The Market for Block Space

A Microstructure Lens on Decentralized Payment Networks*

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Abstract

We use Ethereum's EIP-1559 upgrade to examine how fee pricing and allocation mechanisms impact market quality in decentralized payment networks. Introducing a semi-uniform auction pricing stabilizes some aspects of fee volatility, but also increases average fee and dispersion and leads to higher inflation for users. Miners earn higher public subsidies per average transaction and, paradoxically, include less on-chain activity and monetary value transferred through dynamically adjusted block sizes. The transition to Proof of Stake serves as a placebo test that reinforces these results. Our findings offer practical guidance for technologists on designing fee structures in future blockchain systems.

Keywords: Blockchain, decentralized market, market design, market microstructure, payment network, resource allocation

JEL Codes: D47; D53; D61; D82; G14; G18

1 Introduction

Payment networks, ranging from card processors like Visa and MasterCard to two-sided platforms like PayPal and decentralized blockchains such as Ethereum, perform the essential economic function of clearing value transfers, while rationing their limited processing capacity with transaction fees.[1] A value transfer creates economic surplus only when the sender's private gain exceeds the transaction fee, making the pricing mechanism central to consumer welfare and the division of rents among users, intermediaries, and, in proof-of-stake systems, token holders. Fee mechanisms vary widely across payment networks: card systems typically impose near-fixed tariffs on merchants; platforms layer additional charges for payers; early cryptocurrencies relied on winner-take-all first-price auctions paid by the sender; and recent blockchain protocol upgrades have introduced hybrid models combining posted base fees, optional tips, and elastic block capacity. We study some of the welfare implications of fee pricing in payment networks.

While centralized infrastructures offer almost infinite processing capacity, decentralized payment networks operate under strict constraints, with each block imposing a fixed limit on the number of transaction slots. This scarcity turns block space into a critical economic resource, where users compete via fees for inclusion. As a result, blockchain introduces a novel resource-allocation challenge central to its economic design. This makes decentralized payment systems an ideal setting for studying broader economic questions, particularly how pricing schemes and allocation mechanisms affect user behavior, efficiency, and welfare. Importantly, this is not a niche concern. In 2023 alone, the Ethereum blockchain processed $3.01 trillion in transactions, nearly matching Visa's $3.08 trillion, underscoring the scale and significance of these systems in the global economy.[2] By exploiting a key policy innovation in Ethereum, the leading public blockchain for value transfers, this study empirically examines the microstructure of decentralized payment

[1] Blockchains can also perform other economic activities, such as the creation of smart contracts.
[2] Source: Binance Square (accessed 27 June, 2024).

networks.

We use Ethereum's protocol upgrade EIP-1559 to examine how changes to blockchain fee structures and block-space allocation affect users' transaction costs, miners' revenues, and overall network welfare. Implemented on 5 August 2021, EIP-1559 replaced the traditional first-price auction with a two-part fee mechanism consisting of (i) a posted 'base fee', uniform across users and algorithmically adjusted to maintain average block utilization at 50% of the maximum size, and (ii) an optional priority fee paid directly to miners. The base fee is burned (destroyed) rather than transferred to miners, and block capacity can double (from 15 million to 30 million units) in response to demand. This redesign reallocates some of the fee revenue from miners, who previously earned the entire fee, to all token holders via deflation when ETH is burned. It also renders block-space piecewise elastic rather that perfectly inelastic. This protocol improvement aims to mitigate some of the well-known issues such as transaction delays, overbidding and fee volatility, which have historically undermined both network throughput and user welfare in decentralized payment networks (Basu et al., 2023).[3]

Despite these improvements, significant cost-related barriers remain for real-world financial applications. For example, Robinhood recently announced plans to tokenize traditional financial assets using Ethereum technology but opted to deploy the initiative on Arbitrum, a more cost-efficient Layer-2 network, rather than the main decentralized infrastructure.[4] Similarly, reports suggest that the European Central Bank has considered issuing a digital euro on public blockchains such as Ethereum or Solana, yet substantial concerns over scalability, transparency, and, especially transaction costs continue to limit the viability of these infrastructures for retail payments and large-scale settlement.[5] The recent introduction of Google's own Layer-1 blockchain, the Google Cloud Universal Ledger (GCUL), underscores both the growing institutional push to develop new infras-

[3]More on the institutional settings in Appendix A.
[4]Source: Forbes (accessed 17 June, 2025).
[5]Source: Financial Times (accessed 23 August, 2025).

tructures and the urgency of addressing these unresolved design challenges before inefficiencies are replicated at scale.[6] We show that Ethereum's policy goals were only partially achieved, underscoring ongoing barriers that hinder broader adoption by traditional financial institutions.

In blockchains, users submit state-changing transactions, such as value transfers, which are grouped into a chain of blocks by miners, who verify and validate these transactions (Easley et al., 2019).[7] Each transaction consumes space (measured in 'gas' on Ethereum), and each block has a maximum capacity (e.g., 30 million units of gas) to prevent malicious actors from overwhelming the network by flooding it with transactions. To secure inclusion in a block, users attach private fees, incentivizing miners to include their transaction in the limited block space available (Basu et al., 2023). This bidding process introduces a resource allocation mechanism where block space is rationed among competing users. However, transaction inclusion is not solely driven by private fees. Miners also receive public subsidies for block production (so-called block rewards),[8] which defray the, often fixed, private cost of confirming transactions. In Bitcoin, both the public subsidy (block reward) and private fee (transaction gas fees) are retained by successful miners. In contrast, under Ethereum's EIP-1559, the majority of private fees (base fees) are burned. As such, the design of both private fee mechanisms and public subsidies is crucial to the development of current and future decentralized payment networks based on blockchain technologies.

To understand how block-pricing and allocation rules shape (i) users' transaction costs, (ii) miners' revenues, and (iii) protocol-level welfare, we construct a set of market microstructure proxies that capture on-chain 'market quality.' Drawing from traditional finance, where bid–ask spreads and price-impacts reflect trading costs, liquidity, and frictions, we adapt analogous blockchain fee metrics. Fee dispersion, the difference between

[6] Source: CoinDesk (accessed 29 August, 2025).

[7] We use the terms miner and validator interchangeably.

[8] In this study, we use public subsidy and block reward interchangeably. A miner's reward can also refer to both private fees and public subsidies. For clarity, we distinguish this by using the term total fees.

the highest and lowest fees paid within a block, mirrors the absolute bid–ask spread, while fee inflation, the sensitivity of fees to network congestion, parallels Amihud's illiquidity measure (Amihud, 2002). Fee volatility adds a temporal dimension, capturing both revenue risk for validators and cost uncertainty for users. Fee-based measures are paired with matching outcomes to study welfare. Accordingly, we track (i) the number and value of transactions included in blocks, (ii) those left pending in the buffer (called mempool), and (iii) transactions that deploy new smart contracts. Together, these indicators allow us to characterize market quality on-chain and to evaluate whether the proposed fee mechanisms or block-space-allocation reforms enhance, maintain, or diminish aggregate welfare.

Building on classical auction theory (particularly the Revenue Equivalence Theorem (Myerson, 1981; Riley & Samuelson, 1981; Vickrey, 1961)),[9] and interpreting Ethereum's EIP-1559 as a transition from a first-price auction to a semi-uniform price auction, we derive several theoretical predictions. First, in line with Roughgarden (2024) and the policy's stated objectives,[10] fee volatility should decrease due to the introduction of a more predictable, dynamically adjusted base fee. Second, given the institutional setting, where all users face the same base fee and only need to offer modest tips for timely inclusion, we expect reductions in both fee dispersion and fee inflation. Third, the Revenue Equivalence Theorem suggests that changes in auction formats should not affect aggregate revenue, implying that miners' earnings will remain stable despite a shift in the composition of rewards from private fees to public subsidies. Finally, we anticipate a rise in the number and total value of confirmed transactions, as congestion-responsive block sizes enable more efficient allocation of block space and reduce the volume of unconfirmed transactions.

Our empirical findings offer partial support for the theoretical predictions regarding fee structures and allocation mechanisms in decentralized payment networks. After the introduction of EIP-1559, Ethereum transaction fee volatility declines relative to Bitcoin,

[9] We acknowledge that our setting does not provide a perfect test of the theorem.
[10] See https://eips.ethereum.org/EIPS/eip-1559.

indicating greater pricing predictability. This is aligned with the stated policy objectives and consistent with the design of EIP-1559 (Roughgarden, 2024). However, contrary to expectations, both fee dispersion and fee inflation increased per average transaction, jumping from a daily average of $\$150$ to $\$300$–$\$700$ and from $\$2$ to $\$6$ per block, respectively. A daily average block-transaction on Ethereum rose from roughly $\$5$–$\$20$ to $\$20$–$\$60$, significantly higher than Bitcoin's $\$2$–$\$5$ per block. These results suggest that, despite the more predictable base fee, users continue to engage in aggressive bidding for block inclusion, and this competition remains difficult to anticipate. For context, if Ethereum and Visa both processed a $1,000 transaction on a typical day, Visa would charge roughly 1.5%–3.5%, or $\$15$–$\$35$, while Ethereum users post EIP-1559 often paid $\$20$–$\$60$ per transaction versus only $\$5$–$\$20$ prior to the upgrade. This suggests that Ethereum users may be incurring transaction costs that are 20–300% higher than Visa, despite improvements in fee predictability.

While Ethereum offers decentralized peer-to-peer transfers, its relatively high transaction costs limit its practicality for low-value or everyday payments. In contrast, traditional payment networks like Visa or MasterCard maintain broad affordability for micro transactions. On Ethereum, increased fee dispersion and inflation amplify unpredictability at scale. As a result, unless users transfer large sums (where higher fees are proportionally smaller), Ethereum remains comparatively expensive. This cost structure risks excluding cost-sensitive users and constrains its utility for financial inclusion. Difference-in-differences estimates comparing pre- and post periods reveal that EIP-1559 significantly re-distributed platform rents. Priority tips paid to miners contracted by roughly 40%, while the fixed 2 ETH issuance subsidy, now spread over a reduced volume of transactions, became the dominant revenue source, lifting miners' average per-transaction payoff by about 70%. However, this gain in producer surplus was not matched on the demand side. Confirmed transactions fell 22%, the total on-chain dollar value settled dropped 40%, and smart-contract creation declined by almost one-half. These patterns suggest strategic under-filling of elastic blocks by miners, likely aimed at keeping base fees and tips elevated. Although fee volatility decreased, both the mean and dispersion of transaction fees more than doubled, resulting in higher and less predictable costs for users, even in periods of reduced congestion. From a welfare perspective, the burn-and-tip mechanism appears to have traded lower price uncertainty for greater rent extraction and a contraction in aggregate surplus. This outcome qualifies, , rather than confirms, the claim that EIP-1559 unambiguously improves allocative efficiency in Ethereum's market for block space.

To ensure that the effects we attribute to EIP-1559 are not simply time-period artefacts, we exploit Ethereum's unrelated shift from proof-of-work to proof-of-stake on 15 September 2022 ('the Merge') as a placebo test. This event permanently removed the 2 ETH block subsidy but left block-space capacity unchanged. According to theory, and as formalized by Easley et al. (2019), eliminating the public reward should not affect private fees, fee dispersion, or volatility, provided that validators continue producing blocks. Consistent with this benchmark, our difference-in-differences estimates show that, relative to matched Bitcoin transactions, the end of the subsidy has no statistically significant effect on priority-fee levels or volatility, even though aggregate validator revenue declines sharply. We interpret this as evidence that validator incentives remain intact despite the loss of the public transfer. Platform capacity also remains stable, with only a modest increase in congestion, while network activity actually rises. Both smart-contract creation and dollar value transferred increase in the days following the subsidy's removal. These placebo results reinforce our main findings by demonstrating that a change confined to the public side of the pricing mechanism, one that theory predicts should be neutral for users, indeed has no material effect on user costs. In contrast, EIP-1559's burn-and-tip redesign, which simultaneously altered pricing and allocation rules, measurably shifted rent toward block producers and raised transaction costs. More broadly, this exercise underscores how even marginal adjustments to blockchain fee structures or reward schedules can propagate through on-chain incentives in economically predictable ways, highlighting the central role of market-design theory in guiding public policy for decentralized platforms.

The literature on the economics of blockchains has grown substantially in recent years (see, e.g., Capponi & Jia, 2021; Capponi et al., 2024; Cong & He, 2019; Cong, He, & Li, 2021; Cong, Li, & Wang, 2021; Cong et al., 2022, 2025; Hasbrouck et al., 2025; Lehar & Parlour, 2025; Malinova & Park, 2017, 2023; Park, 2023; Sockin & Xiong, 2023a, 2023b). Most closely related to our work is the study by Basu et al. (2023), which introduces the StableFees mechanism, a more predictable fee market design aimed at reducing the variance in transaction costs and miner income. Their theoretical model frames the fee market as a uniform-price auction, promoting fairness and efficiency. Other contributions have explored alternative transaction selection protocols from a theoretical perspective. A notable example is the monopolistic miner protocol introduced by Lavi et al. (2022), in which the miner who wins the right to add a block selects the number of transactions to include and levies a uniform fee equal to the lowest bid among them. Another notable contribution comes from Buterin (2018) with the actual proposal of EIP-1559, which Roughgarden (2020, 2024) and Félez-Viñas et al. (2021) analyze from an economic perspective.[11] EIP-1559 introduces a single, dynamically adjusted base fee for every transaction and allows the block size to vary with demand. It shares conceptual similarities with the work of Basu et al. (2023), who, however, argue that it does not target social welfare maximization. The fundamental difference with our work is that we empirically test whether these fee mechanisms improve or harm market quality and, ultimately, social welfare. Motivated by the study of Basu et al. (2023), we provide the first causal evidence that the microstructure of a decentralized payment network has measurable welfare consequences.

Beyond these primary approaches, a growing body of recent studies has explored the

[11] Other empirical studies have also looked at the EIP-1559 consequences on technical aspects such as transaction latency and consensus security (e.g., Gontara et al., 2022; Liu et al., 2022, among others).

dynamics of blockchain protocols.[12] Despite this surge in theoretical work on protocol designs for block space allocation and pricing, empirical research into these areas remains scarce (Ilk et al., 2021). Consequently, whether the fee market structure enhances or undermines blockchain market quality remains an unresolved empirical question. While cryptocurrency trading fees in centralized cryptocurrency exchanges have been extensively analyzed empirically from a traditional financial perspective (see, e.g., Brauneis et al., 2022; Galati, 2024, among others), fee mechanisms within the decentralized cryptocurrency markets have received comparatively little empirical attention (e.g., Hasbrouck et al., 2022). This study addresses this gap in the literature by enabling an empirical evaluation of current blockchain fee market structures. In this context, Barbon and Ranaldo (forthcoming) make an important contribution by jointly analyzing transaction costs and price efficiency across centralized (CEXs) and decentralized exchanges (DEXs). Their findings suggest that DEXs constitute a viable and competitive market microstructure, although gas fees remain the key friction limiting their market quality. Our study complements their work by examining the direct impact of gas fees on blockchain market quality. Further, it contributes to the ongoing debate on fee-market design by introducing a set of metrics to assess the health of the market for block space across diverse blockchain architectures.

