Hi all,

In the past months, the interest rate models for stablecoin assets have remained broadly unchanged. As borrow demand has declined, utilization rates (borrowing divided by total supply) has decreased significantly from equilibrium levels seen during the bear market. This indicates that certain rate models may benefit from adjustments to better balance supply and demand.

While Gauntlet has indicated they are planning to add support for interest rate models (forum post), we at Block Analitica have recently posted a rate model analysis framework and update proposal to Compound and think a similar proposal could also provide immediate benefits to the Aave protocol.

Data and simulations referenced in this proposal are listed in this sheet.

Rate Model Overview

Borrow and supply rates for assets on Aave are determined based on market utilization (percentage of supplied assets that are currently being borrowed), interest rate model (function relating borrowing rates to market utilization), and reserve factor (percentage of borrower interest retained by the protocol).

The various rate impacting parameters should be set in a way to maximize welfare across key stakeholder groups; borrowers, suppliers, and the protocol itself. A summary of each group's key preferences are below.

Borrowers:

- Solvency of collateral assets supplied to other markets

- Low borrow cost

- Predictable borrow cost

Suppliers:

- Solvency of supplied asset

- Continuous availability of withdrawal liquidity

- High supply yield

- Predictable supply yield

Protocol:

- Solvency of all asset markets and protocol overall

- Good user experience for both borrowers and suppliers

- High market share of borrowing and deposits

- Reserve growth and protocol revenue

We can draw some inferences on ideal parameters by comparing the stakeholder preferences above.

Protocol solvency can be expected to rank highly among all stakeholder groups, which makes sense as an insolvency event could quickly wipe out supplier earnings, borrower collateral, and protocol equity, leaving everyone worse off.

While solvency is primarily driven by other protocol parameters such as maximum LTV, the most important rate related driver of solvency is maximum borrow rate. The max borrow rate helps disincentivize long periods of 100% borrow utilization by making borrow positions more costly and supply positions more rewarding. In addition to causing negative user experience for suppliers by blocking withdrawals, full utilization can increase risk of liquidations failing because liquidators would not be able to immediately withdraw funds to recycle their capital for additional liquidations. This suggests that maximum borrow rate should be set fairly high to create strong incentives for deposits or repayments when utilization nears 100%.

The next most important set of user preferences is borrowers' desire for low cost, and suppliers' preference for high yield. While these goals may seem to be mutually opposed, in some cases it is possible to improve both supplier yield and borrower cost at once. The key here is to maximize market utilization within a safe range.

Consider the relationship between borrow rate and supply rate:

supply rate = borrow rate * (1 - reserve factor) * utilization rate

As the utilization rate increases up towards the optimal utilization rate, the spread between borrow and supply rate becomes

progressively smaller. So while all stakeholder groups are strongly incentivized to avoid very high utilization approaching 100%, suppliers and borrowers benefit from maximizing utilization within safe bounds.

A secondary implication of the above is that, in cases where market borrow rate equilibria are far below the "optimal rate", which would correspond with low utilization, it may be possible to improve both borrow rates and supply rates by reducing the optimal borrow rate towards market equilibrium. As an added benefit, this would tend to improve the protocol's market share. The limiting factor is gauging borrowers' price elasticity of demand and propensity to switch platforms based on relative cost. If demand is fully inelastic with respect to borrow cost, then reducing optimal rate would not result in higher utilization, and would simply reduce supplier earnings and protocol reserve growth without corresponding gains to usage or market share. Gauging borrowers' price elasticity of demand is an important area for further study.

The above chart gives an example of moving the optimal borrow rate on a stablecoin rate model from 4% to 3%. Assuming a utilization rate of 37% under the old rate model matching existing USDC utilization (1.65% borrow rate and 0.55% supply rate), both borrowers and suppliers would have higher welfare between 43% utilization (where supply rate rises above 0.55% under the new rate model) and 49% utilization (where borrow rate rises above 1.65% under the new rate model).

