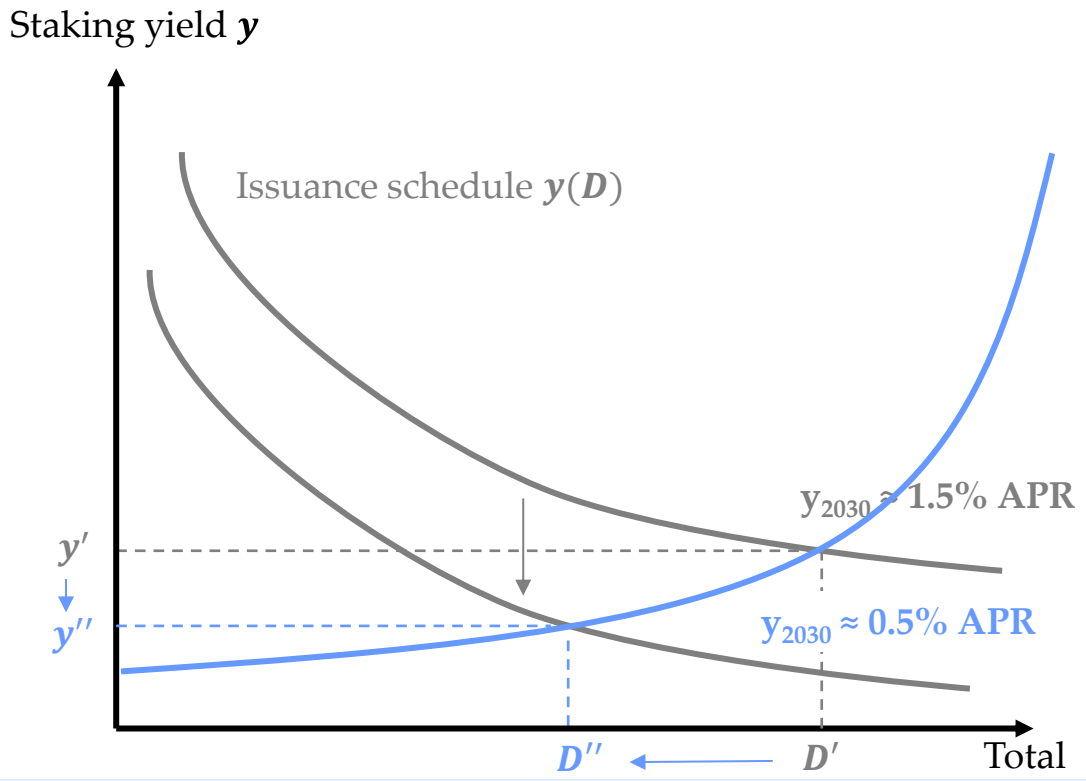
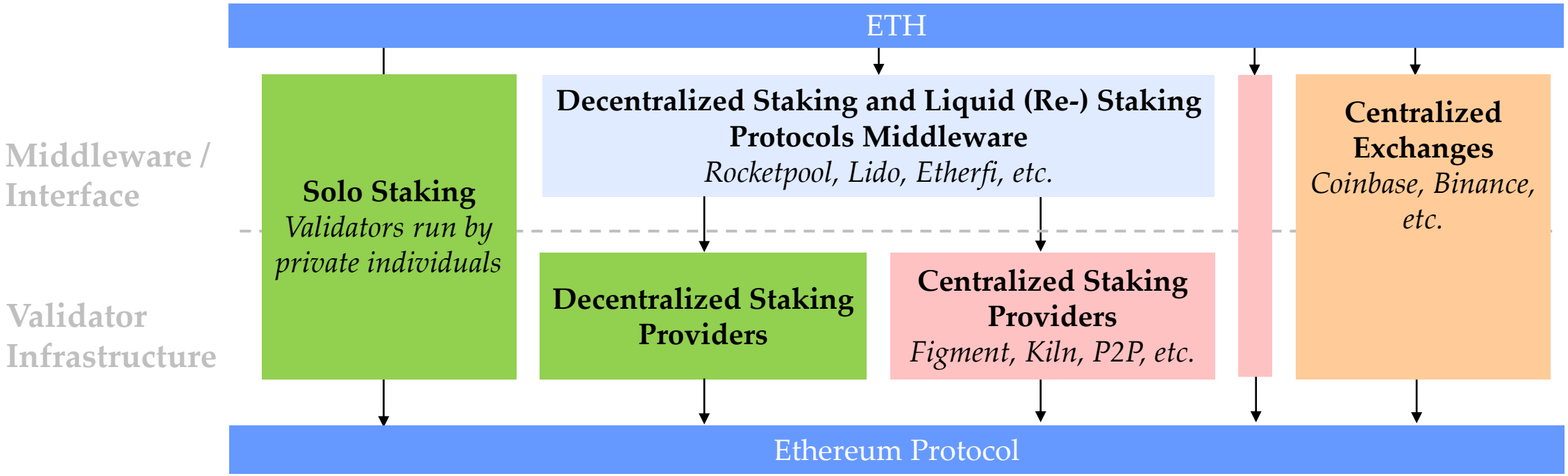