2 Testable Hypotheses

Auction theory views a blockchain's fee market as a continuous multi-unit auction, where *users* bid for block space and *block producers* (miners or validators) serve as auctioneers. Prior to EIP-1559, Ethereum employed a pure first-price auction mechanism. This was replaced by a semi-uniform pricing model that (i) splits each payment into a burned *base fee* and an optional *priority tip*, and (ii) allows block capacity to expand elastically up

[12] For an extensive overview, see Basu et al. (2023).

to twice its target size. Building on the Revenue Equivalence Theorem (Myerson, 1981; Vickrey, 1961) and recent blockchain models (Basu et al., 2023; Roughgarden, 2024), we derive four key predictions:

Hypothesis 1 (Fee Volatility) *Dynamic base-fee adjustment and burst capacity should lower block-to-block fee variance relative to the first-price regime.*

Hypothesis 2 (Fee Dispersion & Inflation) *Since all transactions pay a uniform base fee and only a small tip secures priority, within-block fee dispersion and inflation should decline.*

Hypothesis 3 (Miner Income) *As burning the base fee removes a revenue stream; tips plus the unchanged two-ETH issuance reward must offset that loss, so miner income is expected to fall or, at best, remain stable.*

Hypothesis 4 (Validator Supply & Capacity) *Greater price predictability coupled with elastic capacity should raise, or at least stabilise, the number of confirmed transactions and the value transferred, thereby enhancing aggregate welfare.*

2.1 Placebo: The Merge as a Quasi-Natural Experiment

On 15 September 2022 Ethereum migrated to Proof-of-Stake ('the Merge'), removing the two-ETH block reward while retaining the fee mechanism introduced by EIP-1559. Treating the reward as a participation subsidy (Easley et al., 2019), the Merge offers a clean placebo: a change on the *public* side of the pricing schedule that, in theory, should not affect user fees (the *private* side of the pricing mechanism), provided validators continue producing blocks. This structural shift yields three additional hypotheses:

Hypothesis 5 (Fee Neutrality) *Provided validator participation is stable, private-fee levels, dispersion, inflation, and volatility should remain unchanged.*

Hypothesis 6 (Validator Supply & Capacity) *If fee income is insufficient, marginal validators may exit, lengthening confirmation times and, in turn, reducing throughput.*

Hypothesis 7 (Miner Income) *With the removal of the subsidy, aggregate producer revenue should decline unless private fees rise sufficiently to offset the loss.*

Hypotheses 1-4 isolate the economic consequences of EIP-1559's burn-and-tip redesign, while Hypotheses 5-7 leverage the placebo setting introduced by the Merge to confirm that similar patterns do not arise when only the subsidy component is altered. If the Merge leaves user costs unaffected whereas EIP-1559 does not, then any observed changes in fee dynamics, rent distribution, or network welfare can be attributed to EIP-1559's combined price–and–allocation overhaul rather than to temporal effects or exogenous shocks.

3 Data & Method

3.1 Data & Sample

Our data is sourced from publicly available blockchain files at Blockchair.com, following the approach of Sokolov (2021), and collected through their commercial API. Mempool data for unconfirmed transactions (i.e., network congestion) is sourced from Johoe's public database at mempool.jhoenicke.de. We use both transaction- and block-level data from the Ethereum (ETH) and Bitcoin (BTC) blockchains. The block-level dataset consists of the block size (in kilobytes), block difficulty (hash rate), transaction count, total block value (in Gwei and USD), fee amount (in Gwei and USD), generation and reward (in Gwei and USD), and a timestamp to the nearest second. The transaction-level dataset comprises a coinbase or synthetic dummy indicator, total transaction value (in Gwei and USD), fee amount (in Gwei and USD), and a timestamp to the nearest minute. In principle, the dataset spans the full history of each blockchain (from 3 January 2009 for Bitcoin and 30 July 2015 for Ethereum), through to December 31, 2024.

However, our main empirical focus centers on two major Ethereum events: the EIP-1559 fee market upgrade and the Merge to Proof-of-Stake (PoS). To evaluate their impact, we construct balanced pre- and post-event samples by isolating two 30-day symmetrical windows around each event. For EIP-1559, we examine data from July 6, 2021, to September 3, 2021, capturing the 60-day period surrounding its implementation on August 5, 2021. For the Merge, we analyze data from August 16, 2022, to October 14, 2022, representing the 60-day window surrounding its execution on September 14, 2022. To benchmark Ethereum's results, we use the Bitcoin blockchain as a control group, as it did not experience any changes to the fee mechanism during the event periods. Bitcoin shares Ethereum's original Proof-of-Work (PoW) consensus architecture that has been widely used for more than a decade, and remains a leading blockchain in terms of market capitalization and transaction volume. These characteristics makes it a robust baseline for comparing user fees, block dynamics, and miner incentives. We deliberately exclude other networks, such as Solana, since its hybrid Proof-of-History model and relatively low adoption during early stages of our sample period.

3.2 Blockchain Health Metrics

We develop novel analytical tools that enable an assessment of blockchain health, aiming to quantify the economic impact of fee mechanisms on market quality. One of the key metrics we introduce is dispersion, which measures the absolute variation of private transaction fees within a block, calculated as the difference between the highest and lowest fees paid:

$$\text{Fee Dispersion}_b = HighFee_b - LowFee_b \tag{1}$$

where $HighFee_b$ is the highest private fee, $LowFee_b$ is the lowest private fee paid within a block b, respectively. This measure is crucial for assessing blockchain health, as it highlights discrepancies in fee pricing that could indicate inefficiencies or unequal access to transaction processing, a major concern for blockchain users.

Similarly, we compute the volatility measure as the standard deviation of private fees within a block:

$$\text{Fee Volatility}_b = \sqrt{\frac{1}{T_b - 1}\sum_{i=1}^{T_{cb}}(Fee_b - AvgFee_b)^2} \tag{2}$$

where Fee_b is the private fee paid within a block b and T_b is the total number of transactions within a block b. This metric captures the variability in transaction costs on the private side, reflecting the stability of fee mechanisms over time.

Another crucial indicator of blockchain health and market efficiency is the ratio of fee dispersion to the total number of transactions within a block:

$$\text{Fee Inflation}_b = \frac{FeeDispersion_b}{T_b} \tag{3}$$

Inspired by the illiquidity concept from Amihud (2002), this measure assesses how transaction volume (i.e., congestion) impacts fee variability. Lower fee inflation values indicate a more efficient blockchain, where increasing the number of transactions does not disproportionately increase fee dispersion, signalling a stable and liquid market. Conversely, higher fee inflation values suggest that growing transaction volumes amplify fee variability, pointing to inefficiencies and potential liquidity constraints. Therefore, monitoring fee inflation helps in evaluating the effectiveness of the fee structure in handling varying transaction loads while maintaining stability and fairness in transaction costs.

Collectively, these metrics provide insight into the consistency and fairness of private transaction fee distribution, which is essential for understanding the economic health and user experience of blockchain systems under varying network conditions.

On the public side, we compute the average public subsidy per transaction and then scale them by the total blockchain transaction fees, which include the private fee component:

$$\text{Public Subsidy}_b = \frac{BlockReward_b}{T_b} \tag{4}$$

where $BlockReward_b$ is the reward that a miner publicly receives upon completion of block b. This metric captures the financial incentives offered to miners for processing and validating transactions and helps assess the extent to which miners are compensated through public rewards, a critical factor for ensuring their sustained participation in the network.

Further, we measure the total amount of blockchain transaction fees as follows:

$$\text{Total Block Fee}_b = PrivateFee_b + PublicSubsidy_b \tag{5}$$

By combining the public subsidy with the average private fees paid by users within a block, the total fee metric offers a comprehensive view of the overall cost structure associated with blockchain transactions. This also serves as a proxy for miners' average revenue per transaction.[13] These metrics enable a more precise evaluation of the blockchain's economic environment, helping to evaluate whether the incentivization mechanisms effectively support network efficiency and sustainability.

To quantify platform welfare, we construct several proxies that capture both the volume and quality of blockchain activity. Specifically, we measure welfare using four metrics: (1) the number of confirmed transactions (*No. Tx*), representing blockchain throughput; (2) the monetary value transferred between users (*Monetary Value*), reflecting the intensity of economic activity; (3) the number of zero-value transactions (*Value-Free Tx*), serving as a proxy for smart contract creation and deployment; and (4) the number of unconfirmed transactions (*Unconfirmed Tx*), indicating network congestion due to pending transactions in the liquidity pool. Collectively, these proxies offer insight into the blockchain's operational efficiency and user experience, enabling an empirical assessment

[13] We did not include data on Maximal Extractable Value (MEV) by miners, as it falls outside the scope of this study.

of how changes in blockchain design impact overall welfare.

3.3 Quasi-Natural Experiments

Identifying the microstructure effects of decentralized payment networks can be challenging due to potential endogeneity issues. Although not strictly exogenous, the event provides quasi-experimental variation that helps isolate the causal impact of fee pricing and allocation mechanisms from broader market dynamics. Crucially, the protocol change was determined well in advance of its implementation and involved broad community consensus, including miners, users, and developers. Therefore, no single participant or short-term incentive dictated the final activation date, mitigating concerns that large miners timed the event to coincide with periods of high fees. To further address endogeneity concerns, we use panel regressions with time-fixed effects in robustness tests to absorb market-wide fluctuations and control for factors that are unrelated to the primary variables of interest. Additionally, we compare transactions confirmed on the Ethereum blockchain (treatment) with those executed on the Bitcoin blockchain (control), which did not undergo policy changes. This comparison controls for unobservable factors affecting both networks. The shift from a first-price auction to a semi-uniform fee mechanism, along with the transition from rigid to flexible block space allocation, provides a basis for attributing observed changes in the treated group to the protocol update. Moreover, we exploit a genuine "policy shock", analogous to regulatory interventions in traditional financial markets (such as tick-size reductions or the introduction of circuit breakers), thus enabling a differences-in-differences (DiD) research design. Similar to Capponi et al. (2023), we aim to evaluate whether the policy change introduced by EIP-1559 achieved its intended objectives. Our approach of exploiting this "designed but externally scheduled" protocol shift, represents a robust quasi-experimental framework in the context of public blockchains.

Consistent with established market microstructure literature, we employ a methodology commonly used to assess the impact of regulatory changes. Our first specification employs a daily OLS regression within a DiD framework, designed to account for market-wide fluctuations and isolate the impact of the protocol change:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb} \tag{6}$$

where y_b denotes the blockchain health metric of interest for a cryptocurrency in block b. $Event_b$ is an indicator variable equal to 1 for the post-design-change period (for both treatment and control blockchains), and 0 otherwise. $Treat_b$ is a dummy variable equal to 1 for the blockchain subject to the market design change (i.e., Ethereum) and 0 for control blockchains. The interaction term $Event_b \times Treat_c$ is our primary variable of interest and captures the marginal effects of being a treatment blockchain in the post-change period. Following prior literature (e.g. Galati, 2024), we include a vector of control variables $Controls_b$. $TradePrice_b$ is the natural logarithm of the trade price of the blockchain native coin in block b. $PriceVolatility_b$ is the natural logarithm of the returns for a transaction of the blockchain native coin in block b. $Avg.Size_b$ is the natural logarithm of the average size of a transaction in block b. $Avg.Turnover_b$ is the natural logarithm of the average monetary value transferred for a transaction in block b. $HashRate_b$ is the computational difficulty to mine a transaction in block b. Tx_b is the total number of transactions confirmed in block b. $UnconfirmedTx_b$ is the total number of transactions unconfirmed in block b. $ValueFreeTx_b$ is the total number of transactions confirmed in block b with 0 monetary value transferred (i.e., the creation of smart contracts). ϵ_b is the error term while the remaining β_0 is the intercept.

Consistent with the extant microstructure research, we employ heteroskedasticity-consistent standard errors of White (1980) to address both cross-sectional correlation and idiosyncratic time-series dependence. To mitigate the tendency to over-reject null hypotheses in high-frequency datasets due to the large number of observations, we aggregate data at the daily level, reducing the number of observations while retaining block-level information, ensuring robust inference without compromising informational depth. To ensure the robustness of our findings, we conduct multiple validation checks. First, we perform panel regression analysis with two-way fixed effects and double-clustered standard errors. All results hold both statistical and economic significance. Second, we also run Driscoll and Kraay (1998), GEE-AR(1), Newey and West (1987), and GLS-AR(1) DiD regressions to address concerns about serially correlated outcomes as explained in Bertrand et al. (2004). The results are qualitatively similar. Third, following Dzieliński et al. (2024), we provide a series of sensitivity analyses using varying sample windows, 40, 80, and 810 days surrounding the event periods, reported in Appendix C. The results hold even when using the longest available sample period, which ends prior to the implementation of the second policy change. Fourth, we aggregate data at the intraday (hourly) level[14] to mitigate concerns about data smoothing. Finally, we incorporate additional control variables, such as the squared log-return of the coin, as suggested by Brauneis et al. (2022). These unreported robustness checks confirm our main results, showing no qualitative changes.

4 Empirical Findings

4.1 Descriptive Statistics

Table 1 presents summary statistics for the Ethereum blockchain, based on daily block-level data. Panel A reports descriptive statistics for the EIP-1559 sample, while Panel B provides the corresponding statistics for the PoS sample. Descriptive Statistics for the Bitcoin blockchain are available in Appendix B. All variables are expressed in natural logarithms to stabilize variance and enhance interpretability. Each subsample comprises 60 observations.

[14]The Bitcoin blockchain, unlike Ethereum, exhibits wider block closure times, ranging from 12 minutes to nearly an hour, making direct block-by-block comparisons with Ethereum's 12-second intervals infeasible

Table 1: Descriptive statistics for the Ethereum Blockchain. This table presents summary statistics based on daily block-level data. Panel A (Panel B) shows results for the EIP-1559 sample (PoS sample). All variables are expressed in logarithmic form.

Variables	Mean	Median	Min.	Max.	Std. Dev.	Q1	Q3	No. Obs.
Panel A: EIP-1559								
Fee Dispersion	5.25	5.35	3.88	6.52	0.63	4.77	5.6	60
Fee Inflation	0.55	0.61	-1.01	2.24	0.82	-0.12	1.19	60
Fee Volatility	1.43	1.44	1.3	1.6	0.09	1.34	1.51	60
Private Fee	2.64	2.62	0.96	4.19	0.83	2.01	3.22	60
Private Base Fee	1.5	1.15	0	3.95	1.56	0	2.9	60
Private Tip Fee	1.97	1.99	0.95	3.27	0.56	1.6	2.29	60
Subsidy Fee	4.03	3.94	3.32	4.8	0.57	3.47	4.57	60
Total Fee	4.18	4.23	3.49	4.85	0.5	3.65	4.66	60
Trade Price	7.87	7.89	7.49	8.25	0.22	7.67	8.07	60
Price Volatility	0.01	0.01	-0.09	0.11	0.04	-0.02	0.03	60
Avg. Turnover	9.61	9.58	8.66	10.42	0.33	9.39	9.8	60
Avg. Size	5.94	5.93	5.64	6.22	0.15	5.82	6.05	60
Hash Rate	13.06	13.07	12.93	13.22	0.09	12.97	13.13	60
No. Tx	14.01	14	13.91	14.12	0.04	13.98	14.04	60
No. Unconfirmed Tx	19.17	19.18	18.99	19.19	0.04	19.18	19.19	60
No. Value-Free Tx	13.25	13.25	13.08	13.48	0.07	13.21	13.29	60
Monetary Value	14.79	14.8	13.73	15.54	0.31	14.61	14.97	60
Size	11.13	11.14	10.86	11.45	0.15	11.01	11.23	60
Panel B: PoS								
Fee Dispersion	3.98	4.02	3.39	4.56	0.3	3.76	4.22	60
Fee Inflation	-0.79	-0.8	-1.52	0.17	0.32	-1.03	-0.52	60
Fee Volatility	1.46	1.46	1.31	1.56	0.04	1.44	1.48	60
Private Fee	0.88	0.92	0.04	1.67	0.34	0.62	1.14	60
Private Base Fee	0.57	0.62	-0.49	1.55	0.42	0.18	0.87	60
Private Tip Fee	-0.47	-0.5	-0.92	0.09	0.24	-0.62	-0.26	60
Subsidy Fee	1.98	3.15	0	4	1.94	0	3.86	60
Total Fee	1.67	3.15	-0.92	4	2.25	-0.61	3.86	60
Trade Price	7.3	7.29	7.13	7.55	0.12	7.19	7.39	60
Price Volatility	-0.01	-0.01	-0.13	0.06	0.04	-0.02	0.01	60
Avg. Turnover	8.65	8.68	7.16	10.04	0.56	8.29	8.93	60
Avg. Size	6.25	6.27	5.94	6.46	0.11	6.2	6.32	60
Hash Rate	6.95	12.76	0	13.54	6.78	0	13.5	60
No. Tx	13.92	13.91	13.81	14.09	0.06	13.89	13.95	60
No. Unconfirmed Tx	19.16	19.18	18.95	19.18	0.04	19.16	19.18	60
No. Value-Free Tx	13.21	13.19	12.99	13.57	0.11	13.14	13.28	60
Monetary Value	13.75	13.77	12.18	15.39	0.61	13.38	14.1	60
Size	11.3	11.31	10.88	11.54	0.11	11.25	11.36	60

In the EIP-1559 period (Panel A), the mean log total fee is 4.18 with a standard deviation of 0.50, whereas the PoS regime (Panel B) exhibits a lower mean of 1.67 but with substantially higher dispersion, with a standard deviation of 2.25. Fee inflation also differs markedly: the EIP-1559 sample has a mean of 0.55 and a standard deviation of 0.82, whereas in the PoS sample the mean falls to -0.79 with a standard deviation of 0.32, indicating a higher frequency of negative fee-growth days under PoS.

