Ebisu Risk Assessment & Parameter Recommendations

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1 Introduction

This report provides a comprehensive risk assessment for Ebisu, a CDP lending protocol forked from Liquity V2. Ebisu allows users to deposit collateral such as LRTs and blue-chip crypto assets on the Ethereum mainnet to mint ebUSD, a stablecoin designed to maintain a $1 USD peg. The primary objective of this assessment is to evaluate the protocol's resilience and identify potential vulnerabilities, with the overarching goal of ensuring Ebisu remains solvent under varying market conditions. Through this analysis, we aim to provide recommendations for optimizing protocol parameters that balance user incentives while minimizing the risk of insolvency.

1.1 System Overview

Ebisu is a decentralized CDP lending protocol allowing users to deposit crypto assets as collateral to mint ebUSD, a stablecoin designed to maintain a $1 USD peg. Like Liquity V2, Ebisu implements user-set interest rates, enabling borrowers to adjust their rates based on market conditions and risk of redemption. Redemptions allow users to exchange 1 ebUSD for $1 worth of collateral. This helps maintain the ebUSD peg by creating arbitrage opportunities whenever ebUSD deviates below $1. Redemptions are ordered by smallest interest rate first, so users with lower set rates are prioritized. Users wanting to avoid redemption are incentivized to set higher interest rates, and the the adjustment of this rate can be delegated to a trusted third party (likely a bot) so users don't have to continuously monitor the market.

A key mechanism is the Stability Pool, a reserve of ebUSD supplied by depositors that absorbs undercollateralized positions. When a borrower's collateral falls below the minimum required threshold, liquidations are triggered. The Stability Pool covers the debt in exchange for receiving the liquidated collateral, rewarding depositors with both collateral gains and a share of the interest paid by borrowers. Depositors receive 75% of interest earned by the protocol, with the other 25% going to liquitity incentives for ebUSD in liquidity pools on DEXs like Curve or Uniswap.

If the Stability Pool is depleted and liquidations still occur, external Just-In-Time (JIT) liquidators can profit from liquidating risky positions. As a final fallback, Ebisu redistributes the debt and collateral of liquidated positions proportionally among the remaining borrowers (redistribution).

Ultimately, the protocol's primary risk is accumulating bad debt when liquidations become unprofitable under conditions of low liquidity or extreme market moves. This report evaluates each asset's risk profile and provides recommendations for optimizing parameters to ensure Ebisu remains solvent.

2 Collateral Management (Non-parameters)

This section outlines the assets initially integrated into Ebisu and highlights the primary risk vectors specific to each asset. The goal is to provide a comprehensive understanding of the risks associated with each asset, allowing informed decision-making.

2.1 Monitoring Metrics for All Assets

2.1.1 DEX Exit Liquidity

Collateral assets in a lending protocol secure the loans issued to borrowers. Adverse market conditions, such as economic downturns or sudden shifts in sentiment, can lead to widespread liquidations if collateral values drop below required thresholds. Liquidators then sell these assets on decentralized exchanges (DEXs) to recover loaned funds, making the depth of DEX liquidity a vital factor. During market stress, a surge of liquidations can flood DEXs with sell orders. If liquidity is shallow, large sales overwhelm available buyers, causing significant slippage, where the execution price deviates sharply from the intended price. This reduces the funds recovered, potentially creating bad debt. For instance, if slippage causes a liquidator to recover only $920,000 from selling $1 million of collateral, they may find the liquidation unprofitable and choose not to proceed, leaving the position unliquidated and forcing the protocol to absorb the $80,000 shortfall as bad debt.

This initial price drop can also trigger further liquidations as other borrowers' collateral values decline, amplifying selling pressure in a vicious cycle. Since all lending protocols share the same DEX liquidity pools, simultaneous liquidations across multiple platforms can strain these resources, risking a market-wide liquidity crisis. Monitoring DEX exit liquidity helps Ebisu assess whether secondary markets can absorb liquidation volumes without destabilizing prices.

The Liquidity Score (LS) quantifies the risk that a forced liquidation could have a detrimental impact on market prices. It does so by comparing the simulated slippage incurred during a large sale to an acceptable slippage threshold (Slippage Tolerance), and then adjusting that ratio by the proportion of the asset's collateral-at-risk to the aggregate exit liquidity available on DEXs. A lower LS (below 1) implies that the available liquidity is adequate to absorb the liquidation without causing excessive price impact.

$$\text{LS} = \frac{\text{Simulated Slippage}}{\text{Slippage Tolerance}} \tag{1}$$

- **Simulated Slippage:** Slippage from liquidating collateral-at-risk across entire lending market for a particular asset. Can be calculated using DEX aggregators.
- **Slippage Tolerance:** A threshold (e.g., 4%) considered acceptable.
- **Collateral-at-Risk:** Positions at risk of liquidation given a 20% downward price shock.

2.1.2 Smart Contract Vulnerability

Smart contracts form the backbone of collateral assets in a lending protocol. A vulnerability in these contracts, whether in Ebisu's code or a supported asset's, poses an immediate risk to user funds and operations. A bug or exploit could allow attackers to drain funds, manipulate prices, or disrupt lending processes. If an exploit is found, the protocol should pause all borrowing to prevent new loans from using the compromised asset, limiting exposure. If the issue remains unresolved after 7 days, the asset should be considered to be delisted to eliminate ongoing risk. Clear communication with users about these steps maintains transparency.

2.1.3 Oracle Failure

Oracles provide price feeds that determine collateral valuations, loan-to-value ratios, and liquidation triggers in a lending protocol. A failure in these feeds, whether from inaccurate pricing or stalled updates, can distort these calculations and threaten the protocol's health. If an oracle's price deviates significantly from the spot market, say by more than 2%, collateral may be misvalued. Overvaluation risks undercollateralized loans persisting, while undervaluation triggers unnecessary liquidations. If an oracle stops updating for over an hour, the protocol relies on outdated data, which can lead to mispricing

during volatile markets, failing to liquidate loans when needed or liquidating healthy ones. Such failures can disrupt all loans tied to the affected asset, especially during high market activity.

Ebisu should continuously compare oracle prices to spot market prices via DEX aggregators and monitor feed update frequency. If the price deviates by more than 2% or the feed stalls for longer than the heartbeat period, borrowing should pause to avoid transactions based on faulty data. The protocol should switch to backup oracle providers, if available, and resume borrowing only after the issue is resolved. Agreements with multiple oracle providers ensure redundancy and minimize downtime. Swift action on oracle failures prevents mispriced transactions and protects the ecosystem.

2.1.4 Price Volatility

Collateral assets with high price volatility increase the risk of loans becoming undercollateralized, triggering liquidations that can cause significant slippage, leading to bad debt for the protocol and straining secondary market liquidity. Monitoring volatility helps Ebisu anticipate and manage these risks. A price swing of more than 10% in 24 hours can erode collateral values.

Ebisu should track 24-hour price swings and multi-day trends using DEX or aggregator data. For a swing exceeding 10% in 24 hours, the risk team should review collateral at risk and assess liquidation capacity to ensure the protocol can handle sell-offs. If volatility persists for three days, the team should evaluate exposure and consider pausing borrows or even raising the MCR to reduce risk, notifying borrowers to allow adjustments.

2.1.5 Trading Volume

Trading volume reflects an asset's liquidity and market activity, impacting its viability as collateral. Low volume signals difficulties in liquidating assets during stress, increasing bad debt risk. Persistent volume below $1 million for seven consecutive days indicates insufficient market depth to absorb sales without significant price impact. A sustained drop may also reflect waning interest or underlying issues, compromising reliability.

Ebisu should aggregate daily volume across major DEXs. If volume falls below $1 million for seven days, the protocol should prepare to delist the asset, notifying users and winding down exposure. Borrowers should get a grace period to replace low-volume collateral, minimizing disruption. Delisting illiquid assets avoids unmanageable liquidations.

