

Introduction

Aave v3 Ethereum is planned to launch in the coming weeks following the [community's approval](#) of the deployment. As a first step, the community has decided on the [initial assets](#) listed on this deployment.

The primary blocker to launching v3 Ethereum is the risk parameter configuration of the assets to be deployed. To provide parameter recommendations and enable the deployment at the earliest convenience, Chaos Labs suggests dividing the listing of assets into two stages.

- Launch - Stablecoins and select “top-tier” assets (full list and recommendations below)
- Post-Launch - rest of the assets as voted on [here](#)
- Given Gauntlet’s parameter recommendations for isolated long-tail assets, the community can decide to include them in the initial deployment stage. Chaos Labs will be able to provide our analysis and recommendations for these assets after launching the Parameter Recommendation Dashboard in the coming weeks.
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Chaos Labs is proposing the following framework for deciding on the initial parameter configurations of these assets and is inviting the community to provide feedback and input to incorporate into these initial recommendations.

Motivation

Under the current market conditions and in light of the recent CRV

attack, Aave aims to provide lenders and borrowers with enhanced security and risk measures via the Ethereum V3 deployment. Chaos Labs is building a set of agent-based simulations that will inform optimized risk parameters for V3 markets with the aim of:

- Unblocking other contributors in launching V3 on Ethereum.
- Facilitating a safe and guarded initial launch.
- Recommend parameters in-line with current market conditions and liquidity.
- Iterate on recommended parameters to help incentivize users to migrate from V2 to V3, where more granular risk parameter tuning is available.

Our V3 Monte Carlo simulation framework is expected to be completed in January 2023; however, due to the urgency of deploying Aave V3 on Ethereum, we have devised an interim methodology for initial launch risk parameters. Under current conditions, our risk-reward tradeoff leans heavily toward risk aversion; therefore, our primary motivation with the interim methodology is to provide a risk-off strategy for the community to opine on. Optimizing for risk-averse parameters while producing recommendations promptly has intentionally yielded less capital-efficient results. Once the simulation framework is complete and published for review, we can iterate on the recommendations to produce more capital-efficient risk parameter recommendations while keeping protocol risk at acceptable levels.

Methodology

Since Aave V2 on Ethereum has a long history and significant TVL and volume, the best approach for the initial recommendations is to use its risk parameter settings as a reference. Our approach is as follows:

- Utilize existing risk parameters as a baseline.
- Adjust parameters based on simulation results.
- Introduce additional risk parameters to accommodate extra security measures.

V3 offers a comprehensive set of risk parameters - some available on V2 (LT, LTV, Liquidation Penalty). We start by replicating the existing V2 parameters, adjusting them, and adding new ones (Supply Cap, Borrow Cap). After that, we will examine how we can use additional V3 risk levers and modes (efficiency mode, isolation mode) to make the assets more efficient via parameter updates, unfreezing assets, and enabling borrows.

TLDR - Initial Set Results

Asset

Supply Cap

Borrow Cap

LT

LTV

Liquidation Bonus

Debt Ceiling

WBTC

43K

28K

75%

70%

6.25%

N/A

WETH

1.8M

1.4M

82.5%

80%

5%

N/A

wstETH

200K

3K

79.5%

68.5%

7%

N/A

USDC

1.76B

1.58B

76%

74%

4.5%

N/A

DAI

338M

271M

77%

64%

4%

N/A

LINK

24M

13M

65%

50%

7.5%

N/A

AAVE

1.85M

0

70%

60%

7.5%

N/A

In addition, we recommend configuring an Ethereum-correlated (wstETH & ETH) e-mode category with the following parameters (more info on e-mode configuration below):

Category

Assets included

LT

LTV

Liquidation Bonus

Ethereum Correlated

WETH, wstETH

93%

90%

1%

Initial Parameter Recommendation Process Overview

The Initial Assets List

In light of the urgency to transition to Aave V3, we have focused on a limited number of assets to ensure proper risk coverage. To drive the most impact, we have selected assets representing a significant portion of the protocol's usage (and, therefore, revenue).