We can see change in market efficiency, measured by spread between borrow and supply rates, in the below chart. Lower spread implies potential for mutual benefit across both borrowers and suppliers.

We can also consider potential user welfare benefits from changes in optimal utilization rate. The below chart shows change in market efficiency in a case where the optimal borrow rate remains at 4% but optimal utilization is increased from 80% to 90% (for example in the case of DAI where optimal utilization is currently lower than many other stablecoins).

Both borrowers and suppliers can be expected to value predictability of rates, and this is particularly important for borrowers. Rate volatility rises significantly when utilization increases beyond the optimal point, as the slope of the rate model increases rapidly to mitigate overutilization. A given change in utilization causes a much larger change in borrow and supply rates when above optimal utilization levels. A consequence is that the borrow rate at optimal utilization should be set high enough to be reasonably confident that market equilibrium will fall below this level in most cases.

As a final parameter, setting reserve factor must balance all stakeholders' desire for solvency against higher spreads (and corresponding higher borrow rate and/or lower supply rate) caused by protocol reserve accrual. Insolvency risk is primarily mitigated with collateral factors, but reserves offer an important second line of defense against this risk and also help anchor COMP valuation, which could theoretically be used for recapitalization. The protocol is also likely to maximize reserve accrual (revenue) through relatively low reserve factors, as higher values could push users towards competing platforms.

In summary:

- Maximum borrow rate should be high enough to prevent long periods of 100% utilization

- If market utilization rate is low, reducing optimal borrow rate can improve welfare for both borrowers and suppliers, depending on price elasticity of borrowing demand

- Where liquidity conditions allow, raising the optimal utilization rate can increase market efficiency and improve user welfare

- Optimal borrow rate should be set somewhat higher than reasonably expected market borrow rates to limit interest rate volatility

- All stakeholders benefit from low but non-zero reserve factors to balance preference for low borrow-supply rate spreads against risk mitigation and protocol value accrual

Adjusting Rate Parameters

Optimal Borrow Rate

Recently, rates for many stablecoins on Aave have trended below 3% (and even lower in some cases). This suggests that optimal borrow rates for some stablecoin markets could be adjusted down to as low as 3% without risking excessive utilization or rate volatility.

Source: [Aave DAI Market](#)

Smaller redeemable stablecoins including USDP and GUSD tend to have higher rate volatility, as a single change in positioning can cause relatively greater impact on utilization and rates given lower amounts deposited. But average rates are still broadly in line with USDC with very few cases of high utilization.

USDT rates have tended to be a bit higher than comparable large scale stablecoins, potentially due to more difficulty obtaining USDT (there is a 0.1% mint fee), higher perceived risk for holders, and inability to use as collateral. FRAX has also seen somewhat higher utilization and rate volatility, likely for similar reasons. Non-redeemable decentralized stablecoins such as sUSD, LUSD, and RAI have much higher rate volatility and have experienced occasional spikes in utilization. This is typically linked to periods when these stablecoins exceed their target price, incentivizing users to short them back towards par even if the borrowing cost is relatively high. For these assets, maintaining the current 4% optimal borrow rate seems

suitable.

Optimal Utilization and Max Rate

Increasing stablecoin optimal utilization rates from 80% to 90% can also be considered to improve efficiency further. Aave has used a 90% optimal rate for many stablecoin markets for over a year, without indications this has negatively impacted market safety or user experience.

For low volatility stablecoins, setting 90% optimal utilization rate can help improve market efficiency without adverse impacts on risk or rate volatility. Other more volatile stablecoins with more frequent utilization spikes can maintain their existing target utilization unchanged.

Reserve Factor

Aave's reserve factors could be adjusted to better reflect the risk posed by various assets to the Aave money market. Most stablecoins feature a standard 10% reserve factor, with exceptions being 20% for sUSD, FRAX, RAI, and UST, and 100% for the soon to be deprecated FEI.

