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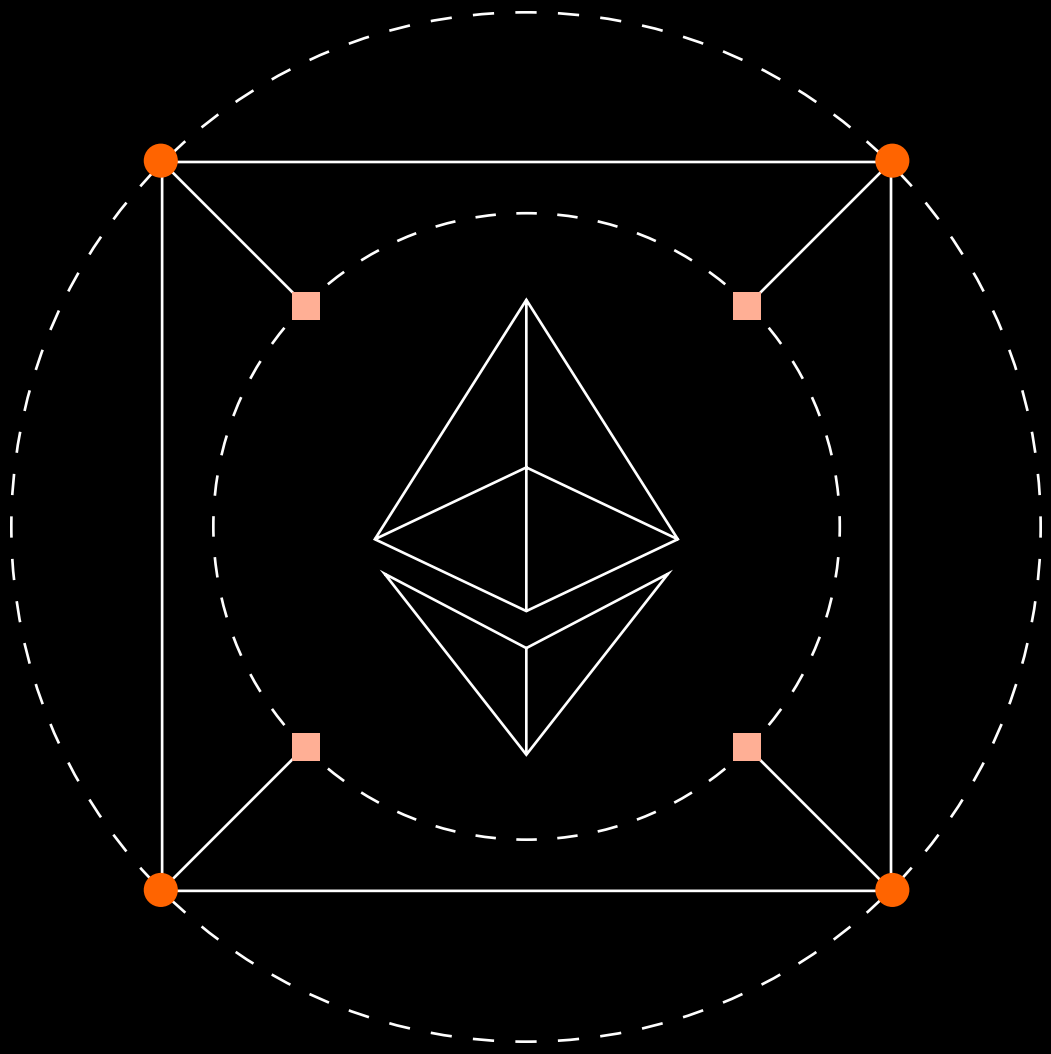
Galaxy Research

The Risks and Rewards of Staking

JULY 15, 2024



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Contents

Summary

This report is the first in a three-part series diving into the risks and rewards of staking, restaking, and liquid restaking. The report offers a comprehensive overview of staking, how it works on Ethereum and important considerations for stakeholders when engaging in this activity. The second report in the series offers an overview of restaking, how it works on Ethereum and Cosmos, and important risks associated with restaking.

Introduction

Ethereum is the largest proof-of-stake (PoS) blockchain by total value staked. As of July 15, 2024, ETH holders have staked over $111bn worth of ether (ETH), representing 28% of total ETH supply. The amount of ETH staked is also referred to as the "security budget" of Ethereum as these assets are in jeopardy of being penalized by the network in the event of double spend attacks and other violations of protocol rules. In exchange for contributing to Ethereum's security, users that stake their ETH are rewarded through protocol issuance, priority tips, and maximal extractable value (MEV). The ease through which users can stake ETH without sacrificing the liquidity of their assets through liquid staking pools has resulted in a higher demand for staking than Ethereum protocol developers expected. Based on current staking dynamics, developers expect the total ETH supply staked, also called the staking rate, to only grow higher over the next several years. To mitigate this trend, developers are considering major changes to the issuance policies of the protocol. This report will give an overview of the staking landscape on Ethereum, which includes the types of users staking on Ethereum, the risk and rewards of staking, and projections about the staking rate. The report will also offer insights on developers' proposals to change network issuance in efforts to curb staking demand.

