Current Rate System

The current rate system uses different inputs to calculate the stability fees of native and non-native vault types. The aim of this research is assessing whether a more suitable methodology would better price in risks related to the onboarded vault types as the exposure towards them increases.

The DSR and EDSR are calculated from the Base Rate, which is derived from two benchmarks, the Stability Collateral Yield Benchmark and the Yield Collateral Yield Benchmark.

Currently, the stability fees of vault types are calculated as follows:

Native Vaults

ETH-A, ETH-B, ETH-C, WSTETH-A, WSTETH-B

Based on the DSR and EDSR Upper limit, the initial rate is calculated, which is equal to the EDSR. In order to take into consideration risks related to individual vault types, some spreads are added to the initial rate, namely:

- 0.00% to ETH-C (LR = 170%) and WSTETH-B (LR = 175%)
- 0.25% to ETH-A (LR = 145%) and WSTETH-A (LR = 150%)
- 0.75% to ETH-B (LR = 130%)

The RETH-A vault type is in the process of being offboarded which will likely be concluded in the beginning of the year. This is the reason why it is not part of the new model.

Non-Native Vaults

WBTC-A, WBTC-B, WBTC-C

On the other hand, non-native vault types base the initial rate on the Yield Benchmark, with the addition of some spreads, namely:

- 0.00% to WBTC-C (LR = 175%)
- 0.25% to WBTC-A (LR = 145%)
- 0.75% to WBTC-B (LR = 130%)

Spark Effective Borrow APY

Spark Effective Borrow APY is currently defined as EDSR + Spread (0.5%).

Relation with Debt Exposure

Unlike other lending markets, the vaults do not currently incorporate a variable risk component in their model that adjusts based on the demand and supply of collateral. In the context of Maker, this variability would typically depend on the total exposure to a specific asset type or the aggregate exposure across different assets. However, it’s important to consider how increased exposure impacts the Stability Fees. Let us take for example WSTETH-A:

[

940×297 39.9 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/b/3/b367ab271055fdca77d02c8d6a284a8aa04c0a65.png)

The WSTETH-A vault type has a debt of 266M with a nominal risk premium of 0.5%, and is utilizing 35.5% of its 750M Debt Ceiling (DC). Notably, when the debt exceeds 300M, we observe a significant increase in Risk Premia. This rise is largely influenced by the current on-chain liquidity among other factors.

In contrast, the ETH-A vault type has a total debt of 235M with a risk premium of 1.2%, and a low utilization rate of 1.57% against its 15B DC. The risk model for ETH-A demonstrates a less steep curve compared to WSTETH-A in terms of increasing Risk Premia with rising debt levels.

[

940×301 40.8 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/3/7/375d24d7814f47ffc1ce7527df83aaa7024fecb5.png)

Although both Vault Types apply the same spread over the EDSR to determine their final Stability Fees, it is evident that their inherent risks differ. This suggests that as a vault's exposure increases, there should ideally be a corresponding variability in Stability Fees to adequately reflect the changing risk profile. The Exposure Model attempts to capture this dynamic.

Exposure (%) Model

[Atlas Rate System for Stability Fee Exposure Public]

Rationale

In order to address the issue with Stability Fees, BA Labs has developed the following system to adapt Stability Fees for Native Vaults, Non-Native Vaults and Spark based on the weight they have in the Maker Ecosystem. We have opted for a model based on %Exposures in order to calculate additional spreads to be applied on top of the Initial Rate and LR Spreads, which take into account asset-specific risks. The final model utilizes Heaviside step functions, which are piecewise functions written in a single equation.

Methodology

The proposed model works as follows:

SF = Initial Rate + LR Spread + Exposure Spread + Asset Spread

Where:

- Initial Rate is the Yiled Collateral Yield Benchmark for WBTC vault types, and EDSR for the remaining vault types,
- LR Spread is the Liquidation Ratio Spread,
- Exposure Spread is a Heaviside equation with two kinks,

[

1340×58 8.64 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/a/5/a592d3fcdda68b80af7f43aa4680b41387839468.png)

- Asset Spread is a Heaviside equation with two kinks.