2.1.6 Table View

Below is a summary of the key monitoring metrics, trigger thresholds, and recommended actions in a table format for daily operational reference.

Monitoring Metric	Trigger Threshold	Action	Rationale
Price Volatility	$> 10\%$ swing in a 24hr period	Risk team reviews collateral at risk and liquidation capacity.	High volatility increases liquidation risk; review ensures protocol can manage potential sales.
Price Volatility	$> 10\%$ swing for 3 consecutive days	Risk team reviews; consider increasing MCR with borrower notification.	Sustained volatility requires higher collateralization to mitigate risk, avoiding forced liquidations.
Price Volatility	$> 20\%$ swing in 24hr period	Pause borrowing until stabilizes.	Extreme volatility risks mass undercollateralization; pausing prevents new exposure.
Trading Volume	$<$ 1M for 7 days	Prepare to delist asset.	Critically low liquidity makes the asset unviable as collateral.
Smart Contract Vulnerability	Any bug or exploit detected	Pause all interactions; prepare to delist if unresolved in 7 days.	Protects against potential exploits or loss of funds.
Oracle Failure	Oracle price deviates $> 2\%$ from spot market or feed stalls longer than heartbeat period	Pause borrows until resolved; use backup feeds if available.	Ensures accurate pricing for liquidations and borrowing, preventing mispriced transactions.
DEX Exit Liquidity	If Liquidation Score $>$ 1	Constrain mint caps to prevent new borrows and determine if decreasing LTV makes sense.	High collateral-at-risk versus liquidity risks cascading liquidations and bad debt.

Table 1: Summary of Monitoring Metrics and Actions

2.2 sUSDe

Ethena's protocol operates on a delta-neutral trading strategy that allows it to generate yield while maintaining the peg of its synthetic dollar, USDe, at \$1. When users mint USDe, they provide collateral (such as ETH or liquid staking tokens), and the protocol simultaneously opens a short position on that collateral using perpetual futures contracts on centralized exchanges. This hedge neutralizes both upward and downward price movements, ensuring that the overall exposure is minimized. In a typical market environment—where more traders tend to go long on crypto assets—those who hold the short positions receive a funding fee from the longs. This funding rate, which is often favorable given the historical upward bias in crypto markets, forms a major part of the protocol's revenue. Additionally, the protocol earns further yield from staking rewards on ETH and other staked assets used as collateral.

Institutional users, who must complete KYC, play a key role in maintaining USDe's peg. When demand for USDe is high and its market price rises above \$1, these users are incentivized to mint more USDe and then sell it on the open market, thereby exerting downward pressure on the price. Conversely, if USDe trades below \$1, institutions can buy it at a discount, redeem it for \$1 worth of collateral, and profit from the arbitrage—this buying pressure pushes the price back up to its intended peg. The overall demand for USDe is driven by the yield-generating opportunity from staking USDe to receive sUSDe, the protocol's reward-bearing token that appreciates over time. As long as the yield from the collateral exceeds the fees paid on the short positions, the protocol remains solvent. In cases where the yield isn't sufficient, Ethena has an insurance fund that can step in to cover any shortfall, ensuring the system's stability and resilience.

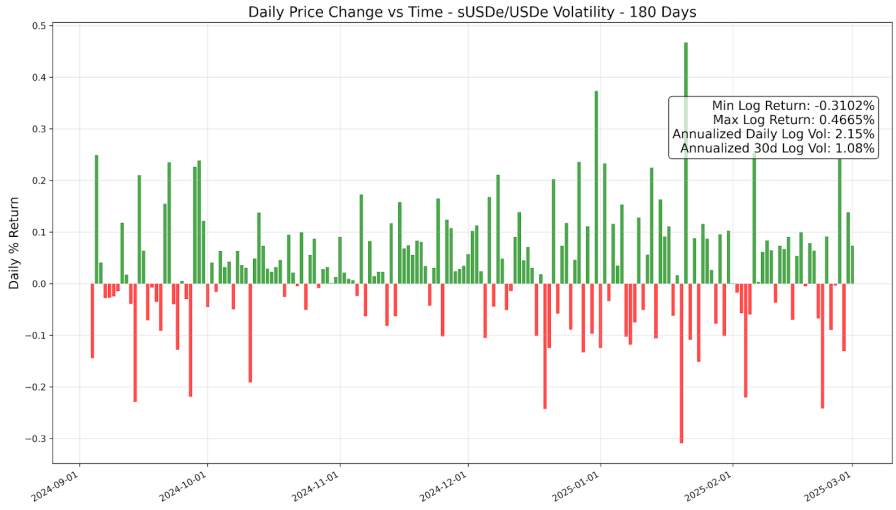

Figure 1: sUSDe/USDe Volatility

2.2.1 Negative Funding Rates

Ethena employs a delta-neutral strategy by shorting crypto assets like ETH through derivatives. In normal market conditions, this position benefits from positive funding rates paid by long positions. However, in bearish periods, funding rates can turn negative, forcing Ethena to cover fees and potentially depleting its reserves. To manage this risk, Ethena maintains a reserve fund to cover shortfalls when funding becomes negative. If funding turns more negative than the rewards earned from staking, the reserve fund intervenes. Persistent negative rates, however, would eventually exhaust the reserve, eroding the principal backing USDe and risking a depeg.

Historically, the crypto market has exhibited a consistent long bias, which is critical to Ethena's structure as it generally ensures the positive funding rates necessary for the delta-neutral strategy.

Should negative value accrual persist for an extended period, it would be irrational for users to continue staking, likely prompting redemptions of USDe. Those redemptions would reduce short derivative positions, easing downward pressure on funding rates and making a return to neutral or positive rates more likely. Essentially, USDe's supply would naturally recalibrate to the market environment.

The primary risk emerges if funding rates remain consistently negative, the reserve fund is exhausted, and users continue staking USDe despite the losses. In such a scenario, USDe could depeg and trigger a mass selloff. In the context of Ebisu, it could be enough of a shock to the system where the protocol incurs bad debt due to insolvencies. However, we view this as highly improbable. Even during the 2022 bear market and the collapses of FTX and LUNA, ETH maintained predominantly positive funding rates for shorts, which would be enough to keep sUSDe afloat.

It's important to underscore that a depeg of USDe/sUSDe is not, in itself, detrimental—it represents a core function of a healthy lending market by liquidating positions that have become too risky. However, the goal is to avoid the extreme shocks or market stress that can lead to rapid, widespread selloffs, which would impose significant stress on Ebisu's system and potentially trigger bad debt scenarios.

2.2.2 Exchange and Custodial Risks

Ethena relies on centralized exchanges (CEXs) to manage its derivative positions and on external custodians to hold its collateral assets. To minimize the risk of withdrawal limits, sudden closures, or insolvencies, threats highlighted by the collapse of FTX, Ethena avoids directly custodying its assets with exchanges. Instead, it employs Off-Exchange Settlement (OES) solutions, which ensure the protocol's backing assets remain under the control of third-party custodians and never reside on CEX servers. This arrangement allows Ethena to delegate funds for perps trading across multiple exchanges without compromising on-chain security. Currently, Ethena uses OES services from Copper's Clearloop, Ceffu, Cobo, and Fireblock's OES solution.

In the event of a bankruptcy at one of the exchanges used, Ethena retains beneficial ownership of its backing assets through its custody arrangements. Any affected assets would likely be transferred to another exchange to maintain the protocol's delta-neutral hedging. Although there may be a delay in

accessing those funds, Ethena's overall hedging positions would automatically adjust and rebalance when the assets are fully available.