Types of Stakers

There are six main types of Ethereum users that earn rewards from staking. Their distinct profiles are detailed in the following table:

Ethereum Staker Profiles

Source: Galaxy Research

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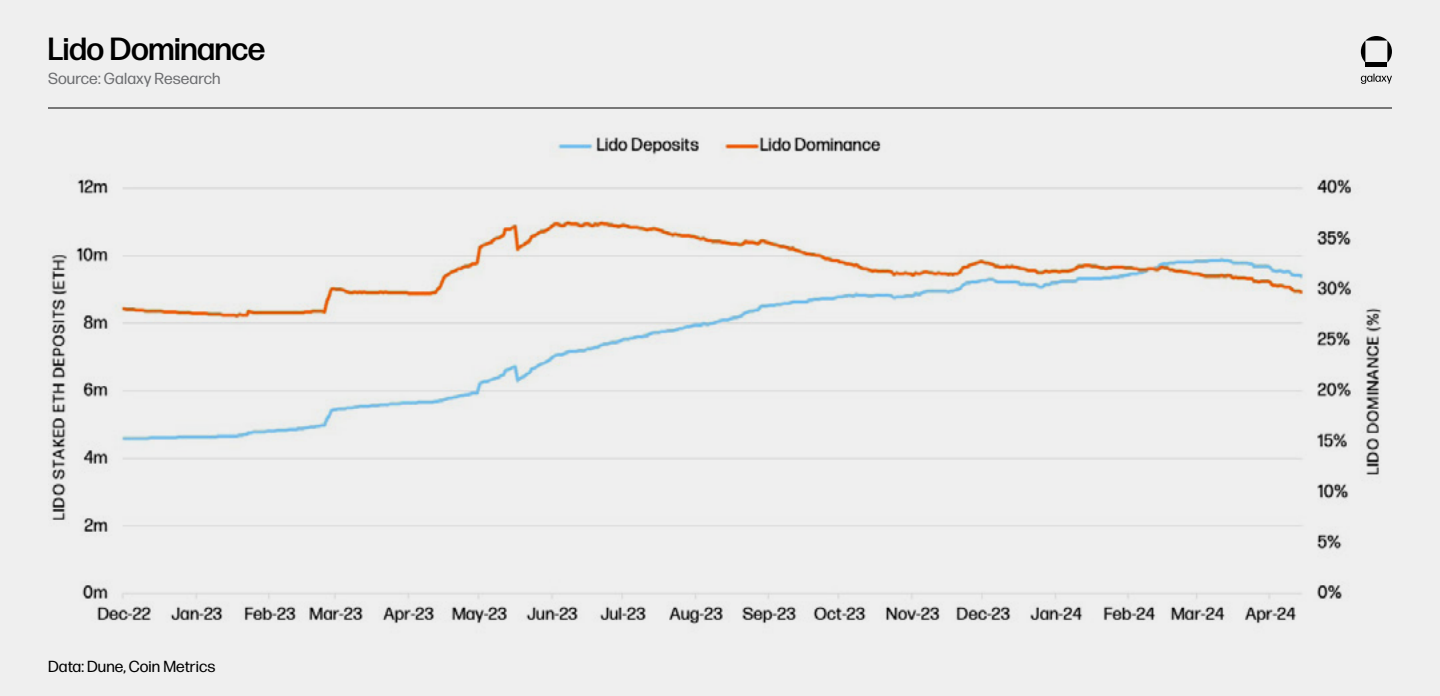
Type	Description	Min. ETH needed	Can choose and customize software configurations? (Y/N)	Examples
Home	Users who stake their own ETH and run their own staking operations from home, also called independent stakers.	32	Y	N/A
Remote	Users who stake their own ETH and run their own staking operations through cloud services such as AWS, also called independent stakers.	32	Y	N/A
Hobbyist	Staking node operators that accept delegated funds from users through a staking pool but whose primary occupation is not managing other users' stake.	>0	Y	Lido Simple DVT Module, Rocketpool, and Puffer Finance node operators
Professional	Professional node operators whose primary occupation is managing other users' stake.	>0	Y	Kiln, P2P.org, Allnodes, Everstake
Managed	Users who stake through professional and hobbyist staking operators whose manages other users' stake.		N	Users who stake through professional staking operators or staking pools involving both professional and hobbyist operators.
Liquid	Users who earn staking rewards by holding liquid staking tokens.	>0	N	stETH, rETH, cbETH holder



Of these primary types of stakers, the type that is most numerous in number are managed stakers, stakers who delegate their ETH to professional staking node operators. Professional staking node operators, while not as numerous as their client base, are the type of staking entity with the highest amount of staked ETH under management.

Liquid staking, restaking, and liquid restaking pool protocols are excluded from this analysis as these entities do not directly run staking infrastructure or finance their use. However, these entities do receive a cut of rewards earned by professional (or hobbyist) stakers using their platform to service managed stakers; they are the middlemen entities that facilitate the relationship between managed stakers and professional (or hobbyist) stakers and thus are important players in the Ethereum staking industry. Lido, a liquid staking protocol, is by far the largest staking pool operator on Ethereum through which approximately 29% of total ETH staked is delegated to professional and hobbyist stakers. Considering the adoption and critical role of liquid staking pools on Ethereum, it is important to understand the risks of liquid staking.