Average trade price declines from 7.87 in the EIP-1559 period to 7.30 under PoS, reflecting broader downward price trend of ETH. Price volatility remains relatively stable in terms of dispersion (≈ 0.04) though mean shifts marginally from 0.01 to -0.01, suggesting similar short-term fluctuation magnitudes despite a lower price baseline. Measures of network activity, such as average transactions per block (mean 14.00) and block size (mean 11.13–11.30), remain stable across regimes, with only minor changes in standard deviations, indicating stable block capacity utilization. In contrast, the hash rate drops sharply from a mean of 13.06 (Std. Dev. = 0.09) under PoW to 6.95 (Std. Dev. = 6.78) under PoS, directly reflecting the protocol's shift in consensus mechanism.

Overall, Table 1 documents that while core usage metrics, such as transaction counts and block sizes, are largely unchanged between the EIP-1559 and PoS regimes, fee-related variables and network security indicators display significant shifts in both levels and variability. These descriptive insights provide essential context for the subsequent regression analyses.

4.2 The Effects of Fee and Allocation Mechanisms on Market Quality

This section evaluates the impact of Ethereum's protocol intervention, specifically the introduction of EIP-1559's semi-uniform price auction, on market quality along multiple dimensions. Using a DiD framework with Bitcoin as an untreated benchmark, we quantify changes in user trading costs (including fee dispersion, inflation, volatility, and average private fees) and block-producer revenues (comprising private base and tip fees, public subsidies, and total rewards) over a 60-day window surrounding the event. By linking observed shifts in these metrics to specific design features, the analysis provides causal evidence that fee-setting rules and elastic block capacity jointly shape price stability, rent distribution, and overall platform efficiency in the market for block space. In this section, we empirically test the theoretical predictions of hypotheses 1, 2, and 3.

Figure 1 plots four daily users' trading-cost metrics for Ethereum (ETH, orange) and Bitcoin (BTC, blue) over the 60 days surrounding the EIP-1559 implementation (shaded region). Prior to the reform, Ethereum's fee dispersion averaged roughly $\$150$ per block, well below Bitcoin's $\$300$–$\$800$ range. Immediately following the event, dispersion on Ethereum jumps to $\$300$–$\$700$, reaching Bitcoin's level, which remained constant, and indicating a clear increase in cross-transaction heterogeneity. Fee inflation on Ethereum rises from just below $\$2$ per transaction a day pre-reform to roughly 2.0–6.0 \$/day post-reform, whereas Bitcoin's inflation stays near 0. Fee volatility, measured as the block-to-block standard deviation of fees, is substantially lower on Ethereum than on Bitcoin both before (approximately 4.5 vs. 8.5) and after (≈ 3.8 vs. ≈ 8.0) the reform, confirming that the base-fee mechanism dampens short-term fluctuations. Finally, private fee outlays for Ethereum rise from about $\$5$–$\$20$ to $\$20$–$\$60$ per block on average per day, while Bitcoin's private fees remain stable at $\$2$–$\$3$, demonstrating a marked increase in average user cost under the new auction design introduced by EIP-1559.

Figure 2 illustrates the corresponding revenue components for block producers. Before the reform, Ethereum's private base-fee was effectively absent, with private tip fees constituting the entirety of private revenue. Public subsidy and total fee reward remained below $\log(5)$. In contrast, Bitcoin, lacking a base fee, generated revenue through private fees (tips), with public subsidies and total rewards consistently around $\log(6)$. Following the introduction of EIP-1559, Ethereum implemented a base fee that is burned rather than paid to miners. This component surged to $\$10$–$\$25$ immediately after the event and continued rising to $\$30$–$\$50$ by day 30, effectively representing deflationary gains for token

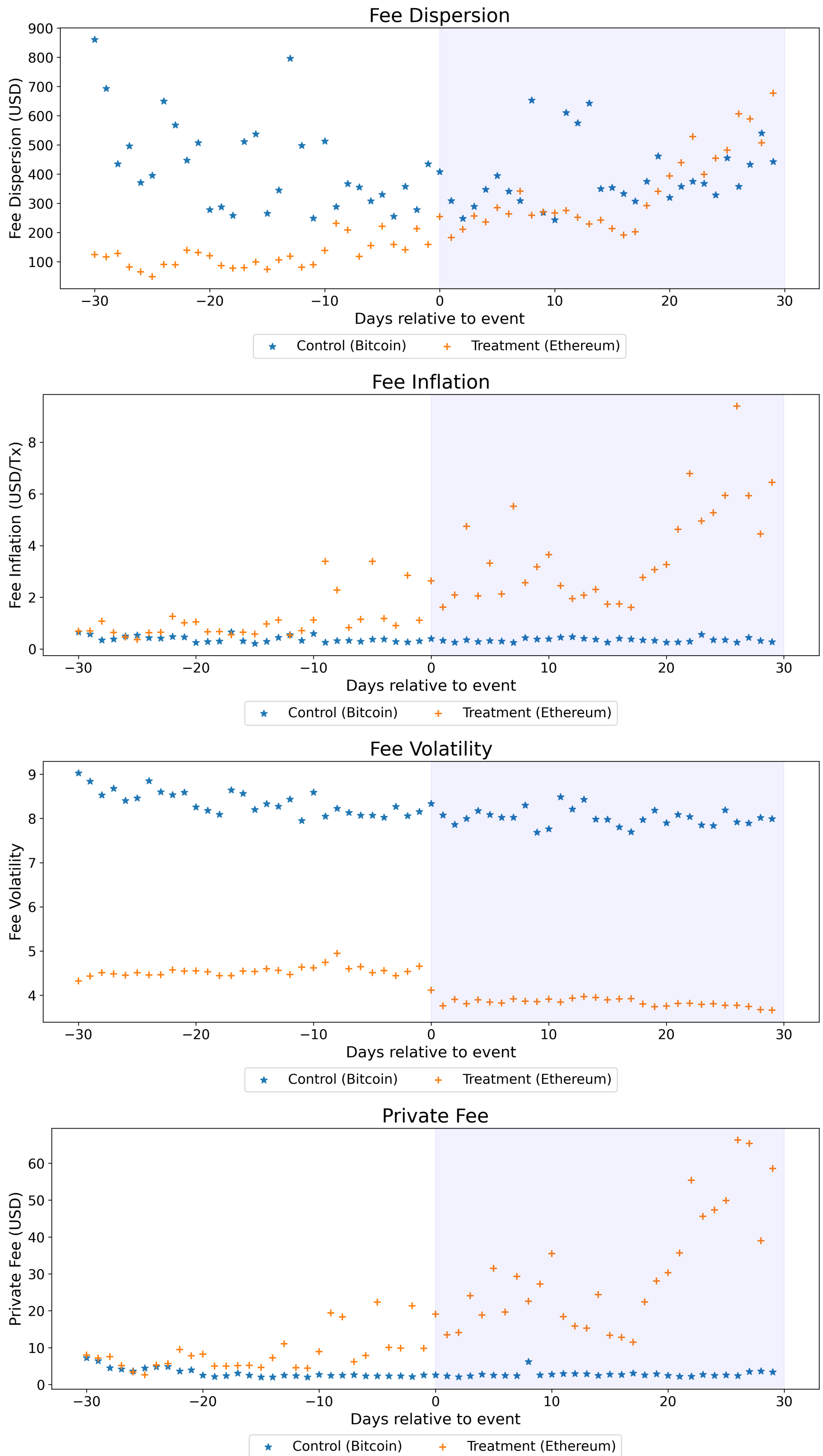

Figure 1: EIP-1559 Users' Trading Costs. This figure plots the fee dispersion, fee inflation, fee volatility, and total private fee for transactions on Ethereum (treatment group depicted by orange plus signs) and Bitcoin (control group denoted by blue stars) over the 60-day window surrounding the implementation of EIP-1559. The shaded region depicts the period of the protocol change. All variables are in US dollars.

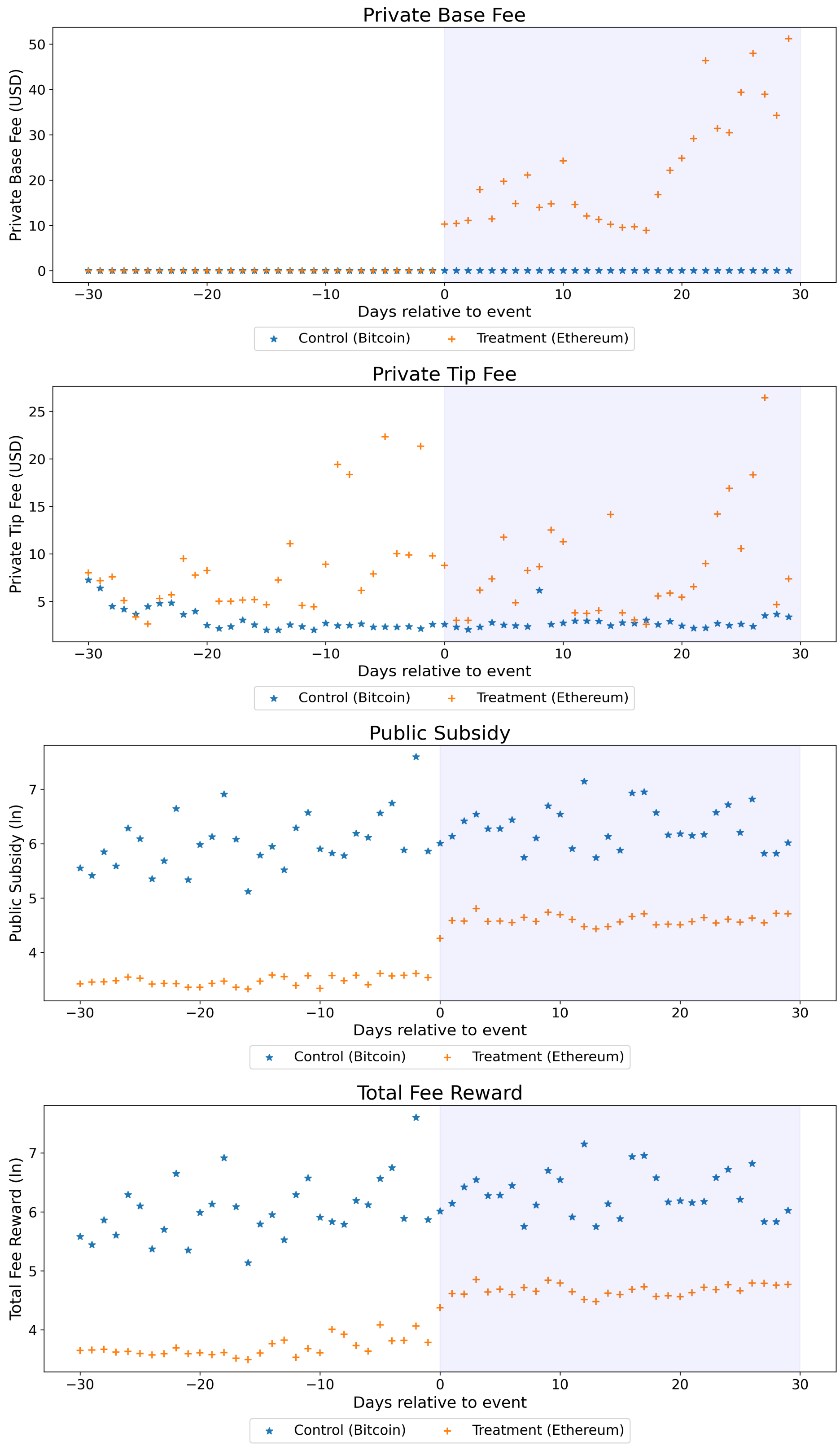

Figure 2: EIP-1559 Token Holders' & Validators' Earnings. This figure plots the base fee, priority tip fee, public subsidy, and total fee reward for transactions on Ethereum (treatment group depicted by orange plus signs) and Bitcoin (control group denoted by blue stars) over the 60-day window surrounding the implementation of EIP-1559. The shaded region depicts the period of the protocol change. Base and tip fee variables are in US dollars, while public subsidies and total fee rewards are expressed in logarithmic form.

holders. Ethereum's tip-fee component remained stable around $\$5$–$\$20$, indicating continuity in users' bidding behavior for transaction prioritization. Public subsidies and total fee rewards on Ethereum increased to higher average levels post-reform, while Bitcoin's corresponding metrics remained unchanged. These shifts suggest that EIP-1559 successfully restructured miner compensation by reallocating revenue from volatile tip fees to more predictable and substantial rewards per transaction, thereby enhancing validator earnings under the new semi-uniform auction mechanism.

Table 2 reports the DiD OLS estimates of users' trading costs surrounding the EIP-1559 mechanism design change. Table 3 shows the corresponding effects on earnings for token holders and validators. Each specification includes the interaction term $Treat \times Post$, which captures the causal effect of introducing an algorithmically adjusted fee pricing and allocation mechanism, with White's robust standard errors in parentheses. The sample uses daily aggregated data spanning 30 days before and after the event, with Bitcoin as the control blockchain.

Table 2 shows that the shift from a first-price to the semi-uniform EIP-1559 mechanism achieved the intended reduction in fee volatility but also produced two offsetting effects on user costs. The interaction coefficient on fee volatility is economically small, about -0.13 log-points, or a 12% decline, but statistically significant in both baseline and fully controlled specifications, lending clear support for Hypothesis 1. Simultaneously, the same mechanism significantly widened the fee dispersion within a block by roughly 0.72–0.75 log-points (a 105%–113% increase) and accelerated fee inflation by 0.85–0.97 log-points (a three- to four-fold jump) on a daily basis. These results contradict Hypothesis 2, which predicted that standardizing the base component would compress both dispersion and inflation. The rise in average private fees, roughly 0.80–0.93 log-points, or a 123%–154% increase, confirm that users ultimately face higher out-of-pocket costs despite lower volatility and supposedly fewer bidding wars. Taken together, the evidence suggests that while EIP-1559 stabilized fee prices by rationing scarce block space, it did so

Table 2: Difference-in-differences OLS regression results for users' trading costs over the 60-day window surrounding the EIP-1559 implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: fee dispersion in models (1-2), fee inflation in models (3-4), fee volatility in models (5-6), and overall private fees in models (7-8). The interaction term $Event_b \times Treat_b$ measures the impact of EIP-1559 on the specified dependent variables. The set of control variables are: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are reported in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are expressed in logarithmic terms. Intercept is omitted for brevity.