Risk Parameters that already exist on Aave V2

Following the guidelines of our approach to start with the battle-tested parameters of V2, we begin with a baseline of LT, LTV, Liquidation Penalty, and IR Curve similar to the values set today for those assets on V2.

Supply Caps for Non-Stable

Crypto Assets

Then, we determine the supply caps described in our supply cap methodology. Since the supply caps are derived from the liquidity available in DEXs to facilitate potential liquidations, it is essential to note that they should apply to the supply of both V2 and V3 for each asset. This is because we expect to see accounts from both V2 and V3 liquidated in cases of high market volatility, and the same DEX pools will be used to absorb the liquidated assets. However, the base assumption is without significant increases in rewards or yields, we don't expect to see significant net new liquidity in V3. Instead, as economic incentives align (improved capital efficiency in V3 versus V2), we expect the liquidity to originate from V2 as users migrate.

To ensure a significant V3 migration, we will recommend risk parameter changes shortly (see recommendations below) to incentivize users to transition to V3.

Supply Caps for Stable Coins

The supply caps for stablecoins are derived from the number of stablecoins required to ensure the economic efficiency of the protocol, similar to V2. To do that, we examine the following:

1. The percentage of collateral each stablecoin represents from the total collateral supplied against non-stable crypto assets (that we choose to list on V3) borrows in V2. For example, consider all positions in which an asset is provided as collateral and assets such as WBTC or WETH are borrowed against the said stablecoins.

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Source - Block Analitica - [AAVE](#) | [Block Analitica](#)

1. The percentage of borrows each stablecoin represents from the total borrows against collateral provided in non-stable crypto assets that we choose to list on V3. The following graphic illustrates this on a trailing 30-day basis:

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Source - Block Analitica - [AAVE](#) | [Block Analitica](#)

We set the supply caps to sufficiently accommodate collateral and borrow against the listed non-crypto assets.

Stablecoins supplied as collateral for WBTC and WETH loans from Aave V2

Asset

Against WBTC Loans

Against WETH Loans

Total

USDC

\$49.7M

\$94.6M

\$144.3M

DAI

\$0

\$12.4M

\$12.4M

Stablecoins borrowed against WBTC and WETH collateral from Aave V2

Asset

Against WBTC Loans

Against WETH Loans

Total

USDC

\$147.2M

\$185.7M

\$332.9M

DAI

\$13.4M

\$36.5M

\$49.9M

USDT

\$62M

\$65.9M

\$127.9M

Observing the current amounts of stablecoins borrowed or supplied against WBTC and WETH, we see the total amounts of stablecoins borrowed are significantly higher. Therefore they should serve as the reference to determine the supply caps of stablecoins. Although stablecoins generally do not contribute much to the risk of the protocol, it is better to set caps if they are such that they can assure proper utilization and efficiency.

Since the only non-stable crypto assets listed initially are WETH, WBTC, and wstETH, we know that the borrows against WBTC collateral will be WETH, wstETH, and stablecoins, and conversely, borrows against WETH collateral will be WBTC, wstETH, and stablecoins.

We recommend setting the caps for stablecoins as the sum of their respective borrow amounts against WETH and WBTC on V2. Once deriving the estimated stablecoin amounts borrowed against WBTC and WETH on V3, we suggest setting the supply cap to the sum of the estimated quantities multiplied by U_{Optimal}

(the optimal utilization ratio) of the crypto asset. This way, in the event of max supply of both WETH and WBTC, there will be enough stablecoins to be borrowed while keeping each stablecoin's utilization rate at the optimal level.