→ Centralization risk? Analyze staking supply (stakers)!

The Ethereum Staking Supply



Source: Cryptecon based on Kotelskiy et al. (2024)

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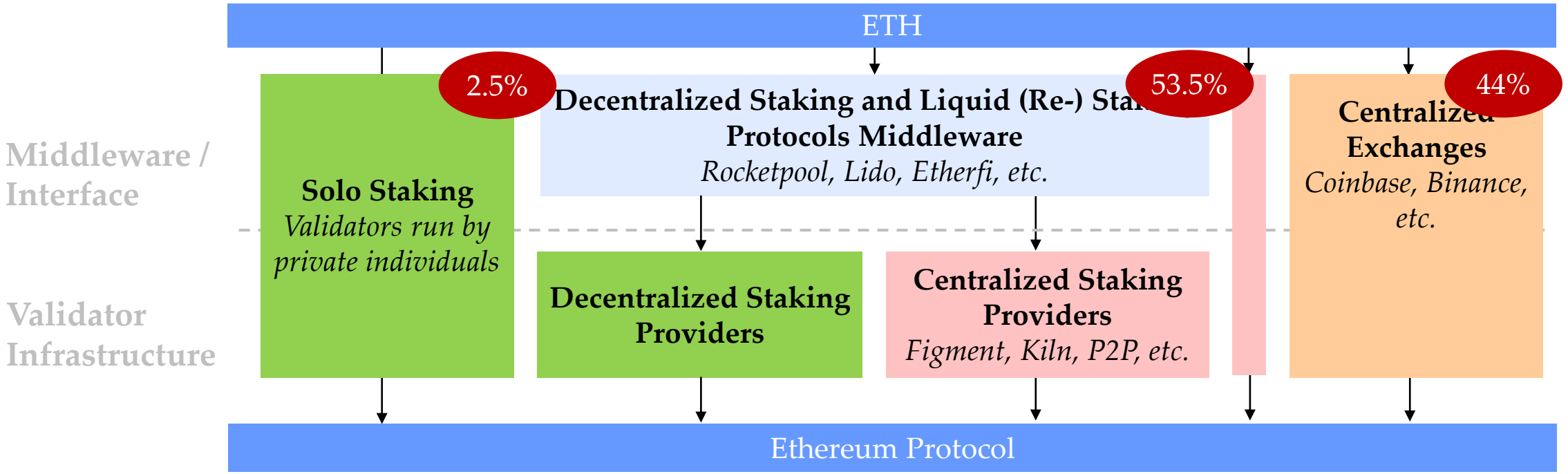