Users' Transaction Costs								
	Fee Dispersion		Fee Inflation		Fee Volatility		Private Fee	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	0.75	0.72	0.97	0.85	-0.13	-0.13	0.93	0.79
	(0.13)***	(0.13)***	(0.16)***	(0.18)***	(0.01)***	(0.01)***	(0.17)***	(0.15)***
ETH	2.77	-14.78	5.53	10.17	-0.81	-2.52	6.15	5.77
	(0.98)***	(10.79)	(1.25)***	(11.47)	(0.08)***	(0.74)***	(1.18)***	(8.93)
EIP-1559	-0.39	-0.31	-0.47	-0.40	-0.01	-0.01	-0.50	-0.40
	(0.13)***	(0.12)***	(0.14)***	(0.14)***	(0.01)	(0.01)	(0.15)***	(0.12)***
$Trade\ Price$	1.43	1.27	1.58	1.39	-0.04	-0.04	1.80	1.48
	(0.37)***	(0.40)***	(0.48)***	(0.51)***	(0.03)	(0.03)	(0.46)***	(0.45)***
$Price\ Volatility$	-0.38	0.42	1.50	1.75	-0.04	0.01	0.02	0.89
	(0.70)	(0.63)	(0.77)*	(0.76)**	(0.06)	(0.06)	(0.82)	(0.73)
$Avg.\ Size$	0.62	0.76	0.75	0.75	0.02	0.03	0.88	0.90
	(0.20)***	(0.20)***	(0.21)***	(0.21)***	(0.02)	(0.01)**	(0.25)***	(0.21)***
$Avg.\ Turnover$	-0.14	0.11	-0.12	0.06	-0.03	-0.01	-0.16	0.18
	(0.11)	(0.10)	(0.11)	(0.13)	(0.01)***	(0.01)*	(0.13)	(0.12)
$Hash\ Rate$		-0.83		0.09		-0.08		-0.16
		(0.51)		(0.56)		(0.04)**		(0.43)
Tx		1.68		0.39		0.11		1.06
		(0.39)***		(0.48)		(0.03)***		(0.45)**
$Unconfirmed\ Tx$		-0.07		-0.08		-0.01		0.04
		(0.11)		(0.13)		(0.01)		(0.12)
$ValueFree\ Tx$		-0.37		-0.35		-0.02		-0.59
		(0.08)***		(0.10)***		(0.01)**		(0.08)***
R^2	73.91%	80.47%	85.75%	86.88%	99.52%	99.60%	86.01%	89.55%
Adj. R^2	72.28%	78.48%	84.86%	85.54%	99.48%	99.56%	85.14%	88.48%
No. Obs.	120	120	120	120	120	120	120	120

by rationing limited block space through higher equilibrium payments, an outcome that diverges from the policy's intended objectives.

Table 3 illustrates how the additional user payments were redistributed following the reform. The majority of the incremental revenue was funneled into the burned base-fee component, with the private base fee received by token holders via deflation rising by approximately 2.81–2.83 log-points. In sharp contrast, the tip component, miners' discretionary reward, contracts by about 0.38–0.49 log-points, or 32%–39%. Public subsidy (the block reward) edges up by roughly 0.71–0.75 log-points, reflecting an endogenous adjustment of the native token price and inflation schedule. Overall miner/validator revenue increases by around 0.54–0.57 log-points. These patterns lead us to reject Hypothesis 3: while burned base fees reduce the private fee stream accruing to block producers, the elastic capacity and higher tip dispersion partly offset this loss, resulting in a modest net gain in total rewards in the short term.

For the EIP-1559 event, control variables behave as expected. A higher trade price is associated with greater fee dispersion (1.4305 in (1)) and higher private fee (1.8026 in (7)), while average size also exerts a positive effect across all four specifications (0.6185, 0.7560, 0.8834, 0.8958). The models explain between 73.91% and 99.60% of the variation (Adjusted R^2 from 72.28% to 99.56%), underscoring their strong fit. For the PoS event, trade price remains positively associated with earnings (e.g. 1.4607 in (3) and 1.3020 in (7)). The explanatory power of these models varies more widely, with R^2 ranging from 58.70% to 96.72% and Adjusted R^2 from 56.12% to 96.38%, indicating varying degrees of explanatory power across components.

In aggregate, the EIP-1559 results paint a mixed picture. While the protocol succeeds in smoothing fee volatility, consistent with auction-theoretic predictions, but does so by shifting price risk from miners to users, who now pay larger, albeit more predictable, average transaction fees. The redistribution of revenue toward token holders via deflation aligns with the design goal of making block production less extractive. However, the ac-

Table 3: Difference-in-differences OLS regression results for token holders' and miners' revenues over the 60-day window surrounding the EIP-1559 implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: base fee in models (1-2), priority tip fee in models (3-4), public subsidy in models (5-6), and the overall total fees in models (7-8). The interaction term $Event_b \times Treat_b$ measures the impact of the introduction of EIP-1559 on the specified dependent variables. The set of control variables are: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are in logarithmic terms. Intercept is omitted for brevity.

Token Holders' & Validators' Earnings								
	Private Base Fee		Private Tip Fee		Public Subsidy		Total Fee Reward	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	2.83	2.81	-0.38	-0.49	0.71	0.75	0.54	0.57
	(0.10)***	(0.10)***	(0.19)**	(0.18)***	(0.15)***	(0.13)***	(0.15)***	(0.13)***
ETH	2.37	10.32	4.95	4.88	0.51	54.25	1.30	54.49
	(0.83)***	(5.31)*	(1.25)***	(8.59)	(0.94)	(11.92)***	(0.94)	(11.77)***
EIP-1559	-0.21	-0.21	-0.37	-0.28	-0.04	-0.15	-0.10	-0.21
	(0.09)**	(0.09)**	(0.14)***	(0.12)**	(0.16)	(0.14)	(0.16)	(0.14)
$Trade\ Price$	0.63	0.50	1.46	1.16	1.09	0.67	1.30	0.86
	(0.31)**	(0.32)	(0.48)***	(0.48)**	(0.36)***	(0.24)***	(0.35)***	(0.24)***
$Price\ Volatility$	0.03	0.05	0.47	1.31	0.38	-0.68	0.50	-0.52
	(0.70)	(0.72)	(0.96)	(0.97)	(0.63)	(0.57)	(0.63)	(0.56)
$Avg.\ Size$	0.40	0.38	0.86	0.86	-0.01	-0.18	0.04	-0.12
	(0.14)***	(0.14)***	(0.25)***	(0.22)***	(0.28)	(0.24)	(0.27)	(0.23)
$Avg.\ Turnover$	0.07	0.11	-0.23	0.08	0.01	-0.23	-0.01	-0.22
	(0.05)	(0.06)*	(0.13)*	(0.14)	(0.09)	(0.08)***	(0.09)	(0.09)**
$Hash\ Rate$		0.33		-0.12		2.45		2.42
		(0.24)		(0.41)		(0.56)***		(0.55)***
Tx		-0.02		0.94		-1.83		-1.70
		(0.23)		(0.46)**		(0.37)***		(0.38)***
$Unconfirmed\ Tx$		-0.00		0.08		-0.01		-0.02
		(0.06)		(0.12)		(0.12)		(0.13)
$ValueFree\ Tx$		-0.09		-0.54		0.23		0.20
		(0.04)**		(0.09)***		(0.06)***		(0.07)***
R^2	96.63%	96.72%	58.70%	66.22%	93.02%	96.67%	92.04%	96.04%
Adj. R^2	96.42%	96.38%	56.12%	62.78%	92.58%	96.33%	91.55%	95.64%
No. Obs.	120	120	120	120	120	120	120	120

companying rise in fee dispersion and inflation raises concerns about fairness and cost effectiveness. Whether these trade-offs persist as users adapt their bidding strategies or migrate to layer-two solutions remains an open question for future research. Nonetheless, the short-run evidence underscores that fee mechanism reforms can have unintended distributional consequences even when they achieve their volatility-reduction targets. Supporting evidence for these findings is provided in long-term robustness tests presented in Appendix C.

4.3 The Effects of Eliminating Public Subsidies on Market Quality: A Placebo Test

We now turn to a placebo test to evaluate how the elimination of block rewards following Ethereum's transition from PoW to PoS alters these market quality metrics. Using a DiD framework with Bitcoin as an untreated benchmark, we quantify changes in users' trading costs—fee dispersion, inflation, volatility, and average private fees—and in validators' revenue composition—private base and tip fees, public subsidies, and total rewards—over a 60-day window around the Merge. By linking observed shifts in these metrics to the withdrawal of public subsidies, this analysis provides causal evidence on how reward-allocation rules influence price stability, rent distribution, and platform efficiency when the fee and allocation mechanisms are held constant. This offers an ideal setting for a placebo test of our core inference. In this section, we test the theoretical predictions of hypotheses 5 and 7.

Figure 3 displays fee dispersion, fee inflation, fee volatility, and private fee for Ethereum (ETH, orange) and Bitcoin (BTC, blue) over the 30 days before and after the Merge to POS (shaded region). Prior to the Merge, Ethereum's fee dispersion averages approximately $60 per block, compared with Bitcoin's $80–$140. Immediately following the event, dispersion on Ethereum declines slightly to $30–$60 while Bitcoin remains near $80–$100. This suggests a modest compression of cross-transaction heterogeneity under PoS. Fee

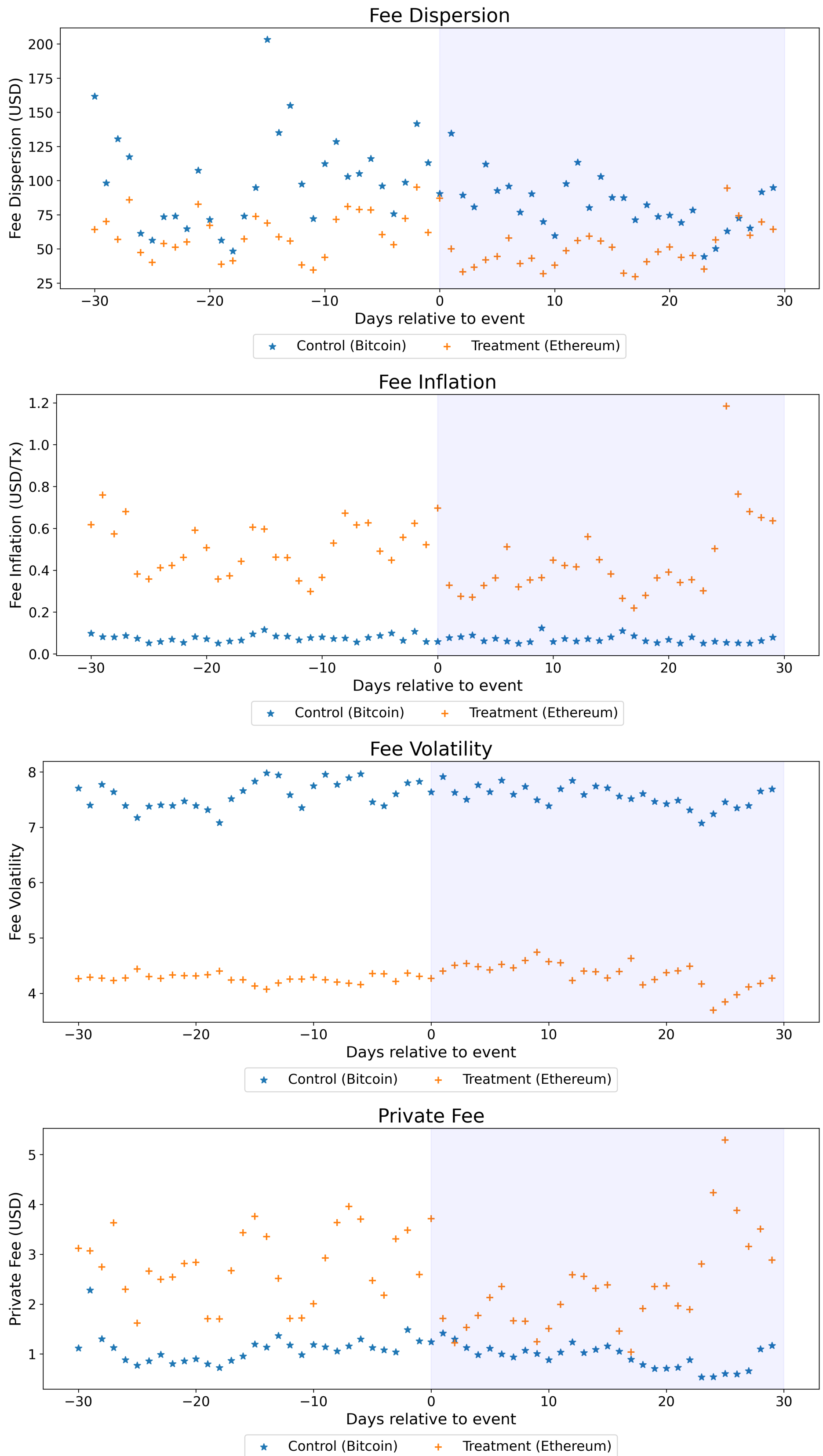

Figure 3: PoS Users' Trading Costs. This figure displays trends in fee dispersion, fee inflation, fee volatility, and total private fee for transactions on Ethereum (treatment sample denoted by orange plus signs) and Bitcoin (control samples depicted by blue stars) 60 days surrounding the introduction of PoS. The shaded area depicts the period of the change in the fee and allocation mechanism. All variables are in US dollars.

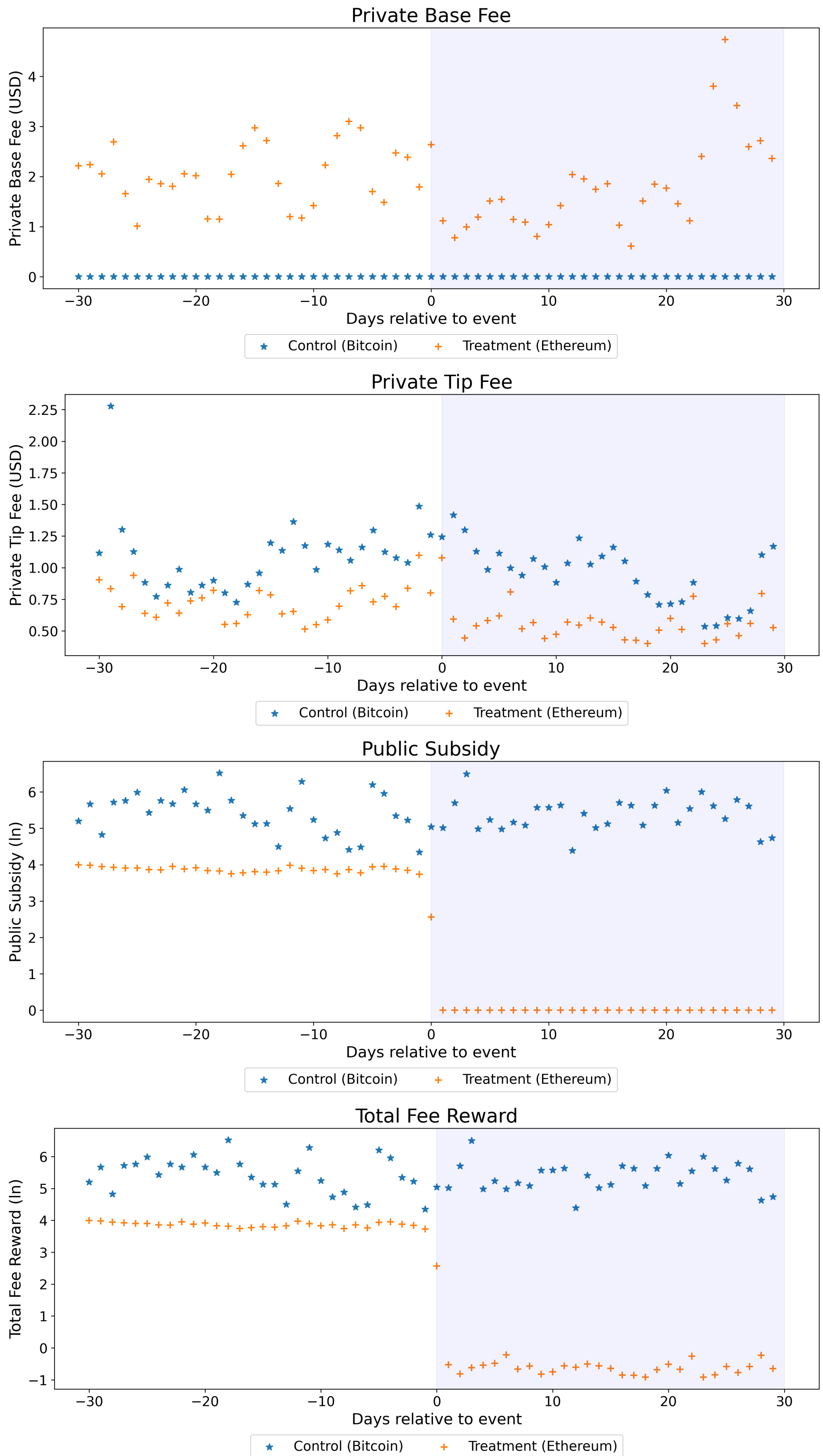

Figure 4: PoS Token Holders' & Validators' Earnings. This figure plots the base fee, priority tip fee, public subsidy, and total fee reward for transactions on Ethereum (treatment sample denoted by orange plus signs) and Bitcoin (control samples depicted by blue stars) 60 days surrounding the introduction of PoS. The shaded area depicts the period of the change in the fee and allocation mechanism. Base and tip fee variables are in US dollars, while public subsidies and total fee rewards are expressed in logarithmic form.

inflation on Ethereum hovers around 0.4–0.7 \$/day pre-Merge and falls slightly to 0.3–0.6 \$/day post-Merge, whereas Bitcoin's inflation remains near 0.05 throughout. Fee volatility is lower on Ethereum than on Bitcoin both before (≈ 4.3 vs. ≈ 7.5) and after (≈ 4.0 vs. ≈ 7.6) the Merge, indicating a slight further smoothing of short-term fluctuations. Private fee outlays on Ethereum average $\$2.5$–$\$3.5$ per block before the event, dip to $\$1.5$–$\$2.5$ immediately after, and then recover toward $\$3.0$–$\$4.0$ by day 30, while Bitcoin's private fees remain stable at $\$0.8$–$\$1.4$. Collectively, these patterns imply that Ethereum's transition to PoS led to a slight reduction user transaction fee costs.