Considering high upside price volatility risk on par with sUSD or RAI which can potentially push borrowed LUSD positions into insolvency, it would be reasonable to increase LUSD's reserve factor to match. On the other hand, FRAX's strong peg and low upside volatility risk reduces likelihood of insolvencies of borrowed FRAX, which could merit a reduction in reserve factor.

Increasing reserve factor on the defunct UST asset to 100% would likely be suitable to incentivize gradual winddown of this market.

Summary of Proposed Changes

This initial proposal will include changes to rate parameters for low volatility, redeemable stablecoins, which seem to have the strongest justification for immediate changes. Future proposals could include adjustments to reserve factors (LUSD, FRAX, UST) as well as adjustments to other markets' rate parameters.

USDC, TUSD, BUSD, USDP, and GUSD are fully redeemable and mintable with USD, which merits a somewhat lower maximum borrow rate at 100% utilization. DAI is a decentralized stablecoin, and while it has strong liquidity through the PSM the linkage with fiat USD deposits is more indirect, which merits a higher maximum borrow rate.

- Set rate model for USDC, TUSD, BUSD, USDP, and GUSD:

- Base rate: 0%

- Optimal utilization: 90%

- Rate at optimal utilization: 3%

- Max rate: 63%

- Base rate: 0%

- Optimal utilization: 90%

- Rate at optimal utilization: 3%

- Max rate: 63%

- Set rate model for DAI:

- Base rate: 0%

- Optimal utilization: 90%

- Rate at optimal utilization: 3%

- Max rate: 78%

- Base rate: 0%

- Optimal utilization: 90%

- Rate at optimal utilization: 3%

- Max rate: 78%

USDC / USDP

TUSD

BUSD / GUSD

DAI

Impacts at Current Usage Levels

While reducing optimal borrow rates could be expected to lead to higher borrowing usage, this is not assured and depends on the independent decisions of Aave users. Therefore, we consider a variety of scenarios to gauge potential impact. Absent other outside influences, the final equilibrium is likely to fall somewhere between these three outcomes.

(Note all data is presented as of 1 November 2022)

Status Quo

This scenario assumes that borrow and supply amounts would stay stable at current levels. In this case, both borrow and supply rates would fall below current levels, and the protocol would see roughly $315,000 per year lower reserve growth versus current levels (a 26.5% drop).

Increasing Borrows

This scenario assumes that borrowings increase until borrow rates equal current levels before implementing the proposed changes. This would result in higher equilibrium supply rates and a significant increase in reserve growth ($430,000 more per year, a 36.3% increase).

Supply Outflows

This scenario assumes that deposits are removed until supply rates equal current levels (before implementing the proposed changes). With total borrowings equal to the status quo scenario, but less assets supplied, this pushes up utilization rate and results in less drop in reserve growth versus status quo scenario ($170,000 less revenue per year, a 14.3% drop).

Future Work

Block Analitica will continue to monitor utilization conditions on Aave, and kick off additional proposals to adjust interest rate models as appropriate. In particular, if rate conditions rise and utilization begins to frequently increase beyond the optimal point, proposals to increase optimal borrowing rate may be warranted. We will also monitor user responses to these changes to get better insight into price elasticity and demand response to rate model changes. Findings from this experience could help inform rate parameter optimization in the forthcoming Ethereum v3 market and other Aave markets.

In the longer term, we hope to support the development of interest rate models that can respond to changing market conditions through automated parameter changes. As we gain further data on interest rate model sensitivities and market responses to the current changes, we will consider how we can best contribute to this process.

Payment

In connection with work going into this proposal, Block Analitica requests a payment of 120 AAVE (roughly $10,000 value at time of posting) to be transferred from Aave to the MakerDAO pause proxy if this set of proposed changes is adopted. This could be effected either through the proposal itself (transfer from the Aave ecosystem reserve) or retroactively via Aave Grants DAO depending on the community's preference.

Voting and On Chain Actions

An ARC post and snapshot poll will be submitted in the coming week to gauge community approval of the proposed changes. If there is support, we will partner with an existing Aave service provider or delegate to submit an on-chain proposal.

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