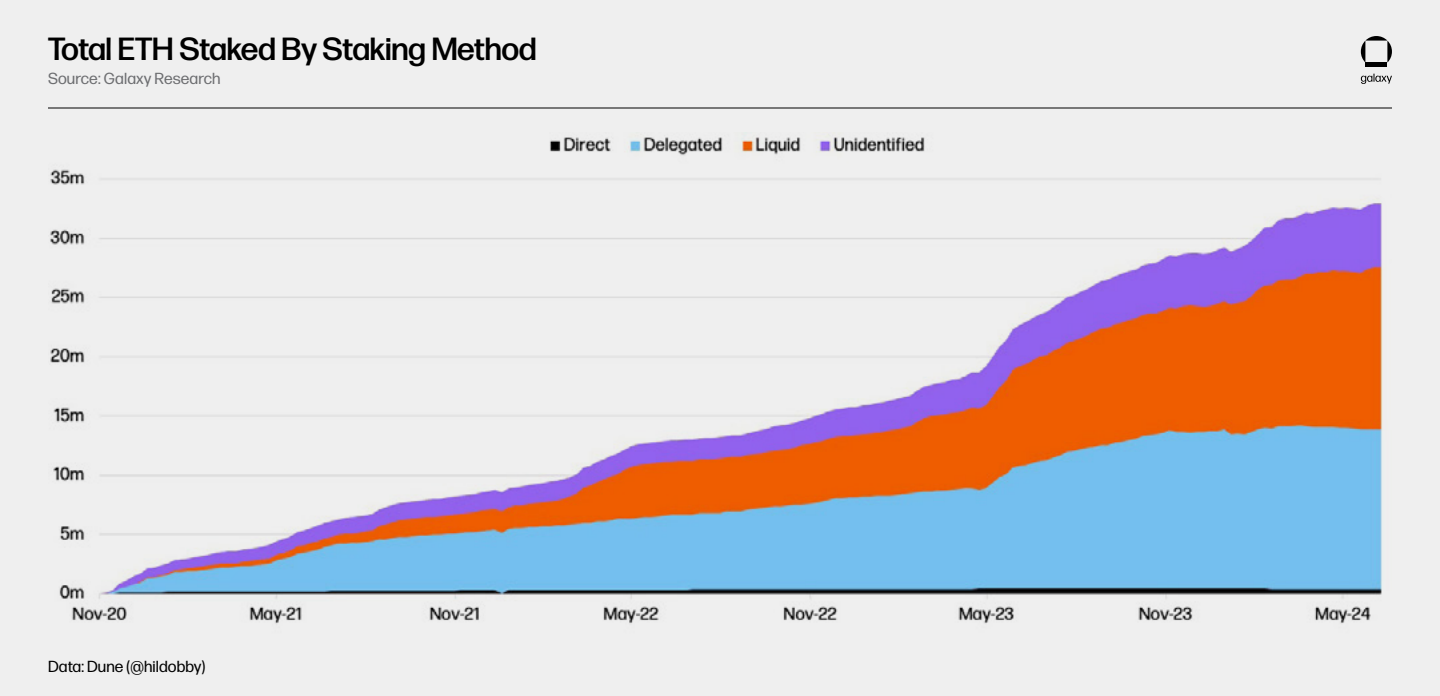
The next section of this report will dive into the risks of staking based on the technologies and entities used to earn staking rewards.

Staking Risks

The risks associated with staking are largely dictated by the method and technologies used to stake. The following are three broad categories to define staking methods and the risks associated with each:

a. Direct Staking: Staking as defined by a user or entity operating their own proprietary staking hardware and software. The risks of directly staking your ETH include staking penalties and slashing risks. Staking penalties for reasons such as prolonged machine downtime can lead to a user losing a portion of their staking rewards. A slashing event due to a misconfiguration of validator software, among other causes, can lead to a user losing a portion of their staked ETH balance, up to 1 ETH.

b. Delegated Staking: Staking as defined by a user or entity delegating their ETH to stake through a professional or hobbyist staker. The risks of delegating ETH to another entity to stake on your behalf include all the risks of direct staking but in addition, counterparty risk as the entity to which you are delegating your stake may not fulfill their responsibilities or obligations as a staking service. ETH holders may delegate their stake to trust-minimized staking-as-a-service entities such as the ones that are controlled largely through smart contract code, but this carries additional technological risk as code can be hacked or contain bugs.



c. Liquid Staking: Staking as defined by a user or entity delegating their ETH to stake through a professional or hobbyist staker AND receiving in exchange a liquid token representation of their staked ETH. The risks of liquid staking include all the risks of direct staking and delegated staking, but in addition, liquidity risks as market volatility and prolonged delays to validator entries or exits may cause a de-pegging event where the value of the liquid staking token significantly deviates from the value of the underlying staked assets.

One other risk that is important to highlight for all three types of staking activity is regulatory risk. The regulatory risk of staking activities increases the more removed an ETH holder is from their staked assets. Delegated staking and liquid staking require ETH holders to rely on different types of intermediary entities. In the eyes of lawmakers and regulators, these entities, depending on their structure and business model, may need to comply with certain rules and regulatory frameworks such as AML/KYC measures and securities law to operate.

Aside from regulatory risk, it is worth detailing the exact protocols risks that are associated with all three types of staking activity. Protocol risks stems from the penalties that the network can automatically initiate against a user's stake for intentionally or unintentionally failing to meet the standards and rules detailed in the Ethereum consensus protocol. There are three main types of penalties. Ordered from low to high severity, they are:

1. Offline penalty: A penalty for when a node is offline and misses responsibilities such as proposing a block or signing block attestations. Generally, validators are penalized only a few dollars a day for this.

2. Initial slashing penalty: A penalty for any validator behavior detected by other validators to go against the rules of the network. The most prolific examples of this are if a validator proposes two blocks for one slot or signs two attestations for the same block. The penalty is between 0.5 ETH to 1 ETH depending on the validator's effective balance, which presently can be a maximum of up to 32 ETH. Protocol developers are currently weighing increasing a validator's maximum effective balance to 2048 ETH and reducing the initial slashing penalty in the next network-wide upgrade, Pectra.