Figure 4 reports the corresponding revenue components for block producers around the PoS transition. Before the Merge, Ethereum's private base-fee receipts fluctuate between $\$1.0$ and $\$3.0$, while private tip fees range between $\$0.5$ and $\$1.0$. Public subsidies (ln scale) remain stable around 3.8–4.0, and total fee reward (ln scale) near 3.8. Bitcoin's series remain largely flat level across all measures. After the introduction of a PoS consensus mechanism, Ethereum's total fee reward falls to negative logarithmic values, reflecting the removal of block rewards. Both private base-fee and tip-fee components adjust slightly in response. Bitcoin's control series exhibit no comparable shifts. These dynamics provide clear evidence that eliminating the block reward subsidy caused a sharp initial decline in validator earnings, particularly in public subsidies and total rewards, followed by a partial recovery driven by fee market adjustments under PoS.

Table 4 presents the placebo estimates for users' trading costs around the Merge, while Table 5 reports the corresponding effects on validators' and token holders' revenues. All specifications employ the same DiD design used in the EIP-1559 analysis, employing Bitcoin as the untreated benchmark, with White's robust standard errors reported in parentheses.

In Table 4, the interaction term $Treat \times Post$ is statistically indistinguishable from zero across all four user-cost metrics. For fee dispersion the coefficient ranges from 0.03 to -0.01 log-points; for fee inflation from 0.04 to 0.14; for fee volatility from 0.006 to 0.016;

Table 4: Difference-in-differences OLS regression results for users' trading costs over the 60-day window surrounding the PoS implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: fee dispersion in models (1-2), fee inflation in models (3-4), fee volatility in models (5-6), and the overall private fees in models (7-8). The interaction term $Event_b \times Treat_b$ measures the impact of the introduction of PoS on the specified dependent variables. The set of control variables are: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are expressed in logarithmic form. Intercept is omitted for brevity.

Users' Transaction Costs								
	Fee Dispersion		Fee Inflation		Fee Volatility		Private Fee	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times PoS$	0.03	-0.01	0.04	0.14	0.02	0.01	0.01	0.08
	(0.11)	(0.12)	(0.11)	(0.12)	(0.01)	(0.02)	(0.13)	(0.15)
ETH	1.84	-0.50	4.34	5.84	-0.45	-0.74	2.70	2.31
	(1.06)*	(1.09)	(1.10)***	(1.30)***	(0.15)***	(0.17)***	(1.31)**	(1.46)
PoS	-0.02	-0.15	-0.01	-0.05	0.01	0.00	-0.06	-0.17
	(0.08)	(0.08)*	(0.08)	(0.08)	(0.01)	(0.01)	(0.08)	(0.08)**
$Trade\ Price$	0.51	0.12	0.81	0.69	-0.00	-0.04	0.48	0.22
	(0.40)	(0.38)	(0.39)**	(0.41)*	(0.05)	(0.06)	(0.48)	(0.52)
$Price\ Volatility$	1.86	2.01	1.38	1.44	-0.02	-0.01	1.82	2.06
	(0.62)***	(0.53)***	(0.55)**	(0.58)**	(0.07)	(0.07)	(0.67)***	(0.68)***
$Avg.\ Size$	0.19	0.03	0.24	0.14	0.14	0.12	0.10	-0.08
	(0.34)	(0.35)	(0.37)	(0.38)	(0.04)***	(0.04)***	(0.38)	(0.38)
$Avg.\ Turnover$	0.26	0.24	0.07	0.14	0.02	0.02	0.14	0.16
	(0.06)***	(0.07)***	(0.07)	(0.07)**	(0.01)**	(0.01)	(0.09)	(0.10)*
Tx		1.25		-0.27		0.14		0.52
		(0.41)***		(0.40)		(0.04)***		(0.47)
$Unconfirmed\ Tx$		0.07		0.02		0.00		0.10
		(0.04)*		(0.03)		(0.00)		(0.05)*
$ValueFree\ Tx$		-0.14		-0.20		-0.01		-0.23
		(0.09)		(0.08)**		(0.01)		(0.09)***
R^2	57.87%	63.75%	93.03%	93.51%	98.87%	98.99%	73.96%	75.89%
Adj. R^2	55.24%	60.42%	92.59%	92.92%	98.80%	98.90%	72.33%	73.68%
No. Obs.	120	120	120	120	120	120	120	120

and for the average private fee from 0.01 to 0.08. None of these estimates reach conventional levels of statistical significance, and the implied semi-elasticities are economically negligible (within $\pm 1.5\%$). These findings support Hypothesis 5 that once the fee and allocation mechanism are held constant, the removal of block rewards does not materially alter the dispersion, growth, or volatility of user fees, nor does it raise average payments. Control variables behave as expected, larger blocks and higher turnover correlate with modest increases in cost measures. However the R^2 values (from 57.9% to 99.0%) indicate that the explanatory power stems largely from time-varying fundamentals rather than the subsidy shock itself.

Table 5 shows a markedly different pattern on the revenue side. The interaction coefficient on public subsidy declines sharply by -3.19 to -3.41 log-points, corresponding to a 96%–97% reduction in the block reward component. Total fee reward falls in tandem by -3.73 to -3.98 log-points, a decline of roughly 97% consistent with the elimination of the reward itself. By contrast, neither the private base fee (-0.06 to -0.10) nor the private tip fee (0.00 to 0.06) exhibits a statistically meaningful change, supporting the theoretical proposition that equilibrium fees are determined primarily by congestion rather than subsidy policy. These large and precisely estimated drops in subsidy and total revenue provide strong support for Hypothesis 7 that eliminating the block reward materially diminishes validator income when private fees fail to rise commensurately. The explanatory power of the models is high for the subsidy and total-reward regressions (adjusted R^2 up to 97.9%), but much lower for the private fee components, consistent with the view that the observed effects operate predominantly through the subsidy channel.

In conclusion, the placebo results underscore a sharp decoupling between the fee market and validator compensation once block rewards are withdrawn. User-side metrics, including dispersion, inflation, volatility, and average fees, remain largely unchanged, indicating that a fee-only regime preserves price formation and queuing dynamics. On the supply side, however, validator earnings contract almost proportionally with the loss

Table 5: Difference-in-differences OLS regression results for token holders' and miners' revenues over the 60-day window surrounding the PoS implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: base fee in models (1-2), priority tip fee in models (3-4), public subsidy in models (5-6), and the overall total fees in models (7-8). Interaction term $Event_b \times Treat_b$ measures the impact of the introduction of PoS on the specified dependent variables. The set of control variables are: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are expressed in logarithmic form. Intercept is omitted for brevity.

Token Holders' & Validators' Earnings								
	Private Base Fee		Private Tip Fee		Public Subsidy		Total Fee Reward	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times PoS$	-0.10	-0.06	0.00	0.06	-3.41	-3.19	-3.98	-3.73
	(0.08)	(0.08)	(0.08)	(0.09)	(0.27)***	(0.27)***	(0.31)***	(0.31)***
ETH	0.90	1.42	3.66	3.29	4.44	11.09	5.62	12.80
	(0.78)	(0.81)*	(0.85)***	(1.00)***	(3.72)	(3.67)***	(4.36)	(4.29)***
PoS	-0.02	-0.02	0.07	-0.05	0.09	0.22	0.16	0.29
	(0.04)	(0.04)	(0.06)	(0.06)	(0.20)	(0.16)	(0.22)	(0.18)
$Trade\ Price$	-0.05	0.03	1.14	0.80	2.48	2.80	2.76	3.07
	(0.28)	(0.29)	(0.32)***	(0.36)**	(1.30)*	(1.08)**	(1.52)*	(1.26)**
$Price\ Volatility$	1.16	1.23	1.04	1.20	1.31	1.07	1.73	1.49
	(0.46)**	(0.46)***	(0.40)**	(0.39)***	(1.44)	(1.18)	(1.58)	(1.34)
$Avg.\ Size$	-0.47	-0.47	0.72	0.54	-0.63	-0.54	-0.52	-0.45
	(0.23)**	(0.24)**	(0.19)***	(0.18)***	(0.39)	(0.37)	(0.43)	(0.42)
$Avg.\ Turnover$	0.04	0.05	0.23	0.26	-0.01	0.17	0.10	0.31
	(0.06)	(0.06)	(0.04)***	(0.04)***	(0.17)	(0.19)	(0.21)	(0.23)
Tx		-0.25		0.61		-2.45		-2.59
		(0.24)		(0.31)*		(0.57)***		(0.55)***
$Unconfirmed\ Tx$		0.02		0.07		-0.13		-0.13
		(0.02)		(0.04)*		(0.08)		(0.08)*
$ValueFree\ Tx$		-0.01		-0.25		-0.17		-0.22
		(0.04)		(0.06)***		(0.16)		(0.18)
R^2	90.64%	90.76%	75.37%	79.63%	96.83%	97.99%	96.97%	98.06%
Adj. R^2	90.05%	89.91%	73.83%	77.76%	96.63%	97.80%	96.78%	97.88%
No. Obs.	120	120	120	120	120	120	120	120

of public subsidies, implying that fee revenue alone is insufficient to immediately offset the incentive gap left by PoW rewards. These findings corroborate Hypotheses 5 and 7, and echo the theoretical arguments of Easley et al. (2019) that when validator participation is sufficiently inelastic in the short run, public subsidies can be removed without disrupting fee equilibrium, but at the cost of sharply lower producer surplus. Whether this income shock induces validator exit or upward pressure on fees in the longer term remains an open question for future research.

4.4 Welfare Effects of Blockchain Market Design

Lastly, we examine how Ethereum's two protocol interventions, EIP-1559 and the subsequent Merge to PoS, affect overall platform welfare. Employing the same DiD framework as previously, we track changes in throughput and value creation across symmetric ± 60-day windows around each event. Our proxies include the daily number of confirmed transactions (No. Tx), the natural logarithm of monetary value transferred among users (Monetary Value), number of smart contracts created (Value-Free Tx), and network congestion rates (Unconfirmed Tx). This joint analysis isolates the incremental contribution of (i) a semi-uniform price auction with elastic block capacity and (ii) the removal of public subsidies to validators, allowing us to assess whether lower fee volatility and altered rent distribution translate into higher on-chain activity or constrain throughput. The empirical tests presented below directly address Hypothesis 4 on welfare gains from EIP-1559 and Hypothesis 6 on potential welfare losses following the elimination of block rewards.

Table 6 quantifies the welfare effects of the EIP-1559 protocol upgrade. The interaction term $Treat \times Post$ is negative and statistically significant across all four outcomes. Columns (1)–(2) indicate that the daily log number of confirmed Ethereum transactions falls by about 0.24 to 0.25 log-points,roughly a 22% reduction, relative to the Bitcoin benchmark. Columns (3)–(4) show an even larger decline of approximately 0.48–0.51 log-

Table 6: Difference-in-differences OLS regression results for platform welfare over the 60-day window surrounding the EIP-1559 implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: number of confirmed transactions in models (1-2), monetary value transferred in models (3-4), number of transactions with 0 monetary value in models (5-6), and the number of unconfirmed transactions in models (7-8). The interaction term $Event_b \times Treat_b$ measures the impact of the introduction of EIP-1559 on the specified dependent variables. The set of control variables are: coin trade price, block size, coin price volatility, and block difficulty. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are expressed in logarithmic form. Intercept is omitted for brevity.

EIP-1559								
	No. Tx		Monetary Value		Value-Free Tx		Unconfirmed Tx	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP\text{-}1559$	-0.24	-0.24	-0.51	-0.48	-0.63	-0.62	-0.57	-0.59
	(0.03)***	(0.03)***	(0.13)***	(0.13)***	(0.13)***	(0.14)***	(0.10)***	(0.10)***
ETH	3.43	9.03	1.58	10.43	10.48	27.32	8.95	-8.88
	(0.28)***	(3.11)***	(1.06)	(11.09)	(1.09)***	(15.95)*	(0.88)***	(7.09)
$EIP\text{-}1559$	0.05	0.04	0.02	-0.03	0.25	0.21	0.15	0.19
	(0.03)	(0.03)	(0.13)	(0.14)	(0.13)*	(0.14)	(0.09)	(0.09)**
$Trade\ Price$	0.16	0.04	1.60	1.51	0.75	0.38	-0.11	0.28
	(0.08)**	(0.09)	(0.33)***	(0.41)***	(0.30)**	(0.41)	(0.19)	(0.22)
$Size$	0.45	0.51	0.90	0.90	0.08	0.25	1.85	1.68
	(0.07)***	(0.07)***	(0.22)***	(0.26)***	(0.31)	(0.30)	(0.21)***	(0.21)***
$Price\ Volatility$		0.13		-1.12		0.41		-0.31
		(0.17)		(0.76)		(0.87)		(0.47)
$Hash\ Rate$		0.26		0.41		0.78		-0.83
		(0.14)*		(0.51)		(0.75)		(0.32)**
R^2	99.17%	99.20%	98.75%	98.78%	99.15%	99.17%	98.80%	98.86%
Adj. R^2	99.13%	99.15%	98.70%	98.70%	99.12%	99.12%	98.75%	98.79%
No. Obs.	120	120	120	120	120	120	120	120

points in the monetary value transferred, equivalent to a contraction of nearly 40%. The number of value-free transactions (Columns 5–6), a proxy for smart contract creation, drops by about 0.62 log-points ($\approx 46\%$), while unconfirmed transactions (Columns 7–8) decrease by roughly 0.58 log-points. These estimates reveal a significant contraction in on-chain activity following EIP-1559, despite the contemporaneous reduction of platform congestion and fee volatility documented earlier. Contrary to Hypothesis 4, the introduction of a semi-uniform price auction and elastic block capacity did not translate into short-run welfare gains, instead, throughput and value creation contracted, albeit alongside lower congestion (fewer unconfirmed transactions).

Table 7 reports analogous estimates for the Merge placebo, shedding more light on the welfare effects of a change in the network consensus mechanism. The coefficient on $Treat \times Post$ for confirmed transactions is negative but not statistically significant (-0.19 in Column 1, -0.03 in Column 2), providing no evidence that the removal of block rewards curtailed transaction counts. In contrast, monetary value transferred rises by 0.48–0.66 log-points (Columns 3–4), an increase of roughly 38%, and value-free transactions climb by about 0.14–0.18 log-points (Columns 5–6). Unconfirmed transactions show a positive but mixed response, with the specification including additional controls (Column 8) yielding a statistically significant increase of 1.65 log-points. Therefore, the Merge did not depress throughput; rather, the value transferred and ancillary activity (e.g., contract creation) expanded modestly, offering little support for Hypothesis 6, which predicted welfare losses from eliminating public subsidies. Instead, the evidence indicates that the subsidy withdrawal left user activity largely intact, while EIP-1559 was associated with a short-run contraction in both transactional volume and value.