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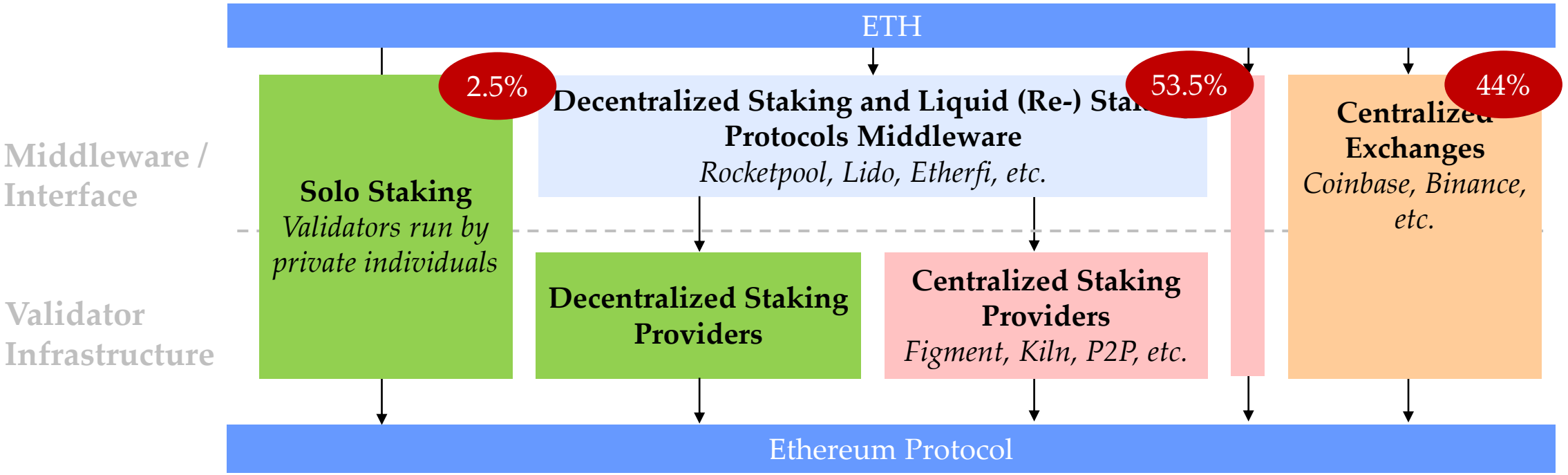

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→ If rewards are reduced (issuance curve is shifted), how do the numbers (2.5% , 53% , 44%) change?
→ Will this drive Solos out?

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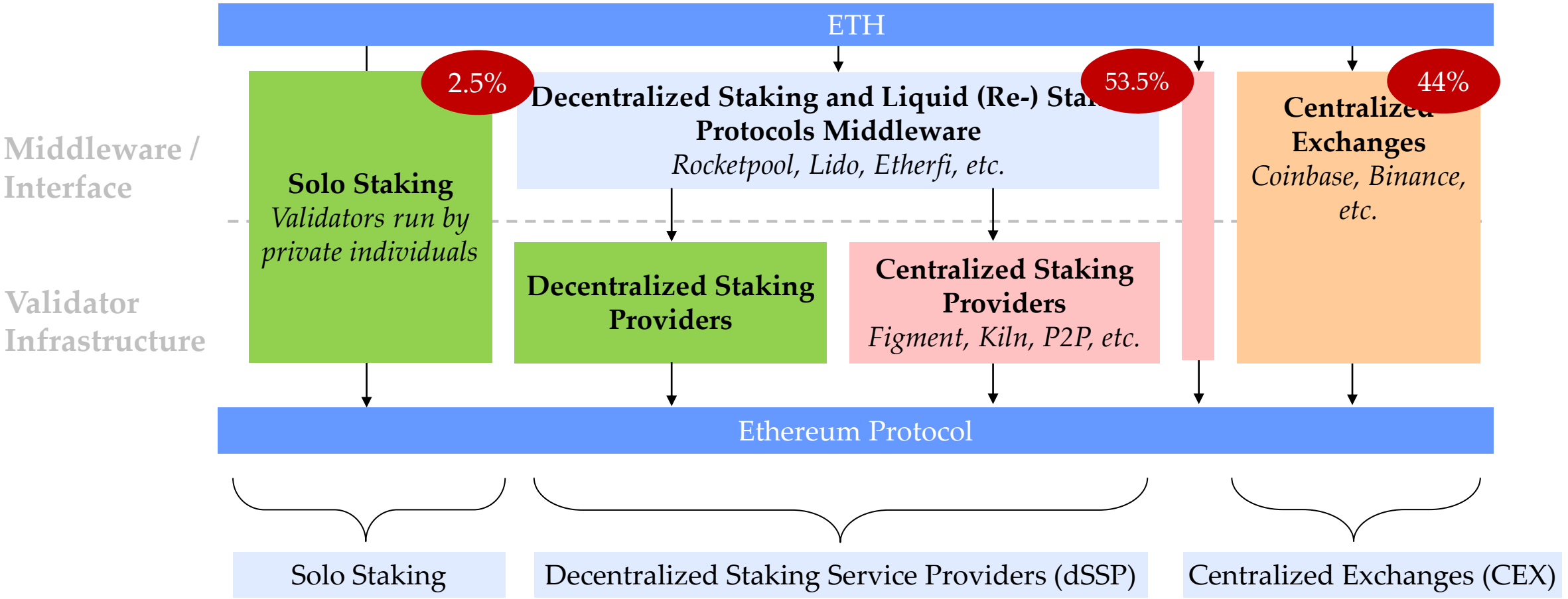