3. Correlated slashing penalty: After the initial slashing penalty, a validator may receive a second penalty based on the total amount of stake slashed during the 18 days before and after the slashing event. The motivation for the correlated slashing penalty is to scale the punishment according to the magnitude of stake under management by validators identified to have broken the rules of the network. The correlated penalty is calculated according to the sum of the malicious validators' effective balances, total balances, and a proportional slashing multiplier of 3.

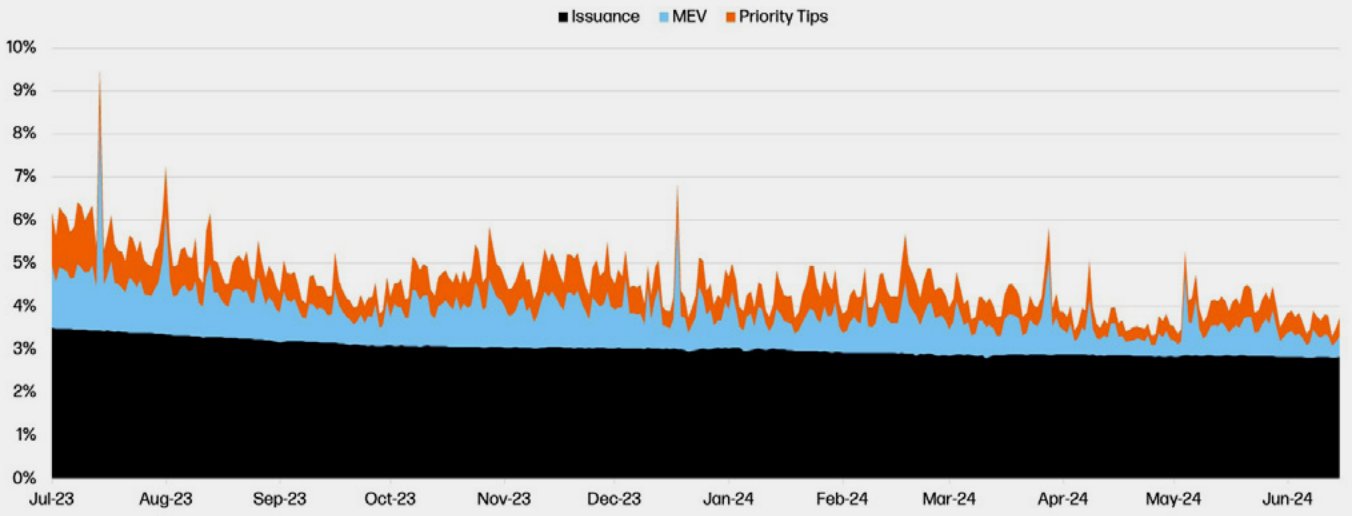
In addition to the above three penalties, there are also special penalties that can be applied to validators if the network fails to reach finality. For a detailed overview of what finality means on Ethereum, refer to this Galaxy Research report. When the network fails to finalize, it attributes an increasingly large penalty on offline validators. By gradually burning the stake of validators that are not contributing to network consensus, the network can rebalance the validator set such that finality can be achieved. The severity of this penalty increases the more time that passes under which the network is unable to reach finalization.

Staking Rewards

In exchange for the above risks, stakers can earn roughly 4% APY on their staked ETH deposits. The rewards are earned from new ETH issuance, priority tips attached by Ethereum end-users on their transactions, and MEV, additional value from the reordering of user transactions within a block.

Nominal ETH Staking APY by Source

Source: Galaxy Research

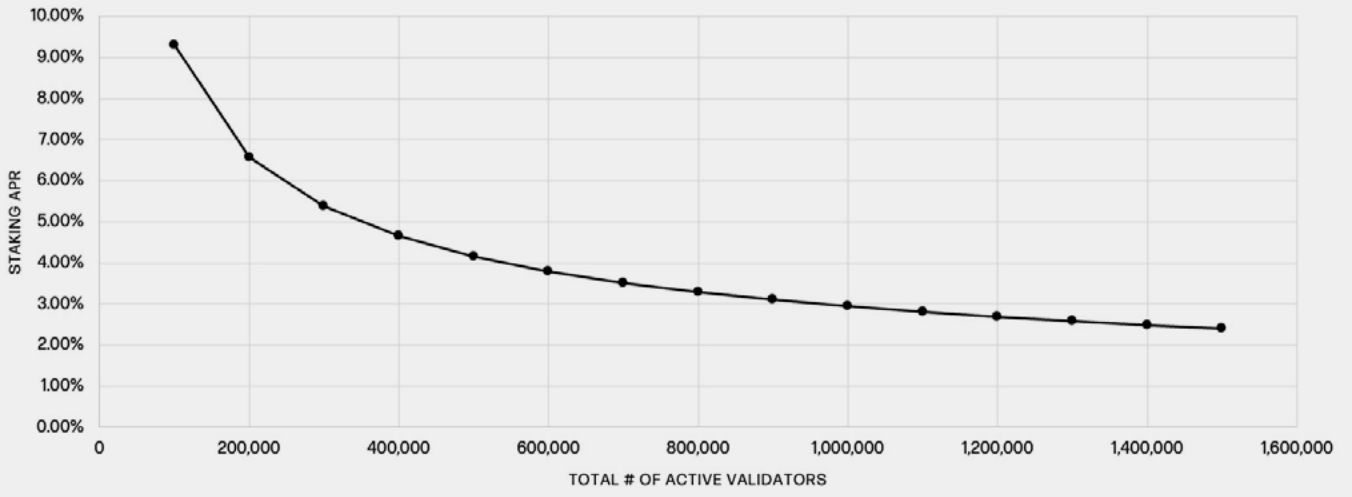


Data: Flipside Crypto, Coin Metrics

Note that rewards have steadily declined for stakers over the past 2 years. There are two main reasons for this. First, the total number of ETH staked and therefore number of validators has increased over the same period. When more value is staked, issuance rewards for validators becomes diluted across a higher number of participants, as indicated by the chart below:

Staking APR (Issuance Only) By # of Active Validators

Source: Galaxy Research



Data: eth2book.info

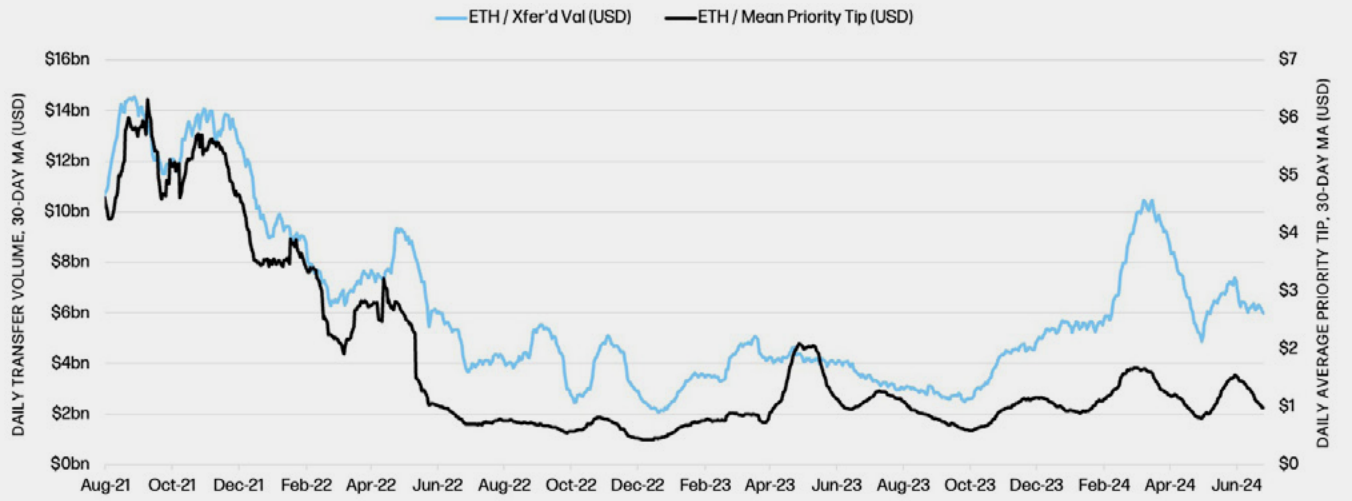
While rewards from issuance can be modelled out based on the total number of active validators and therefore staked ETH supply on Ethereum, the other two revenue streams for validators are less predictable as they are dependent on network transaction activity.

Transaction activity has declined over the past two years resulting in reduced base fees, priority tips, and MEV for validators.

Generally, the higher the value of assets moved on-chain, the higher the tips users are willing to attach to prioritize these transactions in the next block and the higher the MEV for searchers to profit from their reordering within a block. As indicated by the chart below, the daily transferred value in USD is correlated to the average transaction priority fee:

Ethereum Daily Transfer Volume and Average Priority Tip

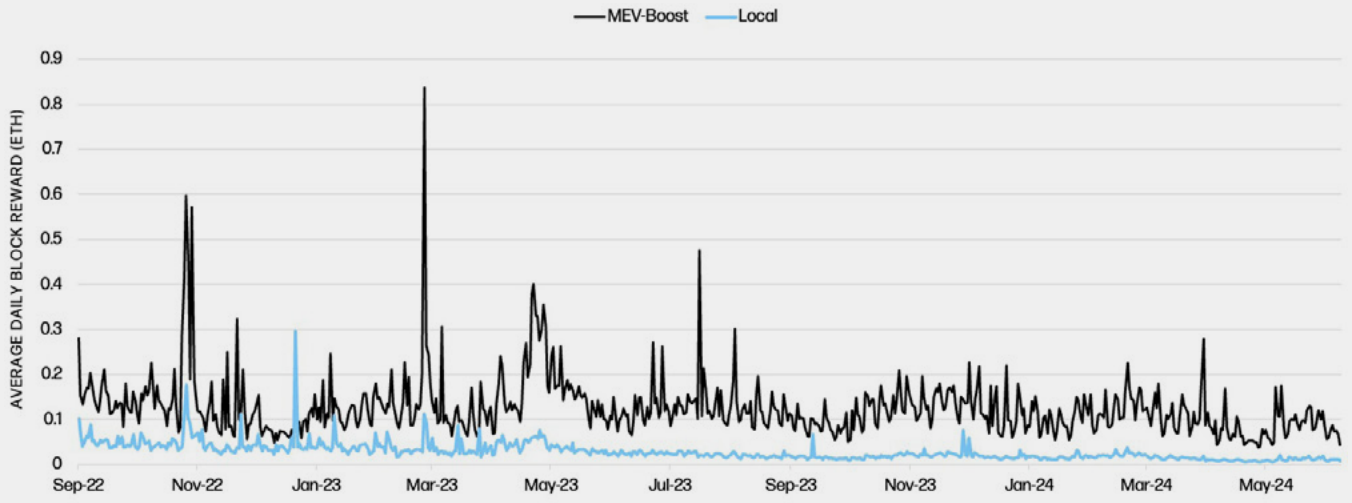
Source: Galaxy Research



Data: Coin Metrics

Average Daily Block Reward From MEV Boost Vs. Locally Built Blocks

Source: Galaxy Research



Data: Dune (@data_always)

Based on Galaxy's calculations, MEV increases validator rewards by roughly 1.2% when rewards are calculated as annual percentage yields. The proportion of validator rewards from MEV in comparison to other types of validator income including issuance and priority tips is roughly 20%. Some attribute MEV as the additional value awarded to a block proposer that is not from priority tips or issuance, which is the methodology represented in the chart featured earlier in this report. However, others argue that high priority tip transactions can themselves represent MEV profit if the high priority tip is funded by successfully frontrunning or back running a trade. To account for the fact that priority tips may themselves contain MEV, other methodologies compare the value of blocks built through MEV-Boost software and blocks built without MEV-Boost.