Overall, the welfare results highlight a stark asymmetry between price-setting reform and subsidy withdrawal. EIP-1559 is associated with a contraction in both transactional throughput and monetary volume, despite easing congestion. Hence, the semi-uniform auction appears to have traded off lower queuing costs for reduced short-run economic

Table 7: Difference-in-differences OLS regression results for platform welfare over the 60-day window surrounding the PoS implementation using daily aggregates. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are as follows: number of confirmed transactions in models (1-2), monetary value transferred in models (3-4), number of transactions with 0 monetary value in models (5-6), and number of unconfirmed transactions in models (7-8). The interaction term $Event_b \times Treat_b$ measures the impact of the introduction of PoS on the specified dependent variables. The set of control variables are: coin trade price, block size, coin price volatility, and block difficulty. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. Bitcoin blockchain transactions serve as controls. All variables are expressed in logarithmic form. Intercept is omitted for brevity.

PoS								
	No. Tx		Monetary Value		Value-Free Tx		Unconfirmed Tx	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times PoS$	-0.19	-0.03	0.48	0.66	0.14	0.18	0.32	1.97
	(0.27)	(0.22)	(0.12)***	(0.13)***	(0.02)***	(0.02)***	(0.23)	(0.14)***
ETH	7.74	8.57	7.57	7.84	3.23	3.26	2.73	4.12
	(2.25)***	(2.28)***	(1.23)***	(1.19)***	(0.26)***	(0.25)***	(2.65)	(1.71)**
PoS	0.29	0.32	-0.29	-0.29	0.05	0.04	-0.29	-0.33
	(0.18)	(0.19)*	(0.11)***	(0.11)***	(0.02)***	(0.02)**	(0.10)***	(0.09)***
$Trade\ Price$	-0.86	-0.62	-0.61	-0.63	0.30	0.29	1.34	0.72
	(0.76)	(0.79)	(0.42)	(0.46)	(0.08)***	(0.09)***	(0.96)	(0.69)
$Size$	2.23	2.22	1.08	1.07	0.39	0.39	2.03	2.04
	(0.58)***	(0.57)***	(0.27)***	(0.27)***	(0.05)***	(0.05)***	(0.26)***	(0.25)***
$Price\ Volatility$		-3.12		-0.74		-0.04		-2.48
		(2.38)		(0.60)		(0.14)		(1.40)*
R^2	92.19%	92.45%	99.20%	99.21%	99.46%	99.47%	98.12%	98.37%
Adj. R^2	91.85%	91.98%	99.16%	99.16%	99.44%	99.43%	98.04%	98.27%
No. Obs.	120	120	120	120	120	120	120	120

activity, offering limited empirical support for the welfare-enhancing mechanism proposed in Hypothesis 4. This evidence is reinforced by robustness tests on the long-term effects (i.e., Tables 14 and 17 in Appendix C), where even the initial congestion improvements dissipate over time. By contrast, the Merge leaves transaction counts statistically unchanged while increasing the value migrated on-chain and modestly boosting ancillary, low-stake activity. These findings do not corroborate the welfare losses posited by Hypothesis 6; instead, they suggest that a fee-only incentive regime can sustain, and even deepen, economic engagement when validator participation remains robust. These findings address the open question left by Easley et al. (2019), who conjecture that removing block rewards in favor of a purely fee-based incentive scheme could either depress economic activity by weakening miner incentives or enhance welfare by better aligning validator incentives with user demand. Our evidence supports the latter interpretation, indicating that economic engagement can persist and even strengthen, provided validator participation remains responsive and robust.

Taken together, the results imply that auction design exerts first-order influence on utilisation of block space, whereas the reward mix plays a more muted role, with its impact contingent on the elasticity of validator supply. Policymakers seeking to improve blockchain welfare should therefore prioritise (re-)calibrating fee mechanisms and capacity rules, while recognising that subsidy removal need not impede, and may even reallocate economic activity more efficiently, provided fee markets function effectively.

5 Conclusions

This study demonstrates that the microstructure, specifically the pricing and allocation of scarce resources of a blockchain, is an important determinant of decentralized network efficiency and user welfare. This study develops an empirical framework to examine how design choices in decentralized payment networks shape economic outcomes. Leveraging Ethereum's transition through EIP-1559 and later to Proof of Stake, we show how changes in market structure affect transaction costs, validator incentives, and platform throughput. The findings contribute to the market design literature by providing the first causal evidence that the microstructure of decentralized payment networks has measurable welfare implications.

We show that semi-uniform pricing mechanisms, such as those introduced by EIP-1559, can stabilize overall fee volatility but may also increase dispersion and inflation, reflecting heterogeneity in how users bid for transaction priority. This makes the well-known blockchain inefficiency persist. While variable block sizes help alleviate congestion in the very short term, they also shift miner incentives. Under EIP-1559, average revenue per transaction rises, possibly due to distorted miners' incentives to include fewer but larger transactions in the blocks. Following Ethereum's transition to Proof of Stake, the removal of block rewards reduced validator incentives, coinciding with lower on-chain transaction counts. However, the average monetary value of transactions increased, indicating that the remaining activity may reflect more efficient use of block space. In addition, the evidence supports a net welfare improvement, accompanied by markedly lower energy consumption relative to Proof of Work. Benefits not observed under EIP-1559.

These observations align with longstanding insights from traditional finance, where design features such as auction formats, participation incentives, and resource constraints can significantly shape cost dynamics, participation, and overall system welfare. Poorly calibrated fee markets, just like ineffective bond auctions or misaligned equity trading rules, risk limiting throughput and discouraging participation. This ultimately threatens the overall viability of a decentralized payment platform. Conversely, an empirically grounded mechanism design can support more balanced, efficient, and welfare-enhancing policies for fees and rewards.

Looking ahead, decentralized payment protocols can benefit from incorporating theoretical and empirical insights drawn from conventional market design, such as mitigating "winner's curse" effects or aligning fees with welfare externalities. Adaptive block-size rules and flexible subsidies are potential policy levers that may uphold secure operations while preserving affordable access for diverse user groups. Our empirical evidence provides actionable guidance on optimal fee structuring in future blockchain-based payment systems, Layer-2 solutions, and Central Bank Digital Currency (CBDC) implementations. Ultimately, the evolution of Ethereum's fee market and consensus design underscores the importance of rigorous economic analysis and theory in shaping decentralized financial infrastructures. By systematically assessing the welfare consequences of protocol changes, it becomes possible to foster more stable, efficient, and inclusive digital transaction systems.

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A The Ethereum Protocol

Ethereum, launched in 2015, is a decentralized blockchain platform that operates as a public ledger for transactions and smart contracts. Unlike Bitcoin, which was designed primarily as a digital currency for peer-to-peer payment systems, Ethereum also supports programmable transactions and code execution on a global virtual machine (Harvey et al., 2024). Ethereum accounts can initiate transactions that invoke computations on the network's virtual machine, with each computational step costing a unit of "gas." Users pay transaction fees in Ether (ETH), Ethereum's native currency, proportional to the gas used. Historically, under the original design, users specified a gas price (fee per gas unit) and miners prioritized transactions with the highest fees. This first-price auction mechanism often made fees volatile and unpredictable. Block production was handled by a PoW consensus mechanism, similar to Bitcoin: a network of miners expended computational power to solve cryptographic puzzles, thereby proposing the next valid block and earning a block reward along with all included transaction fees. Ethereum blocks are typically spaced 13–14 seconds apart, and under PoW, network security relied on substantial energy consumption. However, this design had well-known inefficiencies – fee auctions led to bid uncertainty and frequent overpayment, while fixed block sizes caused backlogs during surges in demand. These issues motivated protocol-level changes to improve transaction pricing and consensus. In recent years, Ethereum implemented two major upgrades that fundamentally altered its transaction fee market and consensus process: EIP-1559 (a new fee mechanism) and The Merge (transition from PoW to PoS).

We outline these changes and their implications on Ethereum's transaction and consensus layers below.[15] For a comprehensive overview of the Bitcoin blockchain protocol (used as a control), refer to Easley et al. (2019) (Section 3) and Huberman et al. (2021) (Appendix A).

[15]For more information on the Economics of the Ethereum blockchain within the PoS context, see the recent study by John et al. (2025).

A.1 EIP-1559: Transaction Fee Market Reform

EIP-1559 (implemented on August 5, 2021) introduced a new pricing mechanism for Ethereum transactions, overhauling the previous first-price auction system. At its core is a concept called the base fee, a minimum per-gas price that the protocol calculates dynamically for each block. This base fee acts as a reserve price for block space: any transaction must pay at least the base fee (per gas unit) to be considered for inclusion. The base fee is algorithmically adjusted up or down each block based on network demand. If the previous block was above the target gas usage (meaning it was relatively full), the base fee increases slightly; if it was below the target, the base fee decreases. These incremental adjustments make fee levels more predictable from block to block, dampening the volatility users experienced under the first-price auction model. Notably, the base fee portion of fees is removed from circulation ("burned") by the protocol rather than paid to miners. This burn mechanism permanently destroys that part of the transaction fee, reducing the supply of ETH whenever network activity is high.

Under EIP-1559, each block has a target size (e.g. 15 million gas) and a hard maximum size that is double the target (allowing up to $\sim$30 million gas in a single block). This elastic block size scheme lets Ethereum handle transient spikes in demand more gracefully. In times of congestion, blocks can expand to include more transactions, with a corresponding rise in the base fee; during lulls, blocks shrink and the base fee falls. By permitting variable block sizes around a target, EIP-1559 mitigates the delays users previously faced when every block was capped at a fixed gas limit. Users also benefit from simpler fee estimation: digital wallets, such as MetaMask, can more easily auto-set fees by using the posted base fee and a small tip, rather than guessing a competitive bid during volatile periods.

Therefore, EIP-1559 introduced a new transaction format (often called type-0x02 transactions) that explicitly separates the fee a user is willing to pay into two components:

- **Base Fee** – The required minimum fee per gas for inclusion, set by the protocol each block. This fee is burned by the network.

- **Priority Fee (Tip)** – An optional additional fee per gas that a user offers to the block producer as an incentive to prioritize their transaction. This is the only part of the fee that directly rewards the miner/validator; a transaction paying only the base fee is valid but offers no incentive to be picked from the mempool.

Users specify a max fee (a cap on total gas price they are willing to pay) and a priority fee when sending a transaction. The protocol ensures the user pays at most their max fee, with the base fee (burned) plus the priority fee (to the miner) taken out of it. Any difference (if the max was set higher) is refunded to the user. For example, if the base fee is 100 gwei and a user adds a 10 gwei tip, they pay 110 gwei per gas in total; the miner/validator receives 10 gwei and 100 gwei is burned.[16] This mechanism simplifies the user's experience because they don't need to precisely guess the market-clearing price – as long as their max fee covers the base fee, their transaction will eventually be included, and they only lose the small tip to ensure prompt inclusion.

From an economic perspective, EIP-1559 changed the distribution of transaction fees and introduced a form of scarcity to Ethereum's monetary policy. Pre-1559, miners received all gas fees; now they only receive the priority fees, while the base fee is destroyed. This initially provoked concern from miners (since a portion of their potential income was being eliminated), but the protocol's design maintains that miners still earn the fixed block subsidy (the 2 ETH block reward, until the later switch to PoS) plus any tips, which continued to provide substantial incentive to mine. The fee burn, however, means that network usage can directly reduce ETH supply over time. In periods of high demand, a large amount of ETH is burned: for instance, if gas prices average around 100 gwei for

[16] Gwei is a convenient unit used for calculating gas fees, which are the fees paid to miners for processing transactions. Both Gwei and Sats serve as measurement units in cryptocurrencies, with Gwei representing a fraction of Ethereum and Sats corresponding to a fraction of Bitcoin. Specifically, Gwei is a smaller unit than Sats, as one Gwei equals one-billionth of an Ethereum (1 Gwei = 0.000000001 ETH). In contrast, Sats represent the smallest Bitcoin unit, with one Sat being equal to one-hundred-millionth of a Bitcoin (1 Sat = 0.00000001 BTC). In this study, we convert all units in US Dollars for comparability.

many blocks, the burn rate would far exceed new issuance, causing deflation in ETH supply; conversely, in very low demand periods, little is burned and net supply still grows from issuance. Beyond monetary effects, EIP-1559's fee market reform aimed to improve allocative efficiency for transactions. By replacing the blind first-price auction with a protocol-set price (the base fee), the mechanism is more efficient in theory – users pay closer to the true market-clearing price for inclusion without large random deviations.

A.2 The Merge: Transition from Proof-of-Work to Proof-of-Stake

Ethereum's second major change was The Merge (EIP-3675 executed on September 15, 2022), which transitioned the network's consensus mechanism from Proof-of-Work to Proof-of-Stake (PoS). This upgrade fundamentally altered the way blocks are produced and validated, moving Ethereum's consensus layer to a new design while preserving the existing transaction execution layer. The Merge refers to the merging of Ethereum's original PoW Mainnet (execution layer) with the separate PoS Beacon Chain (consensus layer) that had been running in parallel since 2020. Post-Merge, Ethereum no longer relies on miners racing to solve puzzles; instead, network security is enforced by validators – nodes that prove ownership of a stake in ETH and are responsible for proposing and verifying blocks. In practical terms, The Merge eliminated the need for energy-intensive mining and enabled the network to be secured using staked ETH.[17]

Under the new Proof-of-Stake consensus, anyone wishing to participate in block production must deposit a substantial amount of Ether (32 ETH per validator) into a special contract, effectively "staking" it as collateral. Each validator is then enrolled in the PoS protocol which pseudo-randomly selects validators to propose blocks and organizes committees of validators to vote (attest) on the validity of proposed blocks. Time in PoS Ethereum is divided into fixed slots of 12 seconds and epochs of 32 slots (≈ 6.4 minutes). In every slot, one validator is chosen to be the block proposer, and a large committee of

[17] Source: Ethereum website (accessed December 12, 2024).

other validators is assigned to attest to the block's legitimacy (by checking the transactions and state transitions). These votes are aggregated, and if a supermajority of validators attests to a series of recent blocks, the chain reaches finality, meaning those blocks are considered permanently irreversible. If validators try to collude or act dishonestly – for example, by attempting to create two conflicting blocks or censor transactions – the protocol has a built-in penalty mechanism: slashing. Dishonest validators can have a portion of their staked ETH destroyed (forfeited) if they violate the rules. This serves as an economic deterrent, ensuring that validators have strong incentives to uphold the correct chain: any attack would cost the malicious actors their stake, which is far more expensive than any potential short-term gain.

The shift from PoW to PoS brings several structural changes. First, the block production process is now virtually energy-free compared to mining. Ethereum no longer requires the continuous expenditure of electricity to secure the network, resulting in a dramatic 99.95% reduction in energy consumption for block creation. Security in PoS is achieved not by making attacks computationally infeasible (as in PoW), but by making them economically prohibitive – an attacker would need to acquire a majority of staked ETH and risk losing it. Second, block times became more regular (one block per 12-second slot) rather than the probabilistic timing under PoW. This regular cadence, along with the finality gadget, provides a more predictable settlement of transactions (after a few epochs, blocks are final). Third, the block structure and rewards were adjusted: under PoW, each block included a coinbase reward (new ETH issued to the miner, 2 ETH at the time of the Merge) and could include "ommer" (uncle) rewards for near-miss blocks. The Merge deprecated those PoW block rewards. In the PoS regime, new issuance of ETH is handled within the consensus (Beacon Chain) layer rather than by each block's execution. Validators still receive rewards for proposing and attesting to blocks, but these are distributed periodically and are much smaller per block than the old mining reward.