A custodian bankruptcy triggers similar safeguards. For segregated vaults like Copper's, ownership of the assets never passes to the custodian or exchange, placing them outside the custodian's bankruptcy estate. In an omnibus solution such as Copper's omnibus vault, the assets are held in an English law trust, ensuring they remain distinct from Copper's estate.

Ethena also issues monthly proof-of-reserves attestations, confirming that USDe's backing assets are securely held off-exchange with institutional custodians.

The Bybit exploit on February 21, 2025, tested Ethena's custodial framework, and the structure proved highly effective. Since Ethena's collateral assets were not held on Bybit or any other CEX, but instead resided with third-party custodians, they remained untouched by the exploit. This off-exchange custody meant that even as Bybit faced a security breach, Ethena's backing assets were shielded from direct risk. The protocol's funds were not subject to potential loss or freezing on the compromised exchange, demonstrating a critical advantage of its OES approach.

Ethena's approach to managing custodial and exchange risks appears strong and well-designed. For Ebisu, we see no cause for concern: assets are kept securely off-exchange, and the use of off-exchange settlement solutions, along with regular proof-of-reserves attestations, reinforces confidence in the protocol's resilience. Overall, the structure is highly secure, and from our perspective as risk managers, it seems any potential issues would be swiftly contained with minimal impact.

2.2.3 Monitoring

BTC/ETH Short Position Funding Rate The BTC/ETH short position funding rate is a key indicator of the effectiveness of Ethena's hedging strategy, which directly impacts sUSDe's stability. If the 30-day moving average of this rate turns negative and remains so for 7 consecutive days, it suggests that Ethena is consistently paying to maintain its short positions, which could strain the reserve fund over time. This may point to market instability or weaknesses in the hedging approach, potentially undermining sUSDe's reliability as collateral. Should this threshold be crossed, the risk team should immediately investigate the situation to assess the impact on the reserve fund and overall risk. Based on the findings, the team should determine the appropriate response—options may include monitoring more closely, pausing borrowing, or adjusting risk parameters. While an increase in the MCR is a possible measure, it should only be considered if the investigation reveals a clear and sustained threat to the protocol. The decision should be tailored to the context, ensuring that any action is proportionate to the risk identified.

BTC/ETH Short Position Funding Rate The reserve fund serves as a critical safety net for sUSDe, absorbing losses from Ethena's hedging positions to maintain stability. However, a significant decline in the reserve fund, such as a depletion of 50% or more within 30 days, raises concerns. This rapid drop signals that losses are accumulating at an unsustainable rate, which could undermine confidence in sUSDe's yield generation mechanism. If users perceive the reserve fund as insufficient to cover potential future losses, they may lose trust in the stability and reliability of sUSDe's yield. This erosion of trust increases the likelihood of a rapid sell-off, as users could rush to exit their positions.

Such a sell-off could have significant consequences for Ebisu. A sudden and widespread exit from sUSDe positions could lead to heightened volatility and potentially trigger liquidation cascades. To mitigate these risks, the risk team should consider increasing the Minimum Collateral Ratio (MCR) for sUSDe to reduce exposure. Transparent communication with users about the situation and the actions being taken is also essential to maintain trust and stability during such a critical period.

Depeg Monitoring sUSDe's peg is more intricate because it is designed to appreciate over time due to staking rewards, but it remains essential. A depeg exceeding 1%, where the value strays significantly from its expected trajectory for 24 hours or more, raises concerns. This deviation could point to problems with Ethena's yield generation or hedging mechanisms, eroding trust in sUSDe as collateral. If this happens, borrowing should be paused immediately to avoid new exposure, and an investigation into the cause should begin. During this period, the protocol should reassess whether sUSDe remains viable as a long-term asset and consider raising the MCR if the depeg persists. To track this accurately, the protocol's monitoring tools must factor in the expected appreciation from staking rewards to avoid missing the true extent of any deviation.

2.2.4 Table View

Monitoring Metric	Trigger Threshold	Action	Rationale
BTC/ETH Short Position Funding Rate	30d MA turns negative for 7 days	Risk team investigates the impact on the reserve fund and overall risk. Based on findings, the team determines the appropriate response, which may include closer monitoring, or adjusting risk parameters. Increasing the MCR is considered only if a clear and sustained threat is identified.	Persistent negative rates may signal market instability or weaknesses in Ethena's hedging, potentially straining the reserve fund and undermining sUSDe's reliability.
Reserve Fund Value	Reserve fund depletes by 50% or more within 30 days	Risk team investigates the cause and assesses the risk of further depletion. Given the severity, the team should consider increasing the MCR for sUSDe within seven days, with user notification, to reduce exposure. Other measures, such as pausing borrowing, may also be taken based on the situation.	Significant depletion could trigger sell-offs and shock the system.
Depeg	$>$ 1% depeg from expected value (accounting for staking rewards) for 24 hours	Pause borrowing immediately and investigate the cause. If the depeg persists, consider increasing the MCR. Monitoring tools must factor in expected appreciation from staking rewards to accurately assess deviation.	Moderate depeg risks collateral stability; Increasing the MCR protects the protocol from prolonged exposure.

Table 2: Monitoring Metrics for sUSDe

2.3 weETH

EtherFi is a protocol that allows users to stake ETH in return for eETH, a liquid restaking token (LRT) that represents staked ETH and earns staking rewards, further enhanced by restaking on EigenLayer. eETH is a rebasing ERC-20 token, users can wrap eETH and receive weETH, a non-rebasing LRT designed for broader use in DeFi.

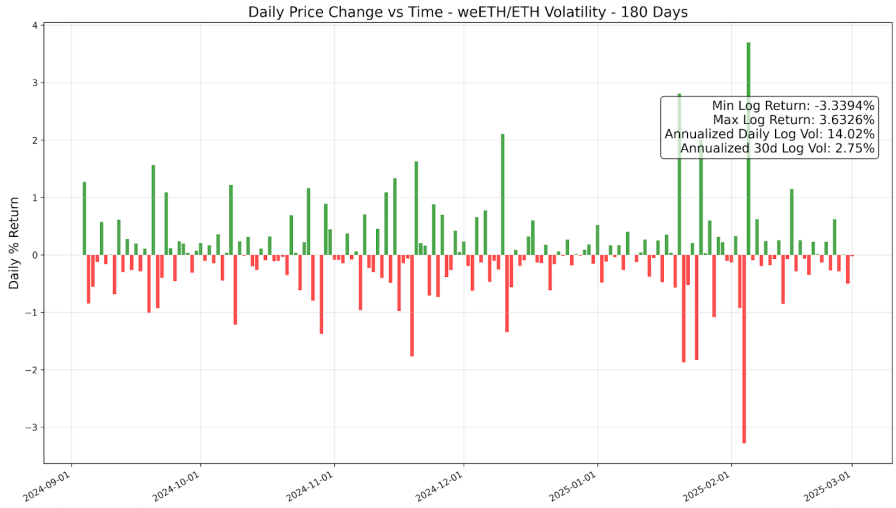

Figure 2: weETH/ETH Volatility

2.3.1 Slashing

In Ethereum staking, slashing is a penalty mechanism designed to maintain network integrity by deducting a portion of a validator's staked ETH if they misbehave or fail in their duties. EigenLayer builds on this through its restaking model, where staked ETH (or derivatives like eETH) is used to secure multiple Actively Validated Services (AVSs), each with its own slashing conditions. This increases risk exposure: the more AVSs a validator supports, the greater their vulnerability to slashing events. To address potential unfairness, EigenLayer has implemented a veto committee with the authority to review and reverse slashing decisions, particularly for newer AVSs where rules may still be unrefined.

