Gauntlet Borrow and Supply Cap Methodology

On Aave V3, borrow caps and supply caps both require multiple considerations including mitigating tail risks to protocols, optimizing user experience, and allowing on-chain liquidity to remain robust. Here we describe the main factors we consider in calculating borrow and supply caps recommendations.

- We provide conservative and aggressive recommendations, each with different levels of risk tolerance. The conservative recommendations are primarily driven by local liquidity (on-chain), and the aggressive recommendations are primarily driven by global liquidity (all chains).
- We apply aggressive recommendations (both borrow and supply caps) for tokens on Ethereum mainnet due to the chain's robust liquidator ecosystem and more developed sources of liquidity.

We may deviate from these methodologies in certain edge cases and in the event of very idiosyncratic or compelling developments.

I. Supply Cap Methodology

Our conservative recommendation framework is summarized below.

- Stablecoin: 40% of the circulating token supply on-chain
- Non-stablecoin: Take the minimum value

of * Minimum supplied tokens needed to break even in a long attack

- The token amount required to move DEX pricing by 25%
- 30% of the circulating token supply on-chain
- Minimum supplied tokens needed to break even in a long attack
- The token amount required to move DEX pricing by 25%
- 30% of the circulating token supply on-chain

Our aggressive recommendation (& ETH mainnet) framework is summarized below.

- Stablecoin: 60% of the circulating token supply on-chain
- Non-stablecoin: Take the minimum value

of * Minimum supplied tokens needed to break even in a long attack

- 10 * 2% aggregate liquidity across all centralized and decentralized sources
- 50% * average daily volume across all centralized and decentralized sources
- 50% of the circulating token supply on-chain
- Minimum supplied tokens needed to break even in a long attack
- 10 * 2% aggregate liquidity across all centralized and decentralized sources
- 50% * average daily volume across all centralized and decentralized sources
- 50% of the circulating token supply on-chain

Notes:

- Bridged assets

: There are slight modifications to the supply cap methodology for specific bridged assets. Given the liquidity and trading volume of the underlying assets, Gauntlet modifies underlying assumptions in order for aggressive cap recommendations to be slightly higher to encourage protocol usage and growth.

- Interplay with other risk parameters

: The focus of our supply cap methodology is around liquidity and on-chain supply. Asset volatility, asset correlations, and user behaviors are the focus of our LTV, LT, and LB recommendation methodology. Therefore simulated insolvency risk is not a focus of our supply cap methodology, but is a consideration. We will also take isolation mode and potential debt ceiling values into account.

Below we describe each factor on a high level (and include relevant details in the Appendix).

Supply Cap Factor 1: Potential Long Attack Bounds

Long market manipulation attacks rely on supplying a minimum number of manipulable tokens. As such, we can set supply caps so that this type of attack is not profitable given the current parameterization. We model long price manipulation attacks with the following framework:

- Strategist repeatedly enters a market buy order for a target collateral asset (thus pushing up its price).
- At each step, the strategist then checks the strategy's profitability if they were to "exit" the trade by depositing all of the purchased collateral tokens on a target platform and borrowing against it at the maximum allowed LTV.
- Repeat until the ROI of the strategy is positive and note the capital required.

We can set the upper bound of supply caps as the tokens needed to break even in such an attack. For a more detailed explanation, see the Appendix. (For security purposes, we do not disclose the exact bounds of a price manipulation attack.)

Supply Cap Factor 2: Local and Aggregate Liquidity

Supply caps should also ensure there is ample liquidity across an individual chain and all chains. This is important so that in the event of liquidations, there is likely to be enough liquidity to prevent insolvencies. As such, we consider the following factors:

- The token amount required to move DEX pricing by 25%
- 10 * the total liquidity available for a 2% move across all centralized and decentralized sources
- 50% * average aggregate daily volume across all centralized and decentralized sources

Supply Cap Factor 3: Total Circulating Supply

In addition, we want to ensure that the supply cap of any given token on a given chain does not exceed 30-60% of its total circulating supply on that chain. The percent scales with the relative safety of each token (stablecoin vs. non-stablecoin). This will help prevent an excess supply of a given token on the protocol relative to its circulating supply on a specific chain. Again, this helps prevent the protocol from having most of the liquidity on-chain (concentration risk).

Future Considerations:

Simulated Insolvency Risk

To mitigate insolvency risk, we can derive supply caps that prevent any given token's Value at Risk (VaR), as calculated in our simulations, from exceeding 10% (as an example) of the total reserve held in a protocol.

Liquidator Behavior

Depending on liquidator behavior per chain, Gauntlet may alter how we look at DEX liquidity for supply and borrow caps. If there are significantly fewer liquidators leveraging on-chain liquidity, we may alter to constrain cap recommendations that were based on DEX liquidity.

Staking Derivatives

Depending on empirical staking derivative usage, we may continue to refine or add to our supply cap methodology in conjunction with other parameters such as LT and interest rate curves.