- Denote amount of stables borrowed against WETH in v2 as $Bv2(\text{Stable}, \text{WETH})$
- Denote $LTV(\text{Stable}, \text{WETH}) = Bv2(\text{Stable}, \text{WETH}) / \text{CollateralUSDValueV2}(\text{WETH})$
- We wish to maintain the same $LTV(\text{Stable}, \text{WETH})$

in v3, even when the WETH

supply cap has been filled.

- That yields $LTV(\text{Stable}, \text{WETH}) = Bv3(\text{Stable}, \text{WETH}) / \text{SupplyCapV3}(\text{WETH})$
- To support this amount of borrows and maintain optimal utilization, we must allow $\text{Supply}(\text{Stable})$

of at least $Bv3(\text{Stable}, \text{WETH}) / U_{\text{opt}}$

.

- Therefore, we set $\text{Supply}(\text{Stable}, \text{WETH}) = Bv3(\text{Stable}, \text{WETH}) / U_{\text{opt}} = Bv3(\text{Stable}, \text{WETH}) / U_{\text{opt}} = (LTV(\text{Stable}, \text{WETH}) * \text{SupplyCapV3}(\text{WETH})) / U_{\text{opt}}$

Conversely, this holds for Supply(Stable, WBTC)

. Adding both terms together yields the following:

$\text{SupplyCap(Stable)} = \text{Supply(Stable, WETH)} + \text{Supply(Stable, WBTC)}$

Lowering LT, LTV for Stablecoins

During the last bull run, many risk parameters on AAVE V2 were relaxed significantly. Specifically, LTs, LTVs, and Liquidation Penalties of stablecoins and the major crypto assets are too high considering current market conditions.

Challenges with Lowering LT, LTV

Increasing LTs enables additional borrows against the same collateral. This has no direct negative impact on users. However, lowering LT may cause loan liquidations that fall below the new lower LT. An example of this regarding USDC and DAI LTs was discussed recently after the CRV attack (link). Therefore, we believe that the best approach will be to launch AAVE V3 on Ethereum with conservative LT parameters and incrementally increase them over time rather than deploy with the current LT and LTV parameters.

A conservative approach to setting LT, LTV for WETH, WBTC

WBTC and WETH are highly liquid assets that lead the market, and their current LT and LTV levels are high, as they were set during different market conditions. As part of the general approach to start with conservative parameter settings, we recommend starting with conservatively low LT and LTV settings for those assets and increasing them over time. The method we chose to adjust the LT and LTV of non-stable assets is to use the LT, and LTV values of those assets on other V3 deployments, relying on the fact that it is derived from volatility and liquidity. Since the volatility of those assets is similar regardless of chain and liquidity is lower on chains of current V3 deployment, the values of LT and LTV will be conservative.

The approach to setting LT and LTV for Stablecoins

LT, LTV, and Liquidation Penalty should be derived from the volatility of the collateral factor, i.e., the ratio between the loan's value and the collateral's value. When stablecoins are used as collateral, we assume that the collateral asset has near-zero volatility, so the LT and LTV should be derived from the borrowed asset's volatility. The intuition behind this is that if we set the LTs to be the same for all assets borrowed against a specific collateral asset (stablecoin), then highly volatile assets are more likely to fall quickly from a state where the loan is healthy to a state where it is defaulted and not profitable for liquidations.

AAVE V3 provides a set of risk parameters to control this type of risk but not directly setting different LTs according to the borrowed asset. Therefore, setting LT and LTV for stablecoins will be determined in conjunction with the risk parameters of volatile assets that may be borrowed against them. Future parameter recommendations will derive these values from large-scale Monte Carlo simulations. To unblock the V3 deployment, we recommend starting with LT and LTV of stablecoins that will reflect the current composition of borrowed assets on V2.

For the initial parameter setting for V3, we recommend deriving the LT of each stablecoin from those of assets borrowed against it in V2, under the assumption that the transition of funds from AAVE V2 to AAVE V3 will not change the supply/borrow composition significantly. To this end, we have calculated the weighted average of LT of assets borrowed against USDC as collateral and against DAI as collateral separately. This is because it reflects the implied volatility behind loans that are taken against those assets. Once LTs are calculated, we set the LTV of DAI and USDC, keeping the same LTV/LT ratio of those assets on AAVE V2.