As of now, slashing is not active on EigenLayer, influencing borrower behavior on platforms like Aave. Borrowers are depositing weETH as collateral and taking out ETH loans at a 93% Loan-to-Value (LTV) ratio, dangerously close to the 95% liquidation threshold. This high-LTV strategy is likely driven by two factors: the absence of slashing reduces immediate risk, and the tight price correlation between ETH and weETH minimizes liquidation chances under normal market conditions.

2.3.2 Monitoring

Slashing Event Monitoring for slashing events is critical due to their potential to destabilize weETH's value. When slashing goes live on EigenLayer, the risk team must immediately reassess weETH's role as collateral. If the collateral-at-risk remains high, such as in the high nine figures or exceeding $1 billion, temporary offboarding of weETH may be necessary until the market stabilizes. This action prevents a liquidation cascade, as evidenced by the December 2024 LTV distribution, where a significant concentration of weETH at 93% LTV sits just 2% below the liquidation threshold.

Depeg Depeg events serve as an early indicator of instability in weETH. A trigger should be set at a $> 1\%$ depeg from its expected value (adjusted for staking rewards) persisting for ≥ 4 hours. Since weETH accrues staking rewards over time, monitoring tools must account for this expected appreciation to distinguish true depegs from normal growth. Upon detection, borrowing should be paused, and the risk team should investigate the cause. If weETH's reliability is compromised, exposure may need to be reduced—either through force liquidating positions or a gradual reduction over seven days—to safeguard the protocol.

AVS The addition of new Actively Validated Services (AVS) backed by weETH increases slashing risks, as each AVS introduces its own unique slashing conditions. When a new AVS is supported, the risk team must analyze the associated slashing rules, assessing the behaviors that could trigger penalties and their potential severity. This review determines whether adjustments to risk parameters, such as the Minimum Collateral Ratio (MCR), are required to mitigate heightened exposure. Proactive evaluation ensures the protocol adapts to the evolving risk profile of EigenLayer.

Current secured AVS: `https://community.chaoslabs.xyz/etherfi/risk/avs`

2.3.3 Table View

Monitoring Metric	Trigger Threshold	Action	Rationale
Slashing Event	Slashing goes live on EigenLayer	Reassess weETH as collateral. If collateral-at-risk remains high (e.g., $1B+), consider offboarding weETH until stabilized.	Potential for liquidation cascade given current market conditions.
Depeg	$> 1\%$ depeg from expected value (adjusted for rewards) for ≥ 4 hours	Pause borrowing and investigate. If weETH is compromised, reduce exposure via force liquidations over next seven days?	Early intervention limits exposure to an unstable asset.
AVS	eETH backs new AVS	Risk team reviews slashing conditions and adjusts parameters (e.g., MCR) if needed.	Each new AVS adds unique slashing risks.

Table 3: Monitoring Metrics for weETH

2.4 WBTC

WBTC, or Wrapped Bitcoin, is a tokenized version of Bitcoin on the Ethereum blockchain, designed for users who want to leverage Bitcoin's value in DeFi without converting it to Ethereum-native assets. It maintains a 1:1 peg with Bitcoin through a custodial model, where Bitcoin is locked with a trusted third party, and an equivalent amount of WBTC is minted on Ethereum.

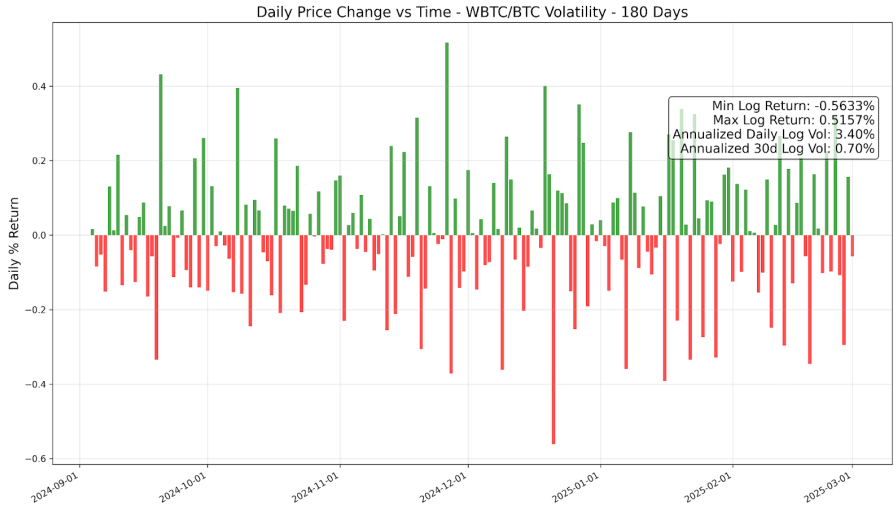

Figure 3: WBTC/BTC Volatility

2.4.1 Custodial Risk

The core risk for WBTC (Wrapped Bitcoin) stems from its custodial framework, where Bitcoin is held by third-party custodians responsible for securing the underlying assets while WBTC circulates on the Ethereum blockchain. This introduces significant counterparty risk, as the security of WBTC's 1:1 peg with Bitcoin depends on the custodians' ability to safeguard the Bitcoin reserves. A security breach or operational failure at the custodian level could result in the loss of backing assets, potentially breaking the peg and causing WBTC to lose value rapidly.

As of late 2024, WBTC's custodial framework has evolved into a multi-jurisdictional model to address growing demand in Asia and mitigate regulatory risks. The underlying Bitcoin is now custodied across three entities:

- **BitGo (U.S.)**: A well-established custody provider based in the United States.
- **BitGo Singapore**: A subsidiary of BitGo, operating under Singapore's regulatory framework.
- **BiT Global (Hong Kong)**: A joint venture partner with ties to Justin Sun.

These entities hold keys in a 2-of-3 multi-signature (multisig) setup. The diversification across the U.S., Singapore, and Hong Kong aims to hedge against regulatory risks in any single jurisdiction. However, this also requires compliance with multiple regulatory regimes, each with its own requirements.

2.4.2 Monitoring

Custody Change Tracking changes in WBTC's custodianship is essential due to its dependence on third-party entities. Any alteration to the custody arrangement, such as the addition of new custodial entities, changes in key holders, or shifts in jurisdictional control, should prompt an immediate risk assessment. The risk team should evaluate the security, regulatory, and reputational implications of such changes. In the event WBTC has increased counterparty risk, the risk team should decide if it makes sense to reduce exposure by increasing MCR over seven days, giving users time to manage positions.

Depeg Monitoring for depegging is critical, as deviations from WBTC's 1:1 peg with Bitcoin signal potential custodial or market confidence issues. Real-time tracking of the WBTC/BTC price ratio should be implemented, with specific thresholds triggering action. If WBTC depegs by more than 0.5% for four hours or longer, the risk team should investigate the root cause to determine the severity. Given the recent custodial changes in late 2024, any depeg event should be scrutinized for potential links to market concerns about the new multi-jurisdictional arrangement involving BitGo (U.S.), BitGo Singapore, and BiT Global (Hong Kong). Should the depeg exceed 1% at any point, borrows must be paused immediately to halt further risk accumulation, and the team should assess whether force liquidations are needed to safeguard the protocol.

Proof of Reserve Verifying WBTC's proof of reserve is fundamental to confirming that its Bitcoin backing remains intact and fully collateralized. Monitoring should ensure reserves consistently match 100% of the circulating WBTC supply, with any shortfall triggering immediate action. If reserves dip below 100% at any time, borrows should be paused immediately to prevent lending against a potentially undercollateralized asset. If the deficiency persists for one hour or more, the risk team must evaluate whether to initiate force liquidations of user positions to protect the protocol from escalating losses.