Factors influencing staking supply

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Staker

Option 1: Solo	Option 2: dSSP	Option 3: CEX
▪ Staking rewards: yield ▪ Fixed costs: high ▪ Variable costs: low ▪ Add. yield: no ▪ Revenue pooling: no ▪ Main risk: slashing ▪ Requires tech. knowledge	▪ Staking rewards: yield ▪ Fixed costs: no ▪ Variable costs: fee ▪ Add. yield: yes ▪ Revenue pooling: yes ▪ Main risk: smart contract ▪ Requires DeFi knowledge	▪ Staking rewards: yield ▪ Fixed costs: no ▪ Variable costs: fee ▪ Add. yield: no* ▪ Revenue pooling: yes ▪ Main risk: counterparty ▪ No knowledge required
$\rightarrow$ Staking Supply$_{Solo}$	$\rightarrow$ Staking Supply$_{dSSP}$	$\rightarrow$ Staking Supply$_{CEX}$

Sources: Survey conducted via r/ethstaker; research by Cryptecon

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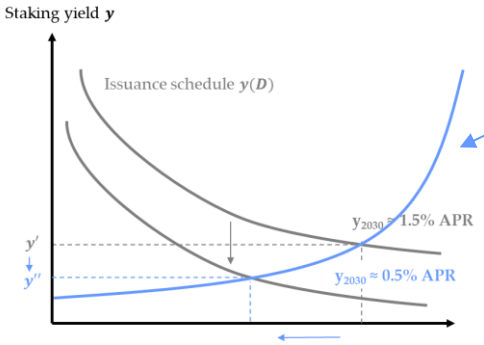

Staking Supply = Staking Supply$_{Solo}$ + Staking Supply$_{dSSP}$ + Staking Supply$_{CEX}$

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$$\text{Staking Supply} = \text{Staking Supply}_{Solo} + \text{Staking Supply}_{dSSP} + \text{Staking Supply}_{CEX}$$

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Aim: To develop a model **framework** that explains staking decisions as a function of staking rewards and cost structures for the different types of staking.

A Simple Model of Staking

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We develop a simple **model that incorporates the relevant drivers**

- Segmented staking market with **three types** of ETH holders:
  - **Retailers:** Stake via CEX
  - **Techies:** Stake via dSSP
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- Agents **maximize staking profits** and behave **strategically**
  - **Revenues:**
    - Issuance: $y^{ISS}(D_i)$
    - Execution rewards / MEV: $y^{Ex} \times D_i$
    - DeFi yields from reinvesting LST: $y^{DeFi} \times D_i$
  - **Costs** for ETH holder i depend on the staking method j:

$$C_j(D_i) = C_j + c_j {D_i}^{\alpha_j}$$

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Research questions:

- How do model parameters affect staking behavior?
- How do staking equilibria compare across different issuance schedules?