Given there are n

assets $X_1 \dots X_n$

borrowed against a stablecoin S

, where the dollar value of the amount borrowed in each asset is $\text{USDBorrow}(X_i, S)$

, and the LT of the borrowed asset is $\text{LT}(X_i)$

; we calculate the LT of stablecoin S

as:

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Recommended LT, LTV Values for USDC and DAI

Based on the methodology described above, we recommend setting the following initial parameters:

Asset

LT

LTV

USDC

76

74

DAI

77

64

Proposals for incentivizing and accelerating a V3 transition

Successful migration of users to V3 will require economically aligning incentives for suppliers and borrowers. Since most initial risk parameters are similar in both versions, users are inclined to keep using V2 because it is more liquid. Moreover, launching the protocol with lower LTs for stablecoins will create a state where stablecoin suppliers are incentivized to use AAVE V2 over AAVE V3, as the LTs are higher.

We believe there are three main levers the protocol can utilize to expedite the transition:

1. Incrementally Reduce LT and LTVs across active markets in V2

We've previously written about this ([here](#), [here](#), and [here](#)) and have initiated this process via a batch of AIPs. Reducing LTs across V2 will ultimately help migrate users to V3, where they can reap the benefits of higher capital efficiency. Since lowering LTs can invoke liquidations, this needs to be done gradually over time, with ample notice for users so that they can wind down positions and, ideally, a clear roadmap communicated from the start.

2. Freezing Markets Post V3 Launch

After the CRV attack, a [proposal](#) was made to freeze most V2 markets. Chaos Labs, with Llama [proposed](#) an alternative path forward aimed at neutralizing market risk more precisely while keeping healthier markets open. The primary rationale was that effective risk mitigation could be applied while not shutting down Aave for business. However, we support revisiting V2 asset freezing as said assets are activated on V3 with tighter risk controls. This is because we no longer harm user experience and limit optionality as users can opt to deposit and borrow on V3 while only withdrawing from V2.

3. AAVE V3 Rewards to Incentivize Transition from AAVE V2

Looking at previous deployments of new protocol versions of AAVE, we know that providing rewards to protocol users is a powerful and significant tool to encourage a timely migration.

For example, let's examine the deployment of AAVE V3 on Avalanche and Polygon. A sizeable reward program was deployed on Avalanche, and in just one week, most funds shifted from V2 to V3. On Polygon, where there was no such reward program, V2 is still more than twice the size of V3, both in terms of market size and total borrows.

A reward program was also put in place during the transition from AAVE V1 to V2 on Ethereum, and it is essential for the quick transition from V2 to V3. We will follow up with further thoughts on a reward program shortly.

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V3 Asset Risk Parameter Recommendations

Supply Caps

1. WETH

The projected price trajectories of Aave assets when ETH price crashes:

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Figure 1.1 Luna returns - 2022/05/09 - 2022/05/10, applied to WETH. Prices of other assets are highly correlated, as expected in such a scenario.

Figures 1.2-1.4 show the ability to liquidate examined asset, WETH, given the price trajectory in figure 2.1. The orange line at the top is the maximum amount that can be liquidated profitably based on the estimated change in liquidity at time t , which we denote as $\text{MaxDump}(t)$. The blue line on the same plot is the projection of the liquidated amount in case the supply cap will be the current supply divided by r . This corresponds with the assumption that an increase in TVL towards the cap is distributed similarly to the current state, so we can expect liquidations to grow at the same rate.