2.4.3 Table View

Monitoring Metric	Trigger Threshold	Action	Rationale
Custody Change	Any change in custodial entities, multi-sig configuration, or jurisdictional control	Risk team digs in - is there increased counterparty risk for WBTC? If yes, does it makes sense to reduce exposure by increasing the MCR in seven days (giving users time to manage positions).	Custodial shifts can introduce new risks requiring reassessment of WBTC's reliability.
Depeg	$> 0.5\%$ depeg for ≥ 4 hours	Risk team investigates the cause.	Early depegging may signal underlying issues with WBTC's backing or market trust, especially post-custodial changes.
Depeg	$> 1\%$ depeg at any point	Pause borrows immediately. Assess if force liquidations are necessary. Consider increasing MCR over seven days.	Significant depegging indicates severe custody or backing problems, necessitating urgent action.
Proof of Reserve	$< 100\%$ for any amount of time	Pause borrows immediately.	Insufficient reserves undermine backing, increasing risk.
Proof of Reserve	$< 100\%$ for ≥ 1 hour	Assess whether to start force liquidating users immediately.	Prolonged reserve shortfalls threaten WBTC's stability, requiring swift protection measures.

Table 4: Monitoring Metrics for WBTC

2.5 cbBTC

cbBTC, or Coinbase Wrapped Bitcoin, is a tokenized version of Bitcoin on the Ethereum blockchain, closely resembling WBTC in its purpose and functionality. Issued and fully managed by Coinbase, cbBTC is backed 1:1 by BTC held in custody by Coinbase, a regulated entity under U.S. law. Launched in September 2024, cbBTC leverages Coinbase's reputation and infrastructure, offering a competitive alternative to WBTC with rapid adoption driven by Coinbase's extensive user base. However, its reliance on a single custodian introduces risks akin to those faced by WBTC.

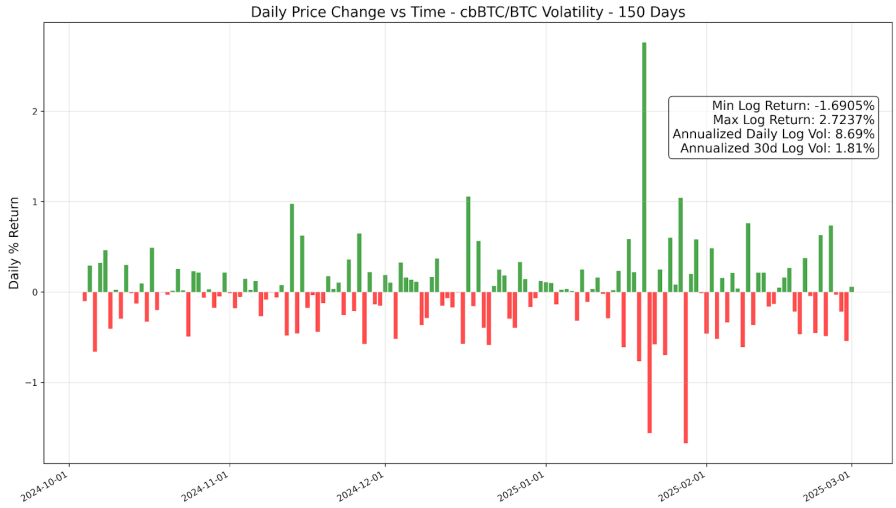

Figure 4: cbBTC/BTC Volatility

2.5.1 Custodial Risk

The primary risk vector is custodial risk, as cbBTC's 1:1 backing depends entirely on Coinbase's ability to securely hold and manage the underlying BTC. A security breach or operational failure at Coinbase could compromise the reserves, breaking the peg and affecting cbBTC's value, scenarios equally applicable to WBTC under BitGo's custody.

2.5.2 Monitoring

Refer to WBTC's recommendations as cbBTC and WBTC are essentially in the same scenario.

2.5.3 Table View

Monitoring Metric	**Trigger Threshold**	**Action**	**Rationale**
Custody Change	Any change in custodianship or oversight	Risk team investigates security, stability, and compliance. If counterparty risk increases, increase MCR over seven days.	Custodial shifts may heighten risk, requiring reassessment.
Depeg	$> 0.5\%$ depeg for ≥ 4 hours	Risk team investigates causes (e.g., custody issues, market dynamics).	Early depegging signals potential backing problems.
Depeg	$> 1\%$ depeg at any point	Pause borrows immediately. Assess need for force liquidations. Consider increasing MCR over seven days.	Severe depegging indicates critical custody or trust issues.
Proof of Reserve	$< 100\%$ at any time	Pause borrows immediately.	Insufficient reserves undermine the peg, increasing risk.
Proof of Reserve	$< 100\%$ for ≥ 1 hour	Assess whether to start force liquidating users immediately.	Prolonged reserve shortfalls threaten stability, requiring swift action.

Table 5: Monitoring Metrics for cbBTC

2.6 LBTC

LBTC is a yield-bearing token backed 1:1 by BTC, enabling Bitcoin holders to earn staking rewards while maintaining liquidity. Using Babylon, a cross-chain Bitcoin staking system, LBTC allows BTC to secure proof-of-stake (PoS) blockchains, known as Bitcoin Secured Networks (BSNs).

The Lombard Security Consortium, a decentralized network of independent validator nodes, oversees LBTC's operations. When a user stakes BTC, the consortium generates a unique SegWit deposit address via CubeSigner, a secure hardware key management system, and provides it to the user. Once the user deposits BTC, consortium members independently verify the transaction, ensuring accuracy in amount, address, and confirmations. After six confirmations, the consortium collectively signs a notarized proof of deposit. This proof triggers an automated relayer service, which mints an equivalent amount of LBTC on the target chain, such as Ethereum. Minting requires signatures from both the consortium and an independent oracle, the Bascule Drawbridge, operated by Cubist.

The consortium then initiates staking in the Babylon protocol by locking the BTC in a time-locked output on Bitcoin and delegating it to a Babylon finality provider, a specialized validator. The staked BTC enhances the voting power of a PoS validator, initially within the Babylon chain. The finality provider receives an Extractable One-Time Signature (EOTS) linked to the locked BTC, allowing it to sign PoS network blocks while preventing direct access to the BTC private key. If the validator misbehaves, the EOTS reveals the key to facilitate slashing of the staked BTC. Over time, staked BTC earns rewards for securing the Babylon/BSN network, with LBTC holders entitled to these rewards after fees, 10% of which go to Lombard. Users can later unstake BTC by burning LBTC, prompting the consortium to undelegate the BTC and return it to the user's Bitcoin address.

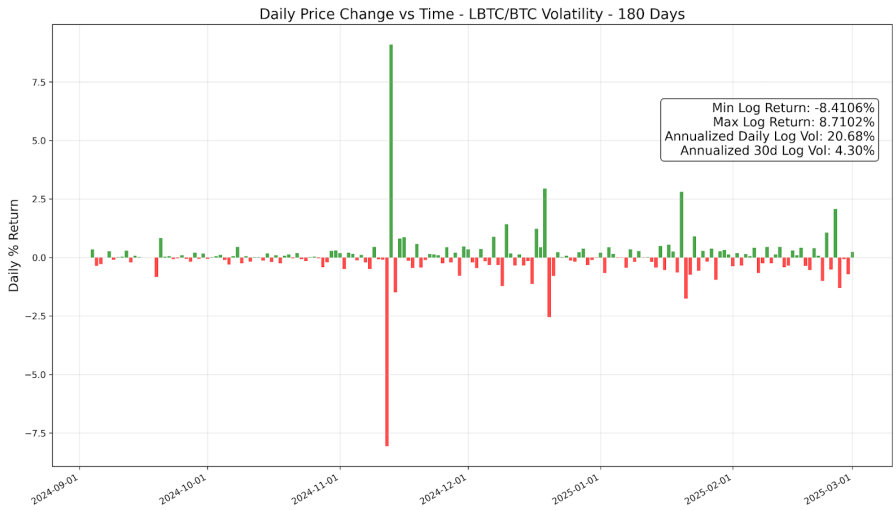

Figure 5: LBTC/BTC Volatility

2.6.1 Slashing

If a finality provider operates maliciously and signs two blocks at the same height, the EOTS exposes the private key of the provider's BTC. This enables anyone to use the key to initiate a slash, where funds are transferred to a burn address. However, slashing is currently not live on Babylon. Slashing is scheduled to be activated during Phase 2 of Babylon's mainnet roll-out.