From an economic standpoint, the transition to PoS radically changed Ethereum's issuance and incentive model. Participating in consensus no longer involves investing in power-hungry hardware; instead, the investment is the opportunity cost of locking up 32 ETH and running a validator node. Because operating a validator is not as economically intense and thus does not require or warrant as high a reward as operating a mining rig, Ethereum was able to drastically cut its issuance of new ETH once PoW was turned off. Before the Merge, the network was issuing roughly 13,000 ETH per day to reward miners under PoW (plus about 1,700 ETH per day on the Beacon Chain to reward PoS validators running in parallel). After the Merge, only the PoS issuance remains, which at the time was on the order of 1,600–1,700 ETH per day, given the amount of ETH staked. In other words, Ethereum's annual inflation rate dropped from $\sim 4\%$ to $\sim 0.5\%$, an $\sim 88\%$ reduction in new supply. This dramatic cut (sometimes called the "triple halving" by analogy to Bitcoin's halving events) means that the supply of ETH is now much more constrained. Furthermore, those validator rewards are locked in the consensus layer — validators cannot instantly sell or use their rewards without first exiting or waiting for withdrawal periods (a mechanism introduced shortly after, in the Shanghai upgrade of 2023, to allow phased withdrawal of staking rewards). This adds an additional dampening effect on sell-side pressure compared to PoW, where miners typically had to sell a portion of earned ETH to cover electricity costs.

At the same time, PoS lowered barriers to entry in some respects while raising them in others. On one hand, anyone with 32 ETH (or even less, via pooled staking services) can become a validator without needing specialized hardware, potentially broadening participation. On the other hand, the requirement to lock up a substantial amount of capital means the cost to participate is the opportunity cost of that capital and the technical effort to run a node. Unlike mining, which incurred ongoing external costs (electricity, hardware maintenance), validating mostly incurs capital costs (funds locked and risk of slashing).

B Descriptive Statistics for the Bitcoin Blockchain

Table 8 reports the descriptive statistics for the Bitcoin blockchain control sample.

Table 8: Descriptive statistics for Bitcoin blockchain. This table presents summary statistics based on daily block-by-block data. The upper (lower) panel shows results for the EIP-1559 sample (PoS sample). All variables are in logarithmic terms.

Variables	Mean	Median	Min.	Max.	Std. Dev.	Q1	Q3	No. Obs.
Panel A: EIP-1559								
Fee Dispersion	5.97	5.91	5.49	6.76	0.31	5.73	6.21	60
Fee Inflation	-1.03	-1.06	-1.58	-0.42	0.27	-1.24	-0.83	60
Fee Volatility	2.1	2.1	2.04	2.2	0.04	2.08	2.13	60
Private Fee	1.04	0.95	0.68	1.98	0.29	0.85	1.11	60
Private Base Fee	0	0	0	0	0	0	0	60
Private Tip Fee	1.04	0.95	0.68	1.98	0.29	0.85	1.11	60
Subsidy Fee	6.16	6.13	5.12	7.6	0.48	5.84	6.54	60
Total Fee	6.17	6.14	5.13	7.6	0.47	5.85	6.54	60
Trade Price	10.6	10.63	10.31	10.81	0.17	10.43	10.76	60
Price Volatility	0.01	0	-0.04	0.08	0.03	-0.02	0.03	60
Avg. Turnover	13.09	13.02	12.21	14.37	0.48	12.71	13.45	60
Avg. Size	6.69	6.67	6.46	7.2	0.17	6.55	6.78	60
Hash Rate	35.35	35.36	35.04	35.66	0.13	35.26	35.45	60
No. Tx	12.36	12.38	11.99	12.58	0.14	12.3	12.46	60
No. Unconfirmed Tx	15.21	15.12	14.4	16.58	0.45	14.93	15.53	60
No. Value-Free Tx	5.34	5.46	3.09	6.49	0.58	5.04	5.68	60
Monetary Value	20.26	20.12	19.37	21.69	0.5	19.93	20.59	60
Size	13.83	13.85	13.55	14.08	0.16	13.72	13.96	60
Panel B: PoS								
Fee Dispersion	4.48	4.5	3.79	5.31	0.31	4.28	4.66	60
Fee Inflation	-2.65	-2.64	-3.02	-2.09	0.23	-2.84	-2.51	60
Fee Volatility	2.02	2.03	1.96	2.08	0.03	2	2.05	60
Private Fee	-0.01	0.04	-0.63	0.82	0.26	-0.14	0.15	60
Private Base Fee	0	0	0	0	0	0	0	60
Private Tip Fee	-0.01	0.04	-0.63	0.82	0.26	-0.14	0.15	60
Subsidy Fee	5.38	5.42	4.33	6.52	0.51	5.06	5.7	60
Total Fee	5.38	5.42	4.35	6.52	0.51	5.07	5.7	60
Trade Price	9.91	9.9	9.82	10.09	0.06	9.87	9.93	60
Price Volatility	0	-0.01	-0.1	0.1	0.03	-0.01	0.01	60
Avg. Turnover	12.23	12.27	11.57	13.01	0.38	11.94	12.52	60
Avg. Size	6.72	6.7	6.52	7.05	0.12	6.63	6.79	60
Hash Rate	36.08	36.08	35.83	36.28	0.11	35.99	36.15	60
No. Tx	12.45	12.47	12.22	12.58	0.09	12.41	12.51	60
No. Unconfirmed Tx	15.19	15.36	11.58	16.23	0.93	15.05	15.63	60
No. Value-Free Tx	6.66	6.68	5.44	7.56	0.48	6.43	6.96	60
Monetary Value	19.77	19.83	18.81	20.61	0.46	19.41	20.17	60
Size	13.95	13.96	13.67	14.21	0.14	13.86	14.05	60

C Robustness Tests

We conduct a series of tests using both shorter (40-day) and long-term (80- and 810-day) windows surrounding the EIP-1559 event. Tables 9, 10, and 11 report the results for the short period of 40 days. Tables 12, 13, and 14 report the findings for the longer period of 80 days. To avoid overlap between the EIP-1559 and PoS event windows, tables 15, 16, and 17 report results for the longest feasible period, ending 405 days after EIP-1559, when Ethereum transitioned to the PoS consensus mechanism.

Table 9: Difference-in-differences OLS regression results for users' trading costs surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the fee dispersion for models (1-2), the fee inflation for models (3-4), the fee volatility for models (5-6), and the overall private fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 40 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Users' Transaction Costs								
	Fee Dispersion		Fee Inflation		Fee Volatility		Private Fee	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	0.4752	0.4940	0.6123	0.5733	-0.1403	-0.1327	0.4868	0.4841
	(0.1422)***	(0.1414)***	(0.1724)***	(0.2069)***	(0.0115)***	(0.0117)***	(0.1540)***	(0.1601)***
ETH	1.9408	-27.2891	5.2474	-0.8024	-0.7020	-2.0479	5.7573	2.9150
	(0.9467)**	(15.9417)*	(1.2139)***	(16.8135)	(0.0772)***	(1.0225)**	(1.0169)***	(11.7869)
EIP-1559	-0.2143	-0.1871	-0.3352	-0.3153	-0.0115	-0.0121	-0.2560	-0.2656
	(0.1096)*	(0.1079)*	(0.1259)***	(0.1344)**	(0.0090)	(0.0097)	(0.1044)**	(0.1003)**
$Trade\ Price$	1.2446	1.4527	1.6715	1.7613	-0.0179	-0.0119	1.7281	1.6449
	(0.3218)***	(0.3931)***	(0.4540)***	(0.5456)***	(0.0318)	(0.0349)	(0.3904)***	(0.4405)***
$Price\ Volatility$	-0.4056	0.0617	1.8364	1.8785	-0.0558	-0.0396	0.3141	0.7960
	(0.5848)	(0.5467)	(0.7972)**	(0.8137)**	(0.0738)	(0.0749)	(0.6769)	(0.6681)
$Avg.\ Size$	0.3606	0.3884	0.2730	0.3190	0.0072	0.0011	0.4047	0.4361
	(0.2583)	(0.2763)	(0.2242)	(0.2493)	(0.0166)	(0.0172)	(0.2243)*	(0.1915)**
$Avg.\ Turnover$	-0.2205	-0.1437	-0.2248	-0.1861	-0.0200	-0.0242	-0.1877	-0.0509
	(0.1167)*	(0.1167)	(0.0990)**	(0.1417)	(0.0105)*	(0.0100)**	(0.1081)*	(0.1298)
$Hash\ Rate$		-1.2823		-0.3191		-0.0489		-0.1830
		(0.7677)*		(0.8434)		(0.0497)		(0.5833)
Tx		1.1249		0.0576		0.0646		0.5066
		(0.4520)**		(0.5362)		(0.0354)*		(0.4624)
$Unconfirmed\ Tx$		-0.0294		-0.0562		0.0014		0.1757
		(0.1656)		(0.1999)		(0.0116)		(0.1706)
$ValueFree\ Tx$		-0.0321		-0.0636		0.0177		-0.3242
		(0.1218)		(0.1390)		(0.0111)		(0.1433)**
R^2	73.69%	79.39%	86.54%	86.60%	99.53%	99.62%	90.04%	90.78%
Adj. R^2	71.13%	76.06%	85.23%	84.43%	99.48%	99.56%	89.07%	89.28%
No. Obs.	80	80	80	80	80	80	80	80

Table 10: Difference-in-differences OLS regression results for token holders' and miners' revenues surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 40 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Token Holders' & Validators' Earnings								
	Private Base Fee		Private Tip Fee		Public Subsidy		Total Fee Reward	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	2.6317	2.5993	-0.7377	-0.7204	0.7459	0.7540	0.5396	0.5427
	(0.0579)***	(0.0604)***	(0.1879)***	(0.2010)***	(0.1610)***	(0.1527)***	(0.1611)***	(0.1518)***
ETH	0.7164	-5.6991	5.3827	8.7480	0.7168	56.1674	1.5742	55.1632
	(0.3392)**	(3.4730)	(1.1517)***	(13.1868)	(1.0779)	(18.6483)***	(1.0599)	(18.2552)***
EIP-1559	-0.0568	-0.0382	-0.2229	-0.2490	-0.1118	-0.1731	-0.1697	-0.2271
	(0.0301)*	(0.0301)	(0.1135)*	(0.1081)**	(0.1724)	(0.1586)	(0.1696)	(0.1563)
$Trade\ Price$	0.2432	0.3428	1.5972	1.4490	1.1847	0.7049	1.4296	0.9550
	(0.1429)*	(0.1767)*	(0.4568)***	(0.5189)***	(0.3985)***	(0.2900)**	(0.3886)***	(0.2786)***
$Price\ Volatility$	0.3070	0.3331	0.7674	1.2311	0.6845	-0.2011	0.7483	-0.0972
	(0.4653)	(0.4952)	(1.1114)	(1.1156)	(0.8887)	(0.8490)	(0.8640)	(0.8167)
$Avg.\ Size$	0.2033	0.2345	0.4466	0.4329	0.1300	0.0882	0.1250	0.1030
	(0.1028)*	(0.1280)*	(0.2608)*	(0.2270)*	(0.4040)	(0.3352)	(0.4023)	(0.3355)
$Avg.\ Turnover$	-0.0359	-0.0115	-0.1992	-0.0853	-0.0138	-0.1746	-0.0320	-0.1746
	(0.0464)	(0.0720)	(0.1192)*	(0.1451)	(0.1243)	(0.1071)	(0.1222)	(0.1074)
$Hash\ Rate$		-0.3216		0.1186		2.4793		2.3848
		(0.1734)*		(0.6492)		(0.8780)***		(0.8600)***
Tx		0.0320		0.3170		-1.7303		-1.6106
		(0.2338)		(0.4806)		(0.4064)***		(0.4192)***
$Unconfirmed\ Tx$		-0.0494		0.2621		-0.0050		-0.0246
		(0.0552)		(0.1786)		(0.1466)		(0.1482)
$ValueFree\ Tx$		-0.0266		-0.3017		0.1023		0.0678
		(0.0649)		(0.1460)**		(0.1206)		(0.1175)
R^2	98.64%	98.66%	69.36%	70.87%	93.20%	96.39%	92.20%	95.72%
Adj. R^2	98.51%	98.45%	66.38%	66.15%	92.54%	95.81%	91.44%	95.03%
No. Obs.	80	80	80	80	80	80	80	80

Table 11: Difference-in-differences OLS regression results for platform welfare surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 40 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

EIP-1559								
	No. Tx		Monetary Value		Value-Free Tx		Unconfirmed Tx	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	-0.1858	-0.1732	-0.1809	-0.1534	-0.3399	-0.2939	-0.3473	-0.3797
	(0.0344)***	(0.0298)***	(0.1442)	(0.1497)	(0.1245)***	(0.1219)**	(0.0824)***	(0.0800)***
ETH	3.5950	12.7542	0.5465	15.0103	11.4379	42.9265	8.2733	-11.0191
	(0.3260)***	(3.4424)***	(1.2182)	(14.1793)	(1.0716)***	(10.5292)***	(0.9133)***	(8.3151)
EIP-1559	0.0275	0.0127	-0.1134	-0.1431	0.0064	-0.0466	0.0942	0.1303
	(0.0323)	(0.0291)	(0.1307)	(0.1364)	(0.1022)	(0.1046)	(0.0900)	(0.0869)
$Trade\ Price$	0.1211	-0.0757	1.2068	0.9554	0.3432	-0.3116	-0.1446	0.2230
	(0.0823)	(0.0764)	(0.3529)***	(0.4798)*	(0.2446)	(0.2962)	(0.1656)	(0.2210)
$Size$	0.5666	0.6953	0.9672	1.0628	0.9630	1.3660	1.6567	1.4707
	(0.0817)***	(0.0830)***	(0.2577)***	(0.3732)***	(0.3048)***	(0.3129)***	(0.2479)***	(0.2487)***
$Price\ Volatility$		0.4124		-0.5699		0.9695		0.0975
		(0.1998)**		(0.9437)		(0.6220)		(0.5083)
$Hash\ Rate$		0.4200		0.6689		1.4460		-0.8891
		(0.1549)***		(0.6463)		(0.4802)***		(0.3812)**
R^2	99.35%	99.45%	98.96%	98.98%	99.64%	99.68%	99.27%	99.32%
Adj. R^2	99.31%	99.39%	98.89%	98.89%	99.61%	99.65%	99.22%	99.25%
No. Obs.	80	80	80	80	80	80	80	80

Table 12: Difference-in-differences OLS regression results for users' trading costs surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the fee dispersion for models (1-2), the fee inflation for models (3-4), the fee volatility for models (5-6), and the overall private fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 80 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Users' Transaction Costs								
	Fee Dispersion		Fee Inflation		Fee Volatility		Private Fee	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	1.0352	0.9319	1.2029	1.0693	-0.1334	-0.1401	1.2968	1.0984
	(0.1461)***	(0.1300)***	(0.1594)***	(0.1644)***	(0.0099)***	(0.0098)***	(0.1823)***	(0.1497)***
ETH	3.6019	-7.7577	6.1251	16.6514	-0.8543	-3.6465	6.2554	12.0770
	(1.0225)***	(8.2080)	(1.1431)***	(7.9674)**	(0.0746)***	(0.6600)***	(1.2097)***	(7.3270)
EIP-1559	-0.6819	-0.5370	-0.6652	-0.5634	-0.0135	-0.0026	-0.7812	-0.5862
	(0.1633)***	(0.1236)***	(0.1487)***	(0.1340)***	(0.0087)	(0.0084)	(0.1805)***	(0.1252)***
$Trade\ Price$	2.0205	1.9778	1.9807	1.7884	-0.0687	-0.0321	2.1376	1.8394
	(0.3699)***	(0.3396)***	(0.4175)***	(0.4054)***	(0.0292)**	(0.0309)	(0.4393)***	(0.3816)***
$Price\ Volatility$	-0.9740	-0.5204	0.2821	0.5359	0.0011	-0.0020	-0.6385	-0.0522
	(0.7428)	(0.6768)	(0.8797)	(0.8337)	(0.0499)	(0.0486)	(0.8787)	(0.7744)
$Avg.\ Size$	0.5065	0.3913	0.6282	0.4605	0.0314	0.0311	0.7907	0.5480
	(0.2046)**	(0.1447)***	(0.1632)***	(0.1468)***	(0.0131)**	(0.0106)***	(0.2346)***	(0.1553)***
$Avg.\ Turnover$	-0.2672	-0.0326	-0.1853	-0.0363	-0.0237	-0.0072	-0.2741	0.0456
	(0.0937)***	(0.0872)	(0.0849)**	(0.1003)	(0.0063)***	(0.0066)	(0.1043)***	(0.0981)
$Hash\ Rate$		-0.5298		0.3930		-0.1334		0.1652
		(0.3906)		(0.3810)		(0.0322)***		(0.3457)
Tx		0.6775		-0.2742		0.0877		0.2648
		(0.2945)**		(0.3024)		(0.0255)***		(0.2798)
$Unconfirmed\ Tx$		0.2341		0.1115		-0.0062		0.2504
		(0.0466)***		(0.0472)**		(0.0045)		(0.0455)***
$ValueFree\ Tx$		-0.2164		-0.2204		-0.0175		-0.4038
		(0.0746)***		(0.0778)***		(0.0066)***		(0.0710)***
R^2	73.91%	83.72%	84.90%	86.89%	99.44%	99.56%	80.74%	88.25%
Adj. R^2	72.71%	82.51%	84.20%	85.92%	99.42%	99.52%	79.85%	87.38%
No. Obs.	160	160	160	160	160	160	160	160