II. Borrow Cap Methodology

Our conservative recommendations take the minimum value

of:

- Minimum borrowed tokens needed to break even in a short attack, given a set cost
- Total token amount of the top 3 wallets on a specific chain

- Borrow cap cannot exceed the supply cap for the asset

Our aggressive recommendation (& ETH mainnet) framework takes the minimum value

of:

- Minimum borrowed tokens needed to break even in a short attack, given a set cost
- Total token amount of the top 5 wallets on a specific chain
- Borrow cap cannot exceed the supply cap for the asset

Notes:

- Stablecoins

: We do not think borrow caps on stablecoins will significantly impact the risk profile of the protocol. In addition, there is a significant capital efficiency consideration with allowing for high utilization of stablecoins for suppliers.

- Staking derivative tokens

: Our borrow cap methodology would suggest a lower-than-market-expected borrow cap for staking assets. For staking assets in general, there is a distinct use case for borrowing the asset. However, this increased borrow interest does not offset potential liquidity risks for the underlying asset nor the staked asset (recall stETH-ETH price deviations and the potential impact on those reserve pools). We note that given liquidity considerations, both the aggressive and conservative borrow cap recommendations for staked assets might be lower than the current borrow.

Below we describe each factor on a high level (and include relevant details in the Appendix).

Borrow Cap Factor 1: Potential Short Attack Bounds

Short market manipulation attacks rely on borrowing a minimum number of tokens. As such, we can set borrow caps so that this type of attack is not profitable. We model a short price manipulation attack with the following framework:

- Strategist supplies USDC and borrows the maximum amount of the manipulable asset possible.
- Strategist enters a market sell order for the borrowed asset, pushing down the price of the asset while receiving proceeds.
- The value of the strategist’s borrow declines, decreasing their loan-to-value ($ borrow / $ supply). As such, the attacker can withdraw some of the supplied collateral until their LTV equals the collateral factor of the supplied token. This withdrawal decreases the strategist’s cost basis.
- The strategist exits the trade when it is profitable (proceeds from short sale > net cost basis) by stopping the short sale and allowing the price of the borrowed asset to recover, thus making their account eligible to be liquidated.

For a more detailed explanation, see the Appendix. (For security purposes, we do not disclose the exact bounds of a price manipulation attack.)

Borrow Cap Factor 2: Liquidity Concentration Risk (Total and Per Chain)

If protocols allow excessive amounts of borrowing for any given token, market makers and users would not have enough access to the token to buoy its liquidity. Thus, we factor in:

- The top 3 or 5 wallets on a specific chain.

Future Considerations:

Governance and Protocol-Specific Considerations

Governance tokens are used to impact protocol decisions by voting on proposals. This makes protocols vulnerable to manipulation by attackers who “hoard” governance tokens and push potentially malicious changes on-chain. As such, we can bind the number of governance tokens available to borrow by factoring in:

- The number of tokens needed to reach quorum.
- The average token amount needed to pass votes in the last month.

Staking Derivatives

Depending on empirical staking derivative usage, we may continue to refine or add to our borrow cap methodology in conjunction with other parameters such as LT and interest rate curves.

Next Steps:

- Welcome feedback from the community.
- Gauntlet will discuss with Chaos to outline the main differences in methodology between our and Chaos's methodology. We then aim to post in the forums summarizing the differences, to provide more transparency and clarity to the Aave community.

Appendix

A. Supply Cap Factor 1: Long Manipulation Attack Methodology

As the strategist iteratively purchases tokens and pushes up its price, they purchase fewer tokens per dollar spent and thus their average price paid per token is less than the final price of this strategy. The strategist must push up the final price of the token p_{f} past their weighted average purchase price p_w to the point that they can profit from supplying it as collateral in the protocol. That is, the ratio of the strategist's weighted average purchase price and final price must reach this equality to breakeven:

Once we know the final price needed to breakeven, we can derive the total tokens needed to supply to breakeven (and set this as the supply cap) by adding the market depth at each price level of the collateral token:

We devise supply caps that prevent profitability with high probability (where the randomness is over the price trajectories and the supply and demand trajectories). And to account for current supply of the collateral token, we add current supply amount to the derived supply cap.

B. Supply Cap Factor 2: Local and Aggregate Liquidity

We have observed DEX liquidity to be important for liquidators:

- 96.2% of liquidations on Optimism use on-chain liquidity.
- 69.4% of Avalanche liquidations use on-chain liquidity.

C. Borrow Cap Factor 1: Short Manipulation Attack Methodology

We solve for the price at which the strategist breaks even in this style of attack. That is, we must solve for Final price

in this equation:

The intuition is that once the ratio of proceeds to initial cost exceeds (Final price/Initial price)

, the strategist becomes profitable. Given the manipulable token's market depth at each price level, we perform this calculation iteratively through each price below Initial price

until the equality holds. After we derive Final price

, we can calculate the total number of borrowed tokens needed to break even (and therefore the borrow cap):

We devise borrow caps that prevent profitability with high probability (where the randomness is over the price trajectories and the supply and demand trajectories). And to account for current borrowed tokens, we add current borrows to the derived borrow cap.