Results

The theoretical model shows…

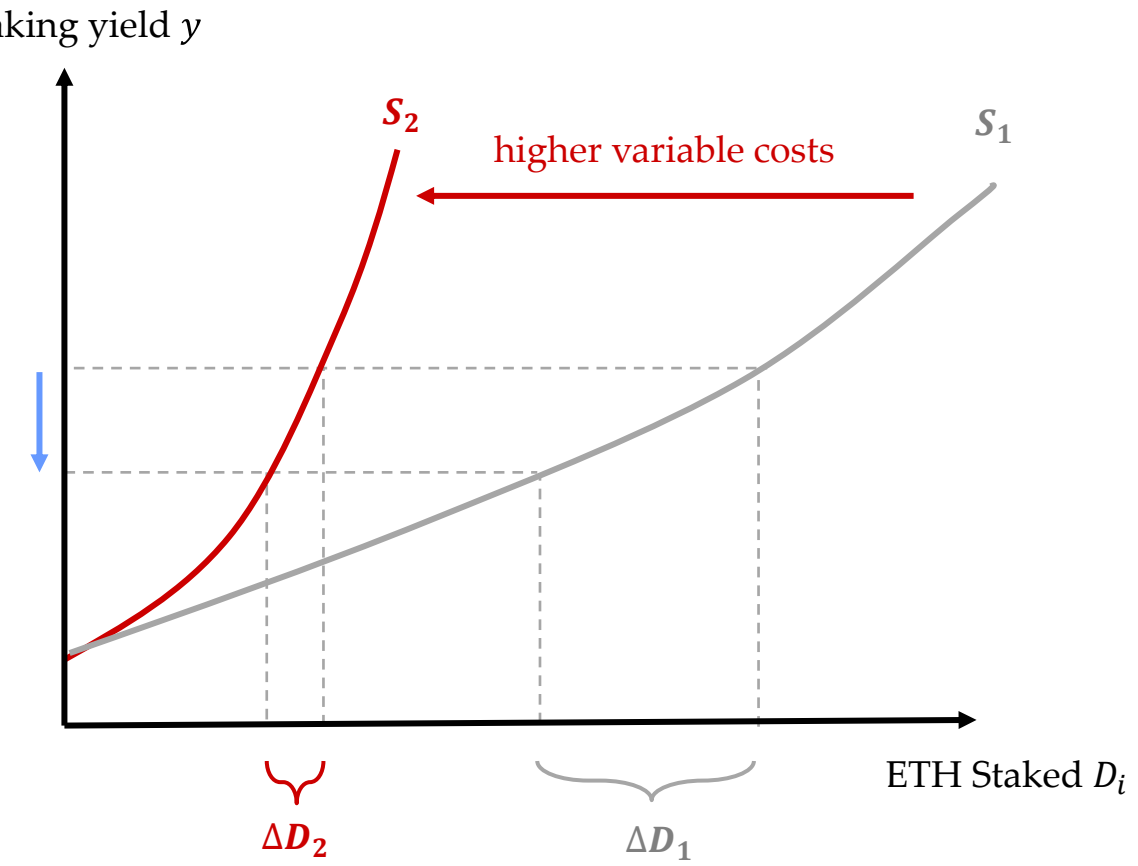
Observation 1a:

The higher the variable costs, the smaller the adjustment in staking supply

Observation 1b:

The more variable cost rise with additional stake, the smaller the adjustment in staking supply

Staking supply functions with different variable costs



$|\Delta D_2| < |\Delta D_1|$

Source: Cryptecon

Results

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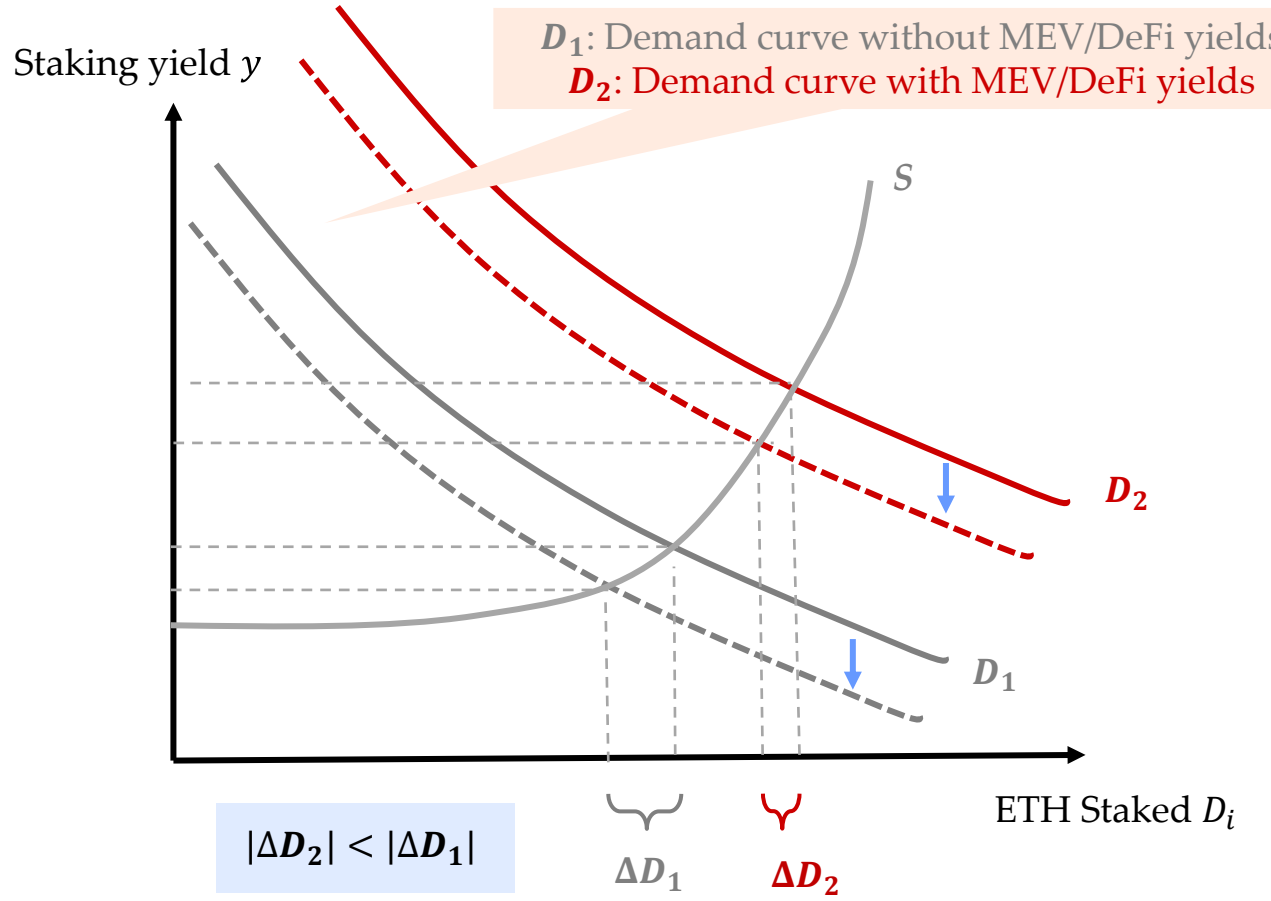
The theoretical model shows…