In some cases, the amount eligible for liquidation cannot be entirely liquidated:

$\text{AmountEligibleForLiquidation}(t)/r < \text{MaxDump}(t)$

We get $\text{debt}(t) = \text{AmountEligibleForLiquidation}(t)/r - \text{MaxDump}(t)$

, shown in the middle plot. If that amount is not liquidated over 3 minutes, the insolvable amount is bad debt (bottom plot). We wish to find minimal r

such that $\text{BadDebt}(t) = 0$

, throughout the entire simulation. We scan over r

in the range $[0.2:1]$

. Below we show examples from this range:

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Figure 1.2 - For $r=0.2$ (which yields a supply cap 5 times the current supply), There is an amount that cannot be liquidated. We assume liquidity will not support the following liquidations.

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Figure 1.3 - For $r=0.388$, there is still bad debt.

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Figure 1.4 For $r=0.435$, no bad debt is left. We set the cap to be the current supply of WETH divided by 0.435

Calculating the Cap for WETH:

$r=0.435$

$\text{SupplyCap(WETH)} = \text{CurrentSupplyV2(WETH)} / r = 782K / 0.435 = 1.8M$

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Figure 1.5 Sweep over r values. The current supply of WETH on AAVE is 782k (12/7/2022). $r=0.435$ yields a cap of 1.8M WETH - The largest Cap where bad debt is still 0.

2. WBTC

The projected price trajectories of Aave assets when BTC price crashes:

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Figure 2.1 - Luna returns - 2022/05/09 - 2022/05/10, applied to WBTC. Prices of other assets are highly correlated, as expected in such a scenario.

Figures 2.2-2.4 show the ability to liquidate examined assets (WBTC), as explained above, given the price trajectory in figure 2.1.

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Figure 2.2 For $r=0.4$ (which yields a supply cap that is 2.5 times the current supply), There is an amount that cannot be liquidated. We assume liquidity will not support the following liquidations.

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Figure 2.3 - For $r=0.727$, there is still bad debt.

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Figure 2.4 Figure 1.4 For $r=0.782$, no bad debt is left. We set the cap to be the current supply of WETH divided by 0.782.

Calculating the Cap for WBTC:

We choose the minimal r

value so that no debt is accrued throughout the simulation. That means the liquidity in the examined scenario can support an increase of $\text{CurrentSupplyV2(WETH)}$

by a factor of $1/r$

under the assumption that additional supply will have a similar distribution of health factor levels to that which we see on V2 today. We Calculate the supply cap for the examined asset:

$r = 0.782$

$\text{SupplyCap(WBTC)} = \text{CurrentSupplyV2(WBTC)} / r = 34K / 0.782 = 43k$

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Figure 2.5 Sweep over r values. The current supply of WBTC on AAVE is 34k (12/7/2022). $r=0.782$ yields a cap of 43K WBTC - The biggest Cap where bad debt is still 0.

3. Link

The projected price trajectories of Aave assets when Link price crashes:

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Figure 3.1 Luna returns - 2022/05/09 - 2022/05/10, applied to LINK. Prices of other assets are their historical prices at the time of the crash.

Calculating the Cap for LINK:

$r = 0.59$

$\text{SupplyCap(LINK)} = \text{CurrentSupplyV2(LINK)} / r = 14.5M / 0.59 = 24M$

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Figure 3.2 Sweep over r values. The current supply of LINK on AAVE is 14.5M (12/7/2022). $r=0.59$ yields a cap of 24M LINK - The biggest Cap where bad debt is still 0.

4. AAVE

The projected price trajectories of Aave assets when AAVE price crashes:

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Figure 4.1 Luna returns - 2022/05/09 - 2022/05/10, applied to AAVE. Prices of other assets are their historical prices at the time of the crash.

Calculating the Cap for AAVE:

While AAVE has significant on-chain liquidity, it still has a lower market cap than the above assets (~800M). To account for this, and in line with the guarded approach we recommend for the initial launch, we introduce MarketCapFactor

for assets with a market cap smaller than 2 billion USD.