The slashing risk for LBTC is substantially lowered by several protective features in the Babylon protocol. Unlike Ethereum, where validators can be penalized for inactivity or going offline, Babylon only triggers slashing if a validator actively votes for a duplicate block, ensuring staked BTC remains secure under normal operating conditions. For a violation to occur, over one-third of the total stake must maliciously sign two blocks at the same height—a high threshold that must be met before a slashing transaction can proceed. Overall, the risk of a slashing event occurring and effecting LBTC is very low.

2.6.2 Monitoring

Slashing Event When slashing goes live on Babylon, the risk team should conduct a thorough assessment to understand its potential impact on LBTC and its backing. The analysis provided from the

weETH section applies similarly here—LBTC's risk profile as a collateral asset changes once slashing goes live.

Depeg Monitoring the peg of LBTC to BTC is crucial for maintaining stability and market confidence. The primary concern is not just the peg itself but whether deviations signal deeper structural issues. A sustained discount in LBTC relative to BTC may indicate market distrust, custodial risks, or inefficiencies in the redemption process. If the peg breaks significantly and does not correct, it could suggest arbitrage mechanisms are failing or that concerns over LBTC's backing are growing. The real risk lies in whether the market believes LBTC remains fully redeemable under all conditions. If a depeg of 1% or more persists for several hours, borrowing should be paused immediately, and an assessment should be made on whether to begin reducing exposure to mitigate systemic risks.

Proof of Reserve Since LBTC is backed 1:1 by BTC, any deviation from its peg may signal custodial issues or potential smart contract vulnerabilities. If the proof of reserves falls below 100% at any point, borrowing should be paused immediately. If the issue persists, Ebisu must promptly assess the situation and determine whether to initiate force liquidations to protect the system's integrity.

2.6.3 Table View

Monitoring Metric	**Trigger Threshold**	**Action**	**Rationale**
Slashing Event	Slashing goes live	Re-assess impact of slash looking at lending distribution.	Would a small slash cause mass liquidations, leading to bad debt?
Depeg	$> 1\%$ depeg from expected value for ≥ 4 hours	Pause borrowing and investigate. If LBTC is compromised, reduce exposure via force liquidations over next seven days?	Early intervention limits exposure to an unstable asset.
Proof of Reserve	$< 100\%$ at any time	Pause borrows immediately.	Insufficient reserves undermine the peg, increasing risk.
Proof of Reserve	$< 100\%$ for ≥ 1 hour	Assess whether to start force liquidating users immediately.	Prolonged reserve shortfalls threaten stability, requiring swift action.

Table 6: Monitoring Metrics for LBTC

3 General Protocol Parameterization

3.1 Debt Cap

When setting debt caps, we aim to allow the highest amount of funds to be supplied as possible while making sure that:

1. There is sufficient DEX liquidity to support liquidation of *collateral-at-risk*.
2. We prevent price manipulation attacks as much as possible.

Collateral-at-risk: Positions at risk of liquidation given a x% downward price shock

$$\text{Debt Cap} = \frac{A(1-B)}{C}$$

Where:

- **A**: Amount able to be profitably liquidated via DEX (swap from token to USDC)
- **B**: Allocation of DEX liquidity to other lending markets
  - (65%–95%, risk-dependent: Lower Risk = 0.95, Mid Risk = 0.85, Higher Risk = 0.65).
- **C**: Percentage of collateral that is underwater/liquidatable in an "extreme drop".
  - Small Cap (less than $2B) - 50%
  - Medium Cap ($2B–$20B) - 35%
  - Large Cap (greater than $20B) - 15%

3.2 Minimum Collateralization Ration (MCR)

A good MCR should balance capital efficiency for users while ensuring protocol solvency. Highly volatile or illiquid assets should have lower MCRs to account for potential sharp price drops and slippage during liquidations, while stable and liquid assets can support higher MCRs.

When determining MCR, we assess the following factors:

- **30d Annualized Volatility of the Asset-to-Underlying Ratio:**
  - This metric captures any tracking error or basis risk between the derivative and its underlying asset. If the ratio is volatile, it indicates that the derivative isn't tracking the underlying consistently, which could lead to unexpected collateral requirements during rapid market moves.
- **Volatility of the Underlying Asset:**
  - Since these derivatives are fundamentally linked to underlying assets such as ETH or BTC, the inherent volatility of the underlying asset drives the overall risk profile.
- **Amount of liquidity of the asset across all DEXs & how much can be liquidated profitably:**
  - Ample liquidity ensures profitable liquidations.
- **Competitive state of the overall lending market:**
  - What are other lending protocols setting their LTVs at for a particular asset?

3.3 Redemption Fee Floor

The Liquity V2 protocol implements a fixed minimum redemption fee, known as the `REDEMPTION_FEE_FLOOR`, to stop users from exploiting small inaccuracies in oracle-reported prices arising from deviation thresholds. These inaccuracies, called *oracle drift*, typically hover around 0.5% and reflect the difference between an oracle's price and the true market price. Without this fee, a user could buy ebUSD for $1 on the secondary market and redeem it for up to $1.005 worth of collateral if the oracle undervalues the asset, profiting from the system. The redemption fee floor, set according to each oracle's configuration, eliminates this exploit and maintains system stability. When multiple oracles are used, these errors can compound, requiring careful adjustment of the fee based on the asset and its oracle setup.

3.3.1 Compounding Effect with Multiple Oracles

When an asset's price is derived from two oracles (e.g., LBTC/BTC and BTC/USD), the maximum deviation—or total error—grows due to a compounding effect. This total error is calculated using the formula:

$$e_{\text{total}} = e_1 + e_2 + e_1 \cdot e_2$$

Here, e_1 is the deviation threshold of the first oracle, and e_2 is that of the second oracle. These values represent the potential error in each oracle's price feed.

3.3.2 Oracle Configurations and Maximum Errors

Below is a table listing various oracles, their providers, addresses, and deviation thresholds:

Oracle	Provider	Address	Deviation Threshold
sUSDe/USD	Redstone	0xb99D174ED06c83588Af997c8859F93E83dD4733f	0.20%
USDe/USD	Redstone	0xbC5FBcf58CeAEa19D523aBc76515b9AEFb5cfd58	0.20%
weETH/USD	Redstone	0xdDb6F90fFb4d3257dd666b69178e5B3c5Bf41136	1%
weETH/ETH	Redstone	0x8751F736E94F6CD167e8C5B97E245680FbD9CC36	0.50%
LBTC/BTC	Redstone	0xb415eAA355D8440ac7eCB602D3fb67ccC1f0bc81	1%
BTC/USD	Redstone	0xAB7f623fb2F6fea6601D4350FA0E2290663C28Fc	0.50%
ETH/USD	Redstone	0x67F6838e58859d612E4ddF04dA396d6DABB66Dc4	0.50%
WBTC/USD	Chainlink	0xfdFD9C85aD200c506Cf9e21F1FD8dd01932FBB23	0.10%
cbBTC/USD	Chainlink	0x2665701293fCbEB223D11A08D826563EDcCE423A	2%

Table 7: Oracle configurations and deviation thresholds (Redstone/Chainlink).