Observation 2:

Stakers with additional MEV/DeFi yields will tend to react less to changes staking rewards*

* if variable costs are increasing with additional stake

Staking demand functions with and without DeFi revenues



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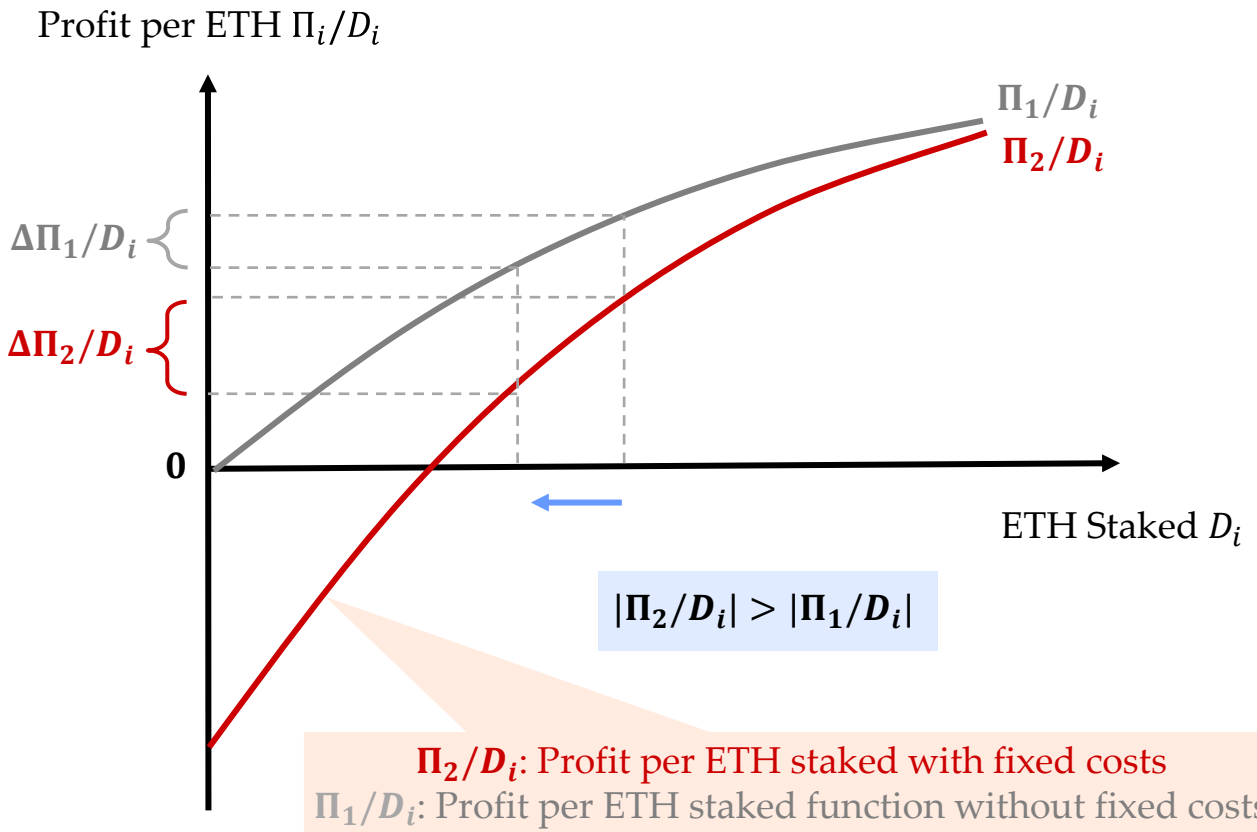
Results