Table 13: Difference-in-differences OLS regression results for token holders' and miners' revenues surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 80 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Token Holders' & Validators' Earnings								
	Private Base Fee		Private Tip Fee		Public Subsidy		Total Fee Reward	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	2.9277	2.9064	-0.0481	-0.2449	0.4525	0.5568	0.3210	0.4234
	(0.1011)***	(0.1017)***	(0.1978)	(0.1697)	(0.1591)***	(0.1142)***	(0.1533)**	(0.1096)***
ETH	3.5695	9.5158	4.3317	4.2425	0.6602	33.7187	1.3514	35.7821
	(0.7768)***	(3.7540)**	(1.3753)***	(8.2268)	(0.9417)	(7.2088)***	(0.8963)	(6.9503)***
EIP-1559	-0.3647	-0.3607	-0.5835	-0.3796	0.1700	-0.0097	0.1038	-0.0724
	(0.0894)***	(0.0889)***	(0.1833)***	(0.1311)***	(0.1662)	(0.1351)	(0.1593)	(0.1311)
$Trade\ Price$	1.1945	1.1299	1.4427	1.2273	0.8578	0.5485	1.0490	0.6954
	(0.2813)***	(0.2914)***	(0.4974)***	(0.4542)***	(0.3382)**	(0.2370)**	(0.3193)***	(0.2202)***
$Price\ Volatility$	-0.8904	-0.8793	0.3411	0.9010	0.6854	0.2890	0.7302	0.3828
	(0.6674)	(0.6610)	(0.8801)	(0.7967)	(0.6437)	(0.4572)	(0.6105)	(0.4245)
$Avg.\ Size$	0.1736	0.1406	0.7649	0.5376	-0.0934	-0.0093	-0.0575	0.0191
	(0.0916)*	(0.0916)	(0.2346)***	(0.1581)***	(0.2401)	(0.1705)	(0.2326)	(0.1644)
$Avg.\ Turnover$	0.0231	0.0242	-0.2622	0.0705	0.1621	-0.0816	0.1495	-0.0832
	(0.0399)	(0.0522)	(0.1076)**	(0.1088)	(0.0828)*	(0.0714)	(0.0792)*	(0.0702)
$Hash\ Rate$		0.2511		-0.1043		1.4872		1.5537
		(0.1676)		(0.3929)		(0.3348)***		(0.3226)***
Tx		-0.2268		0.4368		-0.9783		-0.9530
		(0.1385)		(0.2908)		(0.2306)***		(0.2249)***
$Unconfirmed\ Tx$		0.0048		0.2340		-0.2845		-0.2624
		(0.0213)		(0.0480)***		(0.0429)***		(0.0416)***
$ValueFree\ Tx$		-0.0222		-0.4085		0.1299		0.1175
		(0.0323)		(0.0746)***		(0.0654)**		(0.0635)*
R^2	96.73%	96.77%	41.45%	60.56%	88.83%	95.33%	88.32%	95.08%
Adj. R^2	96.58%	96.53%	38.75%	57.63%	88.32%	94.99%	87.78%	94.71%
No. Obs.	160	160	160	160	160	160	160	160

Table 14: Difference-in-differences OLS regression results for platform welfare surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 80 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

EIP-1559								
	No. Tx		Monetary Value		Value-Free Tx		Unconfirmed Tx	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	-0.2470	-0.2325	-0.6688	-0.6555	-0.5774	-0.5411	-0.6975	-0.7291
	(0.0324)***	(0.0313)***	(0.1253)***	(0.1268)***	(0.1412)***	(0.1473)***	(0.1156)***	(0.1106)***
ETH	3.0652	16.0303	0.1202	9.6903	6.8874	38.4756	12.8671	-14.7842
	(0.2786)***	(4.4444)***	(0.9695)	(10.3458)	(1.3158)***	(11.3952)***	(1.3528)***	(8.1517)*
EIP-1559	0.0807	0.0319	0.3139	0.2522	0.5816	0.4536	-0.1320	-0.0215
	(0.0328)**	(0.0359)	(0.1444)**	(0.1455)*	(0.1660)***	(0.1740)**	(0.1438)	(0.1414)
$Trade\ Price$	0.2187	-0.0815	1.1478	1.0146	0.5924	-0.1076	-0.0926	0.5258
	(0.0802)***	(0.1062)	(0.3084)***	(0.3954)**	(0.3448)*	(0.4092)	(0.2980)	(0.3243)
$Size$	0.2469	0.4024	0.8015	0.8731	-1.1300	-0.7664	3.3080	2.9870
	(0.0875)***	(0.0629)***	(0.1939)***	(0.2368)***	(0.3645)***	(0.3650)**	(0.3657)***	(0.3619)***
$Price\ Volatility$		0.1507		-0.9609		-0.0130		-0.0564
		(0.1592)		(0.5962)		(0.7645)		(0.7845)
$Hash\ Rate$		0.5997		0.4372		1.4593		-1.2777
		(0.2065)***		(0.4769)		(0.5285)***		(0.3726)***
R^2	98.63%	98.89%	98.52%	98.56%	98.71%	98.78%	95.13%	95.36%
Adj. R^2	98.59%	98.84%	98.47%	98.49%	98.67%	98.72%	94.97%	95.14%
No. Obs.	160	160	160	160	160	160	160	160

Table 15: Difference-in-differences OLS regression results for users' trading costs surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the fee dispersion for models (1-2), the fee inflation for models (3-4), the fee volatility for models (5-6), and the overall private fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 810 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Users' Transaction Costs								
	Fee Dispersion		Fee Inflation		Fee Volatility		Private Fee	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP\text{-}1559$	2.2289	1.5795	1.9725	1.5744	-0.0745	-0.0937	2.1761	1.3885
	(0.0866)***	(0.0858)***	(0.0830)***	(0.0868)***	(0.0061)***	(0.0067)***	(0.1020)***	(0.1038)***
ETH	0.9437	-12.9414	3.7476	-7.3750	-0.6402	-1.2289	2.9223	-6.9392
	(0.1086)***	(1.4743)***	(0.1123)***	(1.5290)***	(0.0081)***	(0.1281)***	(0.1244)***	(1.7735)***
$EIP\text{-}1559$	-1.8782	-0.9422	-1.6151	-0.8970	-0.0854	-0.0574	-1.8834	-0.9033
	(0.0487)***	(0.0651)***	(0.0410)***	(0.0623)***	(0.0033)***	(0.0051)***	(0.0547)***	(0.0747)***
$Trade\ Price$	0.9308	0.9776	0.9330	1.0697	-0.0295	-0.0372	1.0125	0.9991
	(0.0428)***	(0.0403)***	(0.0417)***	(0.0429)***	(0.0030)***	(0.0034)***	(0.0491)***	(0.0491)***
$Price\ Volatility$	-0.0708	-0.4419	-0.2232	-0.4078	0.0321	0.0293	-0.1450	-0.4675
	(0.2762)	(0.2475)*	(0.2789)	(0.2587)	(0.0199)	(0.0207)	(0.3271)	(0.3088)
$Avg.\ Size$	-0.6084	-0.1494	-0.3561	-0.0851	0.0347	0.0470	-0.5950	-0.2202
	(0.0608)***	(0.0530)***	(0.0634)***	(0.0586)	(0.0048)***	(0.0055)***	(0.0753)***	(0.0669)***
$Avg.\ Turnover$	0.2367	0.2625	0.2354	0.2585	0.0077	0.0067	0.1804	0.2138
	(0.0366)***	(0.0343)***	(0.0335)***	(0.0356)***	(0.0024)***	(0.0028)**	(0.0421)***	(0.0416)***
$Hash\ Rate$		-0.6033		-0.5521		-0.0239		-0.4302
		(0.0603)***		(0.0629)***		(0.0055)***		(0.0722)***
Tx		1.0409		0.2687		0.0383		0.8483
		(0.1071)***		(0.1041)***		(0.0103)***		(0.1279)***
$Unconfirmed\ Tx$		0.2173		0.1095		0.0036		0.2630
		(0.0272)***		(0.0209)***		(0.0019)*		(0.0329)***
$ValueFree\ Tx$		-0.1233		-0.1486		-0.0023		-0.1322
		(0.0202)***		(0.0196)***		(0.0016)		(0.0236)***
R^2	82.24%	83.31%	85.37%	88.88%	98.70%	98.84%	76.53%	81.28%
Adj. R^2	82.16%	83.18%	85.31%	88.79%	98.69%	98.83%	76.43%	81.14%
No. Obs.	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620

Table 16: Difference-in-differences OLS regression results for token holders' and miners' revenues surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 810 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

Token Holders' & Validators' Earnings	Private Base Fee		Private Tip Fee		Public Subsidy		Total Fee Reward	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	2.9431	3.2483	0.3011	-0.5106	-0.4876	0.0481	-0.5981	-0.1697
	(0.0668)***	(0.0698)***	(0.1016)***	(0.1032)***	(0.0645)***	(0.0675)	(0.0614)***	(0.0670)**
ETH	0.0933	-10.6043	2.8269	-10.2068	1.8177	13.4717	1.9688	11.1225
	(0.0540)*	(1.2665)***	(0.1223)***	(1.8821)***	(0.0651)***	(1.1824)***	(0.0605)***	(1.1781)***
EIP-1559	-0.1071	-0.1937	-1.8621	-0.8039	0.7906	0.0997	0.6700	0.1196
	(0.0281)***	(0.0460)***	(0.0532)***	(0.0737)***	(0.0454)***	(0.0591)*	(0.0435)***	(0.0576)**
$Trade\ Price$	0.2229	0.4567	0.9654	0.9351	1.0747	1.1381	1.0175	1.0982
	(0.0345)***	(0.0472)***	(0.0472)***	(0.0449)***	(0.0260)***	(0.0238)***	(0.0261)***	(0.0242)***
$Price\ Volatility$	-0.3719	-0.6448	0.2477	-0.0560	-0.2724	0.0448	-0.1669	0.1072
	(0.2594)	(0.2619)**	(0.3220)	(0.2966)	(0.1716)	(0.1392)	(0.1641)	(0.1376)
$Avg.\ Size$	-0.6723	-0.3747	-0.5360	-0.1432	0.3454	-0.0423	0.2234	-0.1225
	(0.0568)***	(0.0494)***	(0.0728)***	(0.0642)**	(0.0438)***	(0.0458)	(0.0425)***	(0.0471)***
$Avg.\ Turnover$	0.0384	-0.0004	0.1783	0.2009	-0.0088	-0.0171	0.0480	0.0141
	(0.0295)	(0.0381)	(0.0401)***	(0.0378)***	(0.0257)	(0.0211)	(0.0251)*	(0.0212)
$Hash\ Rate$		-0.4441		-0.5701		0.4384		0.3273
		(0.0529)***		(0.0778)***		(0.0494)***		(0.0495)***
Tx		0.8263		0.7870		-0.9783		-0.9347
		(0.0951)***		(0.1236)***		(0.0962)***		(0.0962)***
$Unconfirmed\ Tx$		-0.1024		0.2825		-0.2807		-0.2516
		(0.0155)***		(0.0334)***		(0.0258)***		(0.0234)***
$ValueFree\ Tx$		0.0295		-0.1299		0.0057		-0.0055
		(0.0160)*		(0.0231)***		(0.0171)		(0.0163)
R^2	87.34%	88.42%	72.11%	79.86%	93.66%	93.87%	92.99%	92.91%
Adj. R^2	87.29%	88.33%	71.99%	79.70%	93.64%	93.82%	92.96%	92.86%
No. Obs.	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620

Table 17: Difference-in-differences OLS regression results for platform welfare surrounding EIP-1559. This table presents the OLS regression results of the DiD analysis for the baseline case with control variables according to Eq. 6:

$$y_b = \beta_0 + \beta_1 Event_b + \beta_2 Treat_b + \beta_3 Event_b \times Treat_b + \beta_4 Controls_b + \epsilon_{cb}$$

The dependent variables are the base fee for models (1-2), the priority tip fee for models (3-4), the public subsidy for models (5-6), and the overall total fee for models (7-8). The table reports the interaction term $Event_b \times Treat_b$ measuring the impact of the introduction of EIP-1559 at the Ethereum blockchain on the dependent variables. The set of control variables is: coin trade price, coin price volatility, average transaction size, average transaction turnover, block difficulty, number of transactions, confirmed, unconfirmed, and with 0 monetary value. White's robust standard errors are in parentheses. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. 810 days surrounding the event. Daily aggregates. Bitcoin blockchain transactions as a control sample. All variables are in logarithmic terms. Intercept is omitted for brevity.

EIP-1559								
	No. Tx		Monetary Value		Value-Free Tx		Unconfirmed Tx	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ETH \times EIP$-1559	-0.1222	-0.1263	-1.7678	-1.7592	-3.0335	-3.0308	0.0675	0.0768
	(0.0229)***	(0.0231)***	(0.0722)***	(0.0710)***	(0.1225)***	(0.1221)***	(0.1182)	(0.1177)
ETH	2.4139	4.2992	-0.1874	-4.9075	9.2409	11.0280	10.2428	3.1618
	(0.0886)***	(0.4309)***	(0.2759)	(1.1051)***	(0.4488)***	(1.7054)***	(0.4797)***	(2.1643)
EIP-1559	-0.0987	-0.1240	0.7325	0.7975	3.0595	3.0281	-1.4045	-1.2888
	(0.0110)***	(0.0109)***	(0.0301)***	(0.0332)***	(0.0678)***	(0.0682)***	(0.0621)***	(0.0624)***
$Trade\ Price$	0.0191	0.0021	1.0339	1.0759	-0.0530	-0.0669	0.1963	0.2139
	(0.0053)***	(0.0069)	(0.0182)***	(0.0209)***	(0.0294)*	(0.0365)*	(0.0384)***	(0.0391)***
$Size$	0.2753	0.2136	0.5582	0.7162	-0.2078	-0.2810	2.3763	2.5609
	(0.0282)***	(0.0344)***	(0.0843)***	(0.0876)***	(0.1456)	(0.1559)*	(0.1422)***	(0.1515)***
$Price\ Volatility$		0.3399		-0.6297		-0.6241		0.5459
		(0.0666)***		(0.2580)**		(0.3005)**		(0.3556)
$Hash\ Rate$		0.0934		-0.2342		0.0903		-0.3400
		(0.0217)***		(0.0525)***		(0.0830)		(0.1020)***
R^2	97.52%	97.61%	98.22%	98.24%	98.08%	98.08%	87.04%	87.20%
Adj. R^2	97.51%	97.60%	98.21%	98.24%	98.07%	98.08%	87.00%	87.14%
No. Obs.	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620