These methodologies like the one featured in the chart above suggest that the magnitude of MEV can be much larger than simply 20% of validator rewards. According to analysis from October 2023 by Ethereum Foundation Researcher Toni Wahrstätter, median block rewards increase 400% if a validator receives blocks through MEV-Boost as opposed to locally building the block.

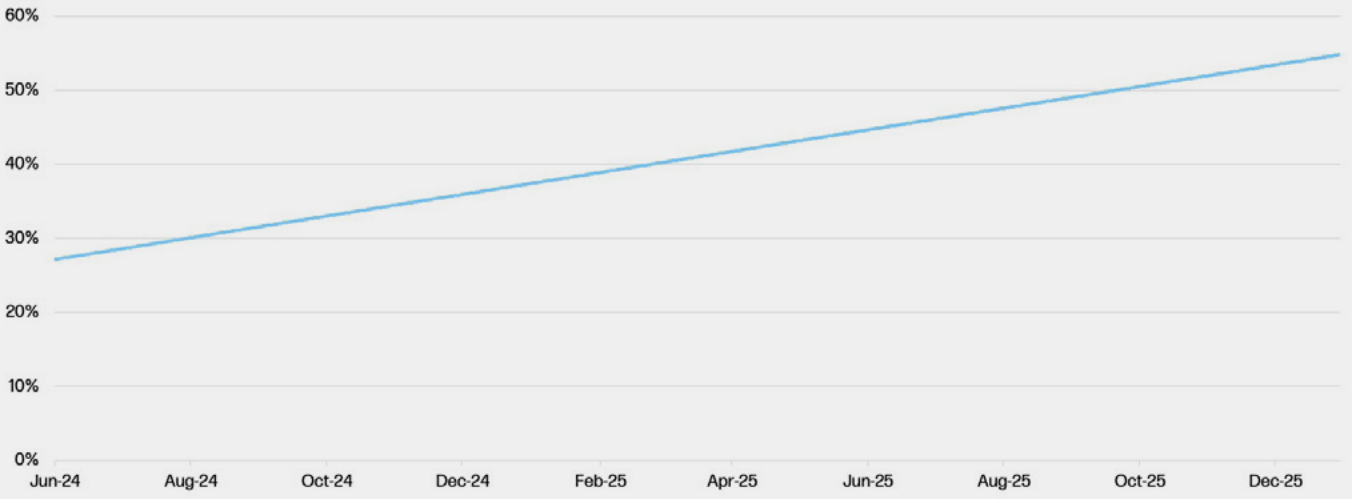
For more information about the impacts of MEV on validator economics, read this Galaxy Research report on MEV-Boost.

Staking Rate Projections

Assuming demand for staking on Ethereum grows linearly as it has for the past two years, the staking rate is expected to exceed 30% in 2024. As explained earlier in this report, a higher staking rate will reduce rewards from issuance. Liquid staking services on Ethereum have made it trivial for users to stake and bypass the normal limitations of staking such as entry queues. Users can simply purchase stETH to gain exposure to staking returns. Large purchases of stETH that create an imbalance in the value of stETH on the open market and the value of underlying staked assets will create a premium on stETH value until more ETH is staked on Ethereum. Unlike purchasing stETH, the activity of staking on Ethereum is subject to a delay. Only 8 new validators, or effective balances of up to 256 ETH, can be added to Ethereum every epoch, or 6.4 minutes. Thus, it will take over a year, or 466 days to be precise, for Ethereum to reach 50% of total ETH supply staked assuming that the number of validator entries is maxed out every epoch from now until the end of 2025.