The theoretical model shows…

Observation 3:

As stakers adjust staking supply, the associated change in profitability is larger when fixed costs are high

Profitability of staking with varying fixed costs



Source: Cryptecon

Calibration Exercise

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We calibrate the cost functions

$$C_j(D_i) = C_j + c_j {D_i}^{\alpha_j}$$

We make the following stylized assumptions

- **Solo staking:**
  - High fixed costs

    $$C_{ss} > C_{dSSP}, \qquad C_{ss} > C_{CEX}$$

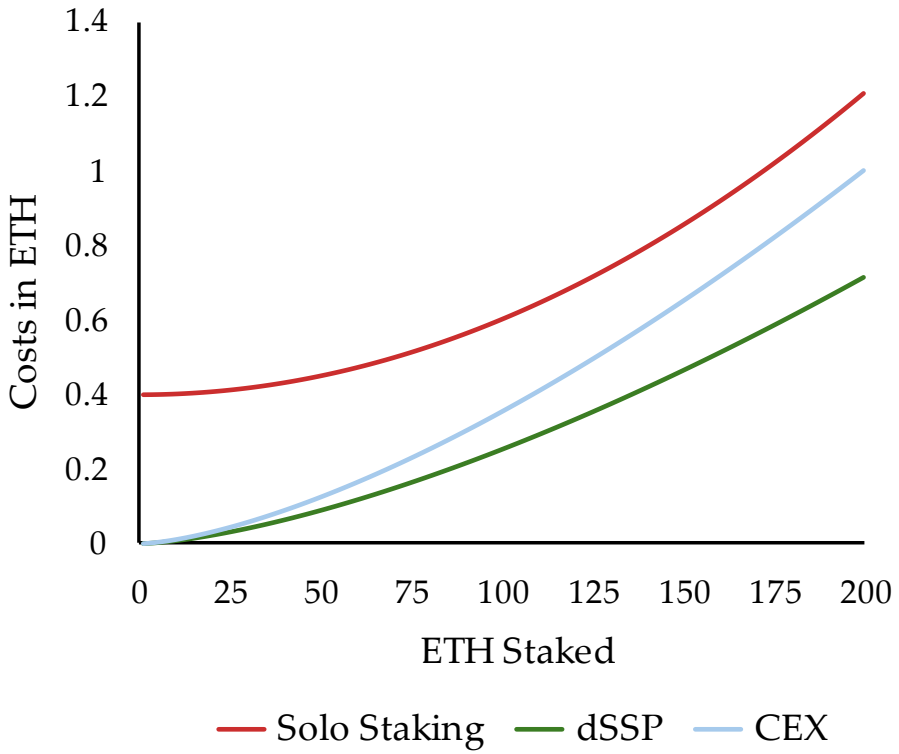
  - Increasing operational costs

    $$\alpha_{ss} > \alpha_{dSSP}, \qquad \alpha_{ss} > \alpha_{CEX}$$

- **CEX:**
  - High variable costs

    $$c_{ss} < c_{dSSP}, \qquad c_{ss} < c_{CEX}$$

Cost functions of different staking solutions



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Calibration Exercise

We then compare equilibria under the following two issuance schedules

- Today:

$$y_i(D) = \frac{2.6 \times 64}{\sqrt{D}}$$

- Reduced reward:

$$y'_i(D) = \frac{2.6 \times 64}{\sqrt{D}(1 + k \times D)}, k = 2^{-25}$$

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Short-run effects:

- Solo stakers adjust their stake by less than other staking solutions due to higher marginal costs.
- Staking profits consolidate among stakers using dSSP and CEX

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Long-run effects:

- High fixed costs and absence of revenues from LSTs (and to some extent MEV) makes solo staking less profitable compared to other solutions
- In the long-run, solo stakers may be driven out of the market or switch to other staking solutions