There's also an alternative LBTC oracle from Chainlink with a lower deviation threshold for LBTC/BTC (0.50% vs. 1%), reducing the total error:

Oracle	Provider	Address	Deviation Threshold
LBTC/BTC	Chainlink	0x5c29868C58b6e15e2b962943278969Ab6a7D3212	0.50%
BTC/USD	Chainlink	0xF4030086522a5bEEa4988F8cA5B36dbC97BeE88c	0.50%

Table 8: Alternative LBTC oracle (Chainlink) with lower deviation threshold.

Using these oracles, the maximum error for different assets is calculated as follows, with the recommended redemption fee floor values included:

Asset	Oracle Config.	Max Err. (%)	Calculation	Redemption Fee Floor (% / bps)
sUSDe	sUSDe/USD	0.20	Direct oracle	0.50 / 50
weETH	weETH/USD	1.00	Direct oracle	1.00 / 100
weETH	weETH/ETH → ETH/USD	1.025	$0.5 + 0.5 + (0.5 \times 0.5)$	1.10 / 110
WBTC	WBTC/USD	0.10	Direct oracle	0.50 / 50
cbBTC	cbBTC/USD	2.00	Direct oracle	2.00 / 200
LBTC (Redstone)	LBTC/BTC → BTC/USD	2.00	$1 + 0.5 + (1 \times 0.5)$	2.00 / 200
LBTC (Chainlink)	LBTC/BTC → BTC/USD	1.025	$0.5 + 0.5 + (0.5 \times 0.5)$	1.10 / 110

Table 9: Maximum oracle errors and recommended redemption fee floors.

In the Liquity V2 protocol, the redemption fee is not static but adjusts dynamically based on redemption activity. At a given time t and redemption event j, the redemption fee $f(t_j)$ can be expressed as:

$$f(t_j) = f_{\min} + b(t_j)$$

where $f_{\min}$ is `REDEMPTION_FEE_FLOOR`, and $b(t_j)$ is a dynamic fee that scales linearly with respect to the redeemed amount m relative to the total supply n, subject to a scaling parameter α. This formulation is detailed in Chaos Labs Liquity V2 Mechanism Design Review.

The structure of this fee implies that large redemption sizes are less likely to reflect attempts to exploit oracle inaccuracies (oracle drift). Conversely, numerous small redemptions, potentially originating from one or a few addresses, could suggest a "skimming off the top" strategy, where users repeatedly redeem small amounts to profit from minor price discrepancies between the oracle-reported price and the actual market price. Monitoring multiple small redemptions from a single address (or multiple) may reveal attempts at gaming the system.

3.4 Critical System Collateral Ratio (CCR)

As an asset's price drops, the **Total Collateral Ratio (TCR)**—defined as the ratio of collateral value (C) to borrowed amount (B)—decreases:

$$\text{TCR} = \frac{C}{B}.$$

The **Health Factor (HF)** measures position safety. For an individual position:

$$HF = \frac{C_i}{B_i \times MCR},$$

where MCR is the Minimum Collateralization Ratio. System-wide, the average HF is:

$$HF = \frac{\text{TCR}}{MCR}.$$

When $HF < 1.2$, positions risk liquidation. The **Critical Collateral Ratio (CCR)** is the TCR threshold triggering protective measures (e.g., pausing borrowing) to mitigate systemic risk, where:

$$HF = \frac{\text{CCR}}{MCR}.$$

Liquity V2 targets $HF = 1.2$–1.4 at CCR. Examples:

- **WETH**: $MCR = 110\%$, $CCR = 150\%$, $HF \approx 1.36$.
- **sETH**: $MCR = 120\%$, $CCR = 160\%$, $HF \approx 1.33$.

3.4.1 Calculating CCR

1. **Convert LTV to MCR**: Using $MCR = \frac{100}{\text{LTV}}$, we derive MCR ranges from Loan-to-Value (LTV) ranges.
2. **Set CCR**: Choose CCR to keep HF between 1.2 and 1.4 across each asset's MCR range, using $CCR = MCR \times HF_{\text{target}}$.

Asset	LTV Range (%)	MCR Range (%)	CCR (%)	HF Range
sUSDe	88–80	114–125	150	1.20–1.32
weETH	78–70	128–143	170	1.19–1.33
WBTC	76–68	132–147	175	1.19–1.33
cbBTC	76–68	132–147	175	1.19–1.33
LBTC	74–66	135–152	180	1.18–1.33

Table 10: Summary of CCR values and HF ranges for each asset.

LTV to MCR Conversion and CCR Results

Notes

- HF occasionally dips slightly below 1.2 at higher MCRs but stays near the target range.
- CCR values are rounded for simplicity and allow LTVs to increase by $\sim 4\%$ while keeping $HF \leq 1.4$.

3.5 Shutdown System Collateral Ratio (SCR)

The Shutdown System Collateral Ratio (SCR) is a key safety threshold. When the Total Collateral Ratio (TCR) falls below SCR, the protocol halts all borrowing except for position closures, triggering a market shutdown. Users can then redeem ebUSD for collateral at a rate better than the current oracle price. This protects the system by curbing the creation of new debt and promoting deleveraging when most positions drop below the branch's Minimum Collateralization Ratio (MCR). Think of SCR as a last line of defense in a worst-case scenario.

To achieve this, SCR should be set close to the MCR so that the shutdown triggers when most positions are at or below this minimum threshold, prompting forced liquidations to limit potential losses for the protocol. A key consideration is that SCR is *immutable*, once set it cannot be adjusted after deployment. To future-proof the system, SCR should not exceed the lowest conceivable MCR the protocol might adopt in the future. Keeping consistent with CCR, let's add 4 percentage points to the upper end of each asset's LTV range and set SCR based on this.

Asset	Theoretical Max LTV (%)	Corresponding Min MCR (%)	SCR Recommendation (%)
sUSDe	92	109	110
weETH	82	122	122
WBTC	80	125	125
cbBTC	80	125	125
LBTC	78	128	128

Table 11: Suggested SCR values based on theoretical max LTV.

3.6 Liquidation Penalties

3.6.1 Stability Pool Liquidation Penalty

Normal liquidations are processed through the Stability Pool, where depositors provide liquidity to absorb debt and collateral from liquidated positions. Following Liquity V2's approach, this penalty can be set to 5%. A 5% liquidation penalty is standard across many lending protocols. For longer tail assets with lower secondary liquidity, like sBOLD, the liquidation penalty can be higher (up to 10%).

3.6.2 Redistribution Liquidation Penalty

In the event that the Stability Pool is empty and no Just-In-Time (JIT) liquidators step in, it likely indicates a large liquidation event has occurred, coupled with low DEX liquidity. This scenario makes JIT liquidations unprofitable due to slippage or insufficient arbitrage opportunities. When this happens, the protocol resorts to redistribution. Redistribution involves transferring the debt and collateral of liquidated positions proportionally to all remaining borrowers in the same market, effectively socializing the losses. Borrowers receive a share of the liquidated collateral and take on a corresponding portion of the debt, with the process designed to maintain the total collateralization ratio (TCR) of the system.

The penalty for redistribution should be higher than the Stability Pool penalty to reflect the increased systemic risk. A higher penalty increases the cost of undercollateralization, deterring borrowers from taking excessive risks in these scenarios. For less-risky assets like sUSDe we recommend a redistribution penalty of 10%, and for more risk assets we recommend 20%.

3.7 Protocol Interest Split

Ebisu plans to split 100% of protocol revenue earned from borrower interest, with the majority going to stability pool depositors and the rest going to liquidity incentives. Similar to Liquity V2 we recommend:
75% to Stability Pool
25% to ebUSD/BOLD and ebUSD/USDC liquidity.