[

1353×57 8.52 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/5/e/5e40390bfdb5c31548f224ea5b8bc29b65854dbf.png)

With Parameters:

- SR equal to a starting rate (1

)

- K equal to the Current %Exposure (rounded to two decimal places)
- Ka equal to the First Kink (2

)

- Kb equal to the Second Kink (4

)

- KFa equal to the Linear increase after the First Kink (3

)

- KFb equal to the Linear increase after the Second Kink (5

)

1. When 0% ≤ K < Ka, both H(K – Ka) and H(K – Kb) are 0, so the equation reduces to ES = SR, and AS = SR.
2. When Ka ≤ K < Kb, H(K – Ka) is 1 and H(K – Kb) is 0, so the equation becomes ES = SR + (K – Ka) × KFa, and AS = SR + (K – Ka) × KFa.
3. When Kb ≤ K ≤ 100%, both H(K – Ka) and H(K – Kb) are 1, so the equation becomes ES = SR + (Kb – Ka) × KFa + (K – Kb) × KFb, and AS = SR + (Kb – Ka) × KFa + (K – Kb) × KFb.

This model can be refined to swiftly adjust to market dynamics. By employing diverse spreads, it more accurately incorporates risk pricing. The Liquidation Ratio (LR) Spread, consistent with the current scenario, is specifically employed to factor in risks associated with different vault types' Liquidation Ratios. It is also crucial to monitor the amount of DAI generated from each vault type to gauge the exposure to risks tied to a particular cryptocurrency asset.

Exposure Spread represents total exposure to a particular asset. In the case of ETH, we combine all of ETH and WSTETH vault types' exposure. To manage this exposure, the Heaviside function is useful in establishing three distinct exposure zones. The first zone applies a basic Starting Rate (SR). In the second zone, as exposure intensifies, the Spread escalates by a factor of KFa. The third zone, triggered at a threshold Kb, sees the Spread rise by a higher factor KFb (with KFb > KFa), reflecting increased risk at higher exposure levels.

This approach is similarly applied to the Asset Spread, currently applied to WSTETH vault types. This Spread takes into account the risks associated with Liquid Staking Tokens (LSTs), which typically carry higher risks than their underlying assets. This method ensures a more targeted and responsive risk management strategy for different asset types and exposure levels. Since the exposure in Spark is derived from the exposure of multiple assets, we also use the Asset Spread to adjust the Spark Effective Borrow APY.

Chosen Parameters

This model allows us to change the parameters based on current exposures and find the most optimal Stability Fees.

ETH:

- SR = 0.00%
- K = 27.19%
- Ka = 0.00%
- Kb = 40.00%
- KFa = 0.01375%
- KFb = 0.0875%

WSTETH:

- SR = 0.00%
- K = 12.29%
- Ka = 0.00%
- Kb = 20.00%
- KFa = 0.00875%
- KFb = 0.0250%

WBTC:

- SR = 1.00%
- K = 1.98%
- Ka = 3.00%
- Kb = 10.00%

- KFa = 0.00875%
- KFb = 0.08%

Spark:

- SR = 0.00%
- K = 10.00%
- Ka = 0.00%
- Kb = 30.00%
- KFa = 0.0015%
- KFb = 0.07%

Results

All data fetched as of 20 December 2023.

Let us take the current exposure amounts divided by category:

[

image

820×452 81.6 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/f/1/f118fefb5cd02081a9143d4f679d8c8d75670907.png)

With Decentralized Collateral being ETH; wstETH; rETH; WBTC; D3M; UniV2 DAI/USDC, which is divided as follows:

[

image

826×405 67.4 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/9/7/972d96ae03cf6c029d6471890a5124ce5a07c557.png)

When looking at the bigger picture, this is the overall exposure of collateral types:

[

image

826×713 114 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/6/6/66000f123d32582085ea81a5d2e2a7bd9b0020bf.png)

When looking at the exposures utilized for the model, this is the result:

ETH Exposure Spread (ETH-A, ETH-B, ETH-C, WSTETH-A, WSTETH-B)

Based on the parameters chosen, these would be the Exposure Spreads applied to ETH-A, ETH-B, ETH-C, WSTETH-A and WSTETH-B vault types:

[

Chart

796×414 23.8 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/2/9/298824488b633268835e308bb6e32e36657ff737.png)

This would result in the following rates:

- Initial rate = EDSR = 5%
- LR Spread equal to 0.25%, 0.75%, 0.00% for different vault types depending on their LR
- Exposure spread of 1.49%
- Asset spread of 0.00% (for ETH vault types)

[

image

1222×210 43.5 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/2/9/29e2652a0455ab3bacd8e36d03edffc4f056ea90.png)

Which would end up in the following stability fees:

[

image

968×207 33.2 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/3/1/31fbb2a8341024108b9d4c952a6874df13856534.png)

WSTETH Asset Spread (WSTETH-A, WSTETH-B)

Based on the parameters chosen, these would be the additional asset spreads for WSTETH-A WSTETH-B vault types, applied on top of the previously calculated Exposure Spreads for ETH Vault Types:

[