Projected Staking Rate Assuming Max Entry Churn

Source: Galaxy Research



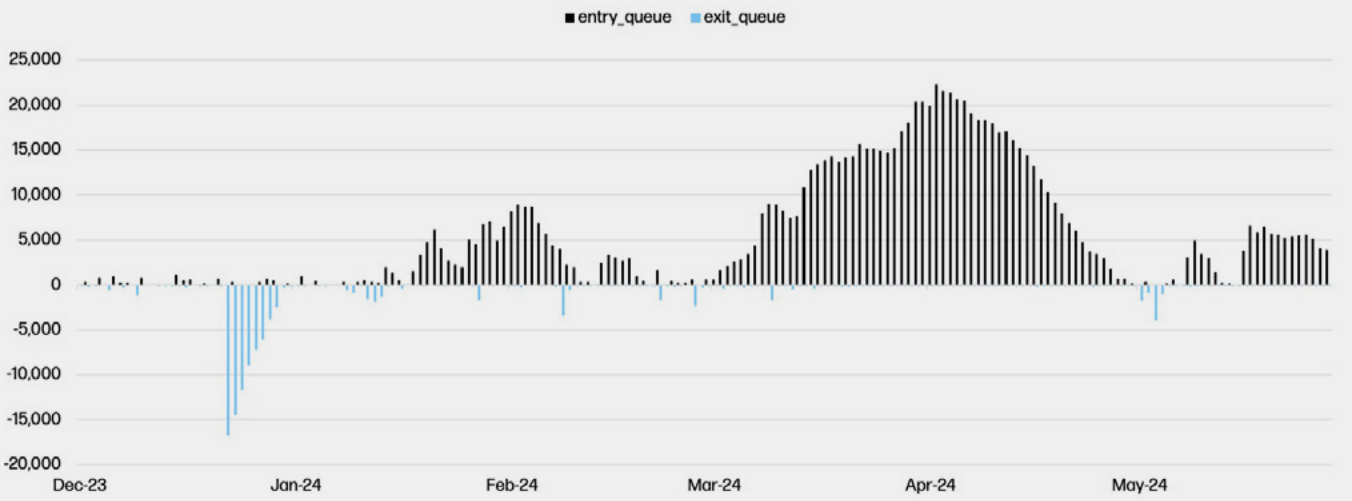
Data: eth2book.info

Demand to enter Ethereum's staking queue has historically been higher than demand to exit. Though in recent days the validator entry queue has decreased in activity, demand for staking is expected to take off again for a variety of reasons including but not limited to additional yields for staking through restaking, increases in MEV from resurgence in DeFi activity, and changes in regulation supporting the activity of staking within traditional financial products such as exchange traded funds.

Knowing that it is a matter of time before the staking rate once again trends higher and yields for stakers trend lower, developers are considering several options for changing network issuance to curb staking demand.

Number of Validators in Entry and Exit Queue

Source: Galaxy Research



Data: beaconcha.in, Galaxy Research

Issuance Change Discussions

ETH holders should expect yields from staking to change drastically in the future. Protocol developers are weighing several options to ensure that the staking rate of Ethereum trends towards a target threshold such as 25% or 12.5%. The main arguments for maintain a low staking rate as explained by Ethereum Foundation Researcher Caspar Schwarz Schilling include:

1. **Liquid Staking Token (LST) Dominance:** If the staking rate increases, the amount of ETH centralized in one staking pool such as Lido will likely increase, thereby creating the risk of centralization and outsized influence over Ethereum's security in one entity or smart contract application.

2. **Credibility of Slashing:** Related to the concern about LST dominance, high issuance coalescing to a single entity or smart contract application may reduce the credibility of mass slashing events on Ethereum. For example, the protocol in the event of a slashing event impacting the majority of stakers could face social pressure from ETH holders that want to organize an irregular state change to restore penalized staked ETH balances. Ethereum protocol developers have only organized an irregular state change for the purposes of restoring user funds in the aftermath of a smart contract bug once in the network's history. It was in 2016 following the infamous DAO hack. (Read more about the DAO hack event in this Galaxy Research report.) Though unlikely, an irregular state change in response to a mass slashing event is not outside the realm of possibility. Indeed, some Ethereum researchers argue there is a heightened possibility of this outcome in a high issuance context.

3. **Ensuring Trustless Base Money:** Also related to the concern about LST dominance, high issuance may lead to a lack of native ETH in circulation and a proliferation of token representations of native ETH issued by a third-party entity. Ethereum researchers have expressed preferences to promote the use of native ETH for use cases other than purely staking so that end-users do not have to rely on using currencies on-chain issued by comparatively less centralized and trusted applications than ETH which is issued by the Ethereum protocol.

4. **Minimal Viable Issuance (MVI):** Though minimal in comparison to the costs of mining, the costs of staking are not negligible. Professional staking providers have operational costs associated with the hardware and software needed to run validators. To stake through these providers, users must pay a fee to these providers. Additionally, even if users are receiving a liquid staking token in exchange for staking native ETH, they are incurring additional risk and penalties for staking through a third-party in the event of a staking operation malfunction. Thus, it is in the interest of the network to keep the costs of staking minimal as additional costs for supporting the activity of staking means higher issuance and therefore inflation of ETH supply.

Ethereum protocol developers and researchers are weighing a myriad of proposals to reduce Ethereum's staking rate. They include but are not limited to:

1. **Short-term, one-time reduction:** A one-time reduction in staking yields was re-proposed in February 2024 by Ethereum Foundation Researchers Ansgar Dietrichs and Caspar Schwarz-Schilling. The idea was originally suggested by Ethereum Foundation Researcher Anders Elowsson. In the most recent post by Dietrichs and Schilling, researchers recommended a 30% reduction in staking yields. However, this number is subject to the staking rate of Ethereum, that is the total supply of ETH staked. Given the increasing staking rate since February, the recommended reduction in yields should in theory be higher according to researchers. The proposal does not guarantee an upper bound for staking demand, but it is a trivial code change to implement and would dampen the financial incentive for staking by reducing issuance rewards in the short term. The proposal is meant to act as a temporary measure to pave the way for a longer-term solution, such as a targeting policy.

2. **Long-term, stake ratio targeting:** The implementation of a new issuance curve that exacts an increasing cost on validators to stake and earn rewards the higher the staking rate exceeds a target ratio such as 25% of total ETH supply staked. The idea is based on research by Elowsson, Dietrichs, and Schwartz-Schilling. There are several mechanisms through which the target ratio can be achieved that each differ in terms of the issuance schedule and severity of issuance decline. For more detail on the issuance curves under a stake ratio targeting model, read this Ethereum Research post.