3.8 Summary

3.9 sUSDe

Parameter	Value
Debt Cap	$2,150,000
Minimum Collateralization Ratio (MCR)	120%
Critical Collateral Ratio (CCR)	150%
Shutdown System Collateral Ratio (SCR)	110%
Redemption Fee Floor	0.5%
Liquidation Penalty (Stability Pool)	5%
Liquidation Penalty (Redistribution)	10%

Table 12: sUSDe Parameter Recommendations

3.10 weETH

Parameter	Value
Debt Cap	$3,430,000
Minimum Collateralization Ratio (MCR)	135%
Critical Collateral Ratio (CCR)	170%
Shutdown System Collateral Ratio (SCR)	122%
Redemption Fee Floor	1%
Liquidation Penalty (Stability Pool)	5%
Liquidation Penalty (Redistribution)	20%

Table 13: weETH Parameter Recommendations

3.11 WBTC

Parameter	Value
Debt Cap	$7,140,000
Minimum Collateralization Ratio (MCR)	138%
Critical Collateral Ratio (CCR)	175%
Shutdown System Collateral Ratio (SCR)	125%
Redemption Fee Floor	0.5%
Liquidation Penalty (Stability Pool)	5%
Liquidation Penalty (Redistribution)	20%

Table 14: WBTC Parameter Recommendations

3.12 cbBTC

Parameter	Value
Debt Cap	$5,000,000
Minimum Collateralization Ratio (MCR)	138%
Critical Collateral Ratio (CCR)	175%
Shutdown System Collateral Ratio (SCR)	125%
Redemption Fee Floor	2%
Liquidation Penalty (Stability Pool)	5%
Liquidation Penalty (Redistribution)	20%

Table 15: cbBTC Parameter Recommendations

3.13 LBTC

Parameter	Value
Debt Cap	$2,000,000
Minimum Collateralization Ratio (MCR)	143%
Critical Collateral Ratio (CCR)	180%
Shutdown System Collateral Ratio (SCR)	128%
Redemption Fee Floor	2%
Liquidation Penalty (Stability Pool)	5%
Liquidation Penalty (Redistribution)	20%

Table 16: LBTC Parameter Recommendations

4 Protocol Health Monitoring

This section presents a structured method for tracking the Ebisu protocol's health and performance through the collection of position data, computation of health factors, and extraction of essential metrics. Aggregating position data within Ebisu is vital for assessing the system's overall stability, benefiting both the Ebisu team and users who seek to understand the risks associated with locking value in the platform. We view transparency in sharing this data as a significant enhancement to user experience, and the following subsection elaborates on the approach to gathering protocol data and generating actionable insights. This section also defines scenarios and triggers to detect unhealthy conditions, with suggested actions for mitigation. Alerts are categorized by scope and severity.

4.1 Data Collection and Organization

Position data should be fetched and organized as follows:

- **Data Points**: Wallet address, collateral asset (e.g., sUSDe, weETH), collateral amount, ebUSD borrowed.
- **USD Values**:
  - Supplied Collateral (USD) = Collateral Amount × Market Price
  - Borrowed Amount (USD) = ebUSD Borrowed × ebUSD Price
- **Organization**: Positions are grouped by collateral asset for asset-specific insights.

4.1.1 Health Factor Calculation

The health factor (HF) quantifies liquidation risk for each position:

$$\text{HF}_k = \frac{C_k}{B_k \times MCR_i}$$

Where:

- k: Position index
- C_k: Collateral value (USD)
- B_k: ebUSD borrowed (USD)
- MCR_i: Minimum Collateralization Ratio for asset i (e.g., 1.20 for sUSDe)

Note: If $B_k = 0$, HF is undefined, and the position is excluded from risk calculations as it poses no liquidation threat.

4.2 Key Metrics

Metrics are categorized into protocol-wide and asset-specific groups to provide a holistic view of Ebisu's health.

Protocol-Wide Metrics

- **Total Value Locked (TVL, USD)**: $\sum_k C_k$ — Indicates system size and user trust.
- **Total ebUSD Borrowed**: $\sum_k B_k$ — Reflects borrowing scale.
- **Total Positions**: $|\{k \mid C_k > 0\}|$ — Measures user engagement.
- **Positions Eligible for Liquidation**: $|\{k \mid \text{HF}_k < 1.0\}|$ — Counts immediate risks.
- **Value Eligible for Liquidation**: $\sum_{k|\text{HF}_k<1.0} C_k$ — Quantifies liquidation volume.
- **Total Bad Debt**: $\sum_{k|\text{HF}_k<1.0}(B_k - C_k)$ — Estimates potential losses.

Asset-Specific Metrics (Per Asset i)

- **Total Supply**: $\sum_{k\in i} C_k$ — Tracks asset usage.
- **Total Borrow**: $\sum_{k\in i} B_k$ — Gauges borrowing demand.
- **Average HF**: $\frac{\text{Total Supply}_i}{\text{Total Borrow}_i \times MCR_i}$ — Assesses position health.
- **Number of Positions**: $|\{k \in i \mid C_k > 0\}|$ — Indicates asset-specific engagement.
- **Utilization Rate**: $\frac{\text{Total Borrow}_i}{\text{Debt Cap}_i}$ — Monitors capacity usage.
- **Positions at Risk**: $|\{k \in i \mid 1.0 \leq \text{HF}_k \leq 1.2\}|$ — Counts near-liquidation positions.
- **Collateral at Risk**: $\sum_{k\in i|1.0\leq\text{HF}_k\leq 1.2} C_k$ — Estimates future liquidation exposure.
- **Positions Eligible**: $|\{k \in i \mid \text{HF}_k < 1.0\}|$ — Identifies immediate liquidation risks.
- **Collateral Eligible**: $\sum_{k\in i|\text{HF}_k<1.0} C_k$ — Measures liquidation exposure.
- **Bad Debt**: $\sum_{k\in i|\text{HF}_k<1.0}(B_k - C_k)$ — Calculates asset-specific losses.

4.3 Branch/Asset-Specific Alerts

Warning	Trigger	Rationale	Action
Rapid Increase in At-Risk Positions	HF (1.0 - 1.2) count doubles in 1 hour/day	Suggests market shock or collateral devaluation.	Investigate, adjust parameters if needed.
Sudden Decline in Average HF	Drop of 0.2+ in 1 hour	Indicates systemic risk or market downturn.	Review protocol health and take corrective measures.

4.4 System-Wide Alerts

Alert	Trigger	Rationale	Action
Borrowing Spike	Total ebUSD borrowed >20% in 1 hour	Could signal an exploit or attack.	Investigate and potentially pause borrowing.
High Liquidation Value	>$100k collateral liquidated in 1 hour	Large liquidations may cause cascading effects.	Review liquidation triggers.
High Number of Liquidations	>20 positions liquidated in 1 hour	Multiple liquidations may strain resources.	Identify cause and take necessary measures.

4.5 Other Metrics

Metric	Significance
Total ebUSD Supply	Tracks the scale of borrowing activity.
ebUSD Secondary Liquidity	Measures liquidity depth and market health.
User-Set Interest Rate Distribution	Tracks range and average of rates set by users.
Stability Pool Balance	Ensures sufficient funds to handle liquidations.
Liquidation Metrics (Stream)	Detects trends and anomalies in liquidations.
ebUSD Peg Stability	Ensures effective stability mechanisms.
Redemption Activity	High redemption rates may indicate oracle drift exploitation.

5 Conclusion

By adopting these recommendations, Ebisu can enhance its resilience against market volatility, maintain the ebUSD peg at $1 USD, and foster a sustainable lending ecosystem. The tailored parameter settings and proactive monitoring strategies collectively mitigate risks associated with collateral volatility, oracle inaccuracies, and liquidation cascades. As Ebisu evolves, continuous monitoring and periodic reassessment of these parameters will be critical to adapt to shifting market dynamics and emerging risks, ensuring the protocol's long-term stability and success.