$\text{MarketCapFactor} = \text{MarketCap}(\text{Token}) / \text{LowMarketCapTokenThreshold}$

MarketCapFactor is applied to the final cap calculation. We have currently set LowMarketCapTokenThreshold

to 2 Billion USD.

Putting it all together, for AAVE, we compute the following:

$\text{MarketCapFactor} = 800 / 2000 = 0.39$

$r = 0.435$

$\text{SupplyCap}(\text{AAVE}) = \text{CurrentSupplyV2}(\text{AAVE}) / r \cdot \text{MarketCapFactor} = 2.07\text{M} / 0.435 \cdot 0.39 = 1.85\text{M}$

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Figure 4.2 Sweep over r values. The current supply of AAVE Token on Aave is 2M (12/7/2022). $r=0.435$ yields a cap of 24M LINK - The biggest Cap where bad debt is still 0.

E-mode Configuration

We recommend the configuration of the following Ethereum-correlated e-mode configuration:

Category

Assets included

LT

LTV

Liquidation Bonus

Ethereum Correlated

WETH, wstETH

93%

90%

1%

Analysis

If liquidated immediately, the entire cap of 200K stETH has a price impact of 5% on the average stETH/ETH price (0.988). In the worst case, where all positions are fully leveraged, an LT of 93% would guarantee an over-collateralization high enough to enable liquidations. LTV is set to 90%, a slightly higher margin than staked assets on other chains, as historically, we have seen daily price changes of 2.22%. This protects retail users and still allows 10x leverage. Under the proposed cap, there is a very low risk of triggering stETH liquidations on v2.

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The Max Abs price change observed historically is 2.15%. LT - LTV margin is derived from absorbing such volatility.

Price Impact When Price = AveragePrice(0.988)

Price impact was calculated using liquidity conditions in the Curve STETH/ETH pool for average price levels.

STETH In

ETH out

Price Impact

10k

9880

0.0%

50k

49200

0.49%

100k

97623

1.2%

150k

144661

2.67%

200K

188k

5.03%

An LT of 93% ensures over-collateralization that allows liquidation of the entire amount.

Price Impact When Price = AllTimeLow(0.934)

Price impact was calculated using a liquidity snapshot of the Curve STETH/ETH pool on June 18, 2022

STETH In

ETH out

Price Impact

10k

9291

0.54%

50k

44808

4.7%

100k

80870

19.57%

150k

99646

29%

200K

106k

42%

As shown in the table above, the high price impact at low liquidity conditions could cause v2 position liquidations that will trigger further cascading liquidations. With stETH supply on Aave v2 of over \$1B this is a significant risk to the protocol.

To mitigate this risk, we recommend a relatively low borrow cap of 3,000 for stETH. Dumping this amount has a price impact of ~0.11, which allows a buffer for profitable liquidations, given the 1% liquidation bonus.

Aave V2 Liquidation Levels

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We see a major account (health=1.18), that would fall under health = 1 if the price drops to 0.81 (If not rebalanced) - <https://debank.com/profile/0x94269a09c5fcbd5e88f9df13741997bc11735a9c>. Liquidation of the entire Supply cap should not bring us to those price levels.

Next Steps

The deployment of V3 on Ethereum must be considered holistically, accounting for the current state of pools on V2. Supply caps are a crucial piece of risk management in V3 but will only be impactful once the usage of the respective asset in V2 is minimized.

Assuming the rationality of borrowers and suppliers, the incentives must be aligned between the protocol and users to usher migration and deployment of new and existing capital to V3. While increasing capital efficiency (i.e., increased Liquidation Thresholds) on V3 immediately would attract new deposits and borrows, it also introduces increased risk, which we advise against during this transition phase. Instead, we propose an incremental plan involving reducing LT and LTVs incrementally on V2, as proposed here ([AIP-136](#), [AIP-137](#)), while proposing attractive Interest Rate curves for V3 deployments, thus aligning economic incentives.