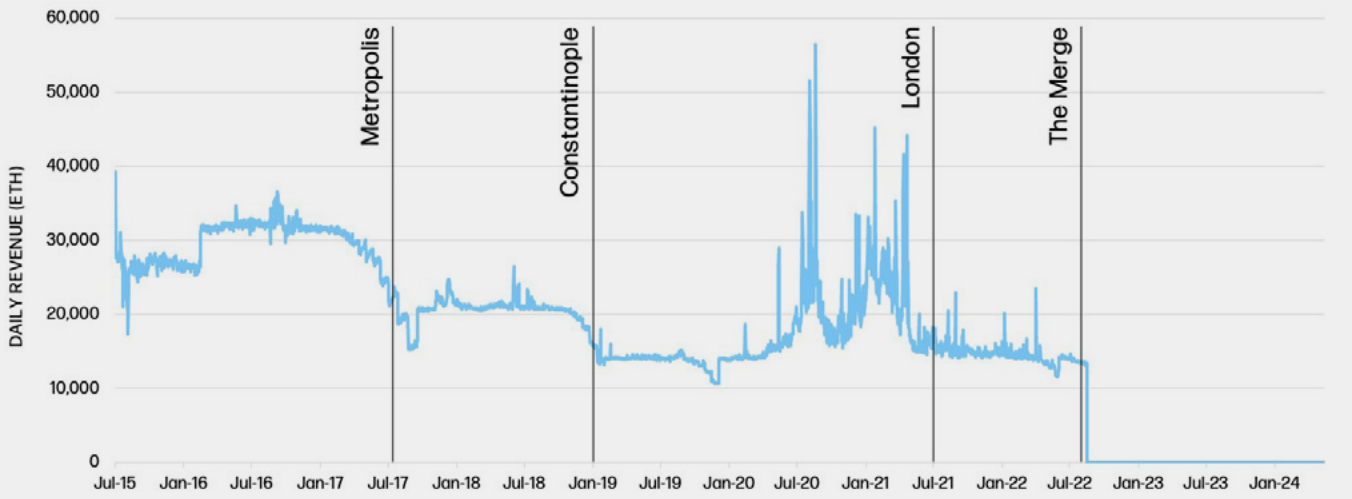
None of the proposals mentioned above are slated for inclusion in the next immediate Ethereum hard fork, Pectra. However, there is a strong chance that protocol developers may push to include a change to issuance in the upgrade thereafter. So far, the discussion within the Ethereum community regarding changes to issuance has been highly controversial and void of broad consensus. The main pushback to changes in issuance includes concerns that reduced revenues from staking will damage the profitability of large staking providers operating on Ethereum, as well as solo and at-home stakers. There is also pushback from users that the proposals thus far impacting issuance lack sufficient research and data-driven analysis. It is unclear what the exact target staking ratio should be to achieve MVI and if achieving this target through changes in issuance will reduce concerns of centralization in stake distribution or exasperate the problem by further discouraging the participation of solo stakers. To address some concerns about the profitability of solo stakers on Ethereum over the long-term, co-founder of Ethereum Vitalik Buterin shared preliminary research in March 2024 on the addition of new anti-correlation rewards and penalties that would favor node operators controlling fewer validators.

The monetary policies of Ethereum's proof-of-stake blockchain, the Beacon Chain, have not changed since its genesis in December 2020. However, the monetary policies of Ethereum before it merged with the Beacon Chain did undergo several revisions over its roughly seven-year history. The rewards for mining a block on Ethereum were initially set to 5 ETH/block. It was reduced to 3 ETH in the Metropolis upgrade in September 2017. It was then reduced again to 2 ETH in the Constantinople upgrade in February 2019. Miners then saw their rewards from transaction fees burned in the London upgrade in August 2021 before mining rewards were made obsolete all together on the network through the Merge upgrade in September 2022.

A change to Ethereum's monetary policies under a proof-of-stake consensus protocol is likely be more contentious than prior changes to network issuance under proof-of-work as the base of users impacted by the change is much broader. As opposed to strictly miners, changes in issuance impact a growing number of ETH holders, staking-as-a-service providers, liquid staking token issuers, as well as restaking token issuers. Due to the broadening base of stakeholders involved in securing Ethereum, it is unlikely that Ethereum protocol developers will be able to change Ethereum's monetary policy as frequently as they had in the past. The contentious nature of this discussion is likely to force increasing ossification of the policies and rewards associated with staking over time. Thus, the window of opportunity for changing this aspect of Ethereum's code base is narrowing and is not likely to stay open for much longer as the staking industry built atop Ethereum grows and matures.

Daily Ethereum Miner Revenue, All-Time

Source: Galaxy Research



Data: Coin Metrics

Conclusion

The staking economy built atop Ethereum is nascent and experimental. When the Beacon Chain first launched in 2020, users that staked their ETH were not guaranteed the ability to withdraw their ETH or transfer their funds back to Ethereum. When the Beacon Chain merged with Ethereum in 2022, users earned additional rewards for staking through tips and MEV. When staked ETH withdrawals were enabled in 2023, users could finally exit validators and realize profits from their staking operations. There is still a slew of other changes incoming on the Ethereum development roadmap that will impact staking businesses and individual, at-home stakers operating atop Ethereum. While most of these changes have no impact on the financial incentive to stake, such as the increase to the maximum effective balance of validators in Pectra, some do. Thus, it is important to carefully assess the risks and rewards associated with staking on Ethereum as Ethereum's development roadmap evolves and becomes implemented through hard forks. Because the staking economy of Ethereum encompasses more stakeholders than the mining industry of Ethereum once did, it is likely that frequent changes impacting staking dynamics will be harder for Ethereum protocol developers to execute over time. However, Ethereum remains a relatively new proof-of-stake blockchain that is expected to evolve in major ways in the coming months and years, prompting the need for careful consideration of changing staking dynamics for all stakeholders involved.

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