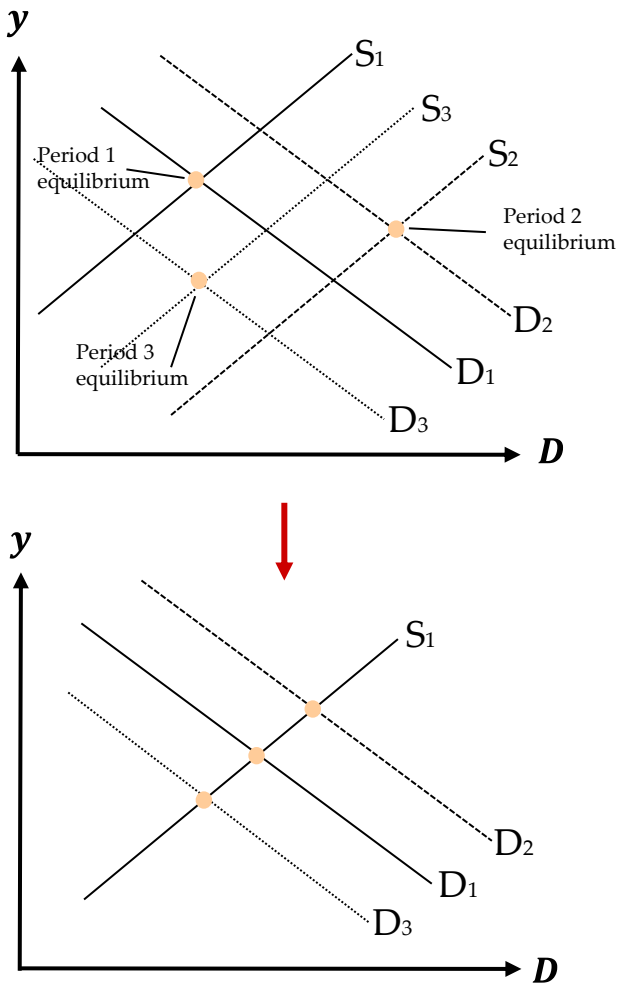
Learning from the Data

Aim:

- Empirical estimation of the shape of supply curves for different stakers

Method:

- **Instrumental variable approach:** Enables identification of supply curve using exogenous shifts in the staking demand curve
- We use **past EIPs and gas fees as instruments**



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Results:

- Depending on the instrument, we obtain conflicting results

EIPs as instrument variables

Table 3: 2SLS with Dollar Rewards and EIP Dummies as Instruments

	Log Validators	Log Solo Validators	Log CEX Validators
ETH Rewards (USD)	0.428***	0.041***	0.225***
	(0.15)	(0.008)	(0.012)
FTX Collapse	0.166***	0.124***	0.152***
	(0.015)	(0.008)	(0.12)
ETH Flash Crash	0.171***	−0.158***	0.100***
	(0.015)	(0.008)	(0.12)
Constant	4.108***	8.995***	7.333***
	(0.307)	(0.170)	(0.251)
Observations	614	614	614
R-squared	0.846	0.531	0.747

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Cryptecon based on data from Dune and Rated Network

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Gas fees as instrument variable

Table 4: 2SLS with Dollar Rewards and Gas Fees as Instruments

	Solo		Total	
	(1)	(2)	(3)	(4)
	Log Staked (USD)	Log Staked (USD)	Log Staked (USD)	Log Staked (USD)
Log Rewards (USD)$_t$	1.184***		1.078***	
	(0.073)		(0.035)	
Log Rewards (USD)$_{t-1}$		1.176***		1.075***
		(0.074)		(0.036)
Constant	6.774**	6.868***	7.739***	7.786***
	(0.877)	(0.888)	(0.543)	(0.556)
Observations	622	621	622	621
R-squared	0.128	0.101	0.858	0.851

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Cryptecon based on data from Dune and Rated Network

Take-Aways

Proposal: Reduce issuance rewards

Research question: Is there centralization risk as cost-inefficient validators (e.g., solo stakers) are pushed out?

Main Findings:

- Reduced issuance could drive out smaller solo stakers
- Reduced issuance might increase demand for solution that offer stakers additional sources of yields

Further research:

- Improve available data to help model calibration
- How does competition among intermediaries affect outcomes?
- What role do other EIPs play in this discussion (e.g. MEV burn, higher maximum effective balance, etc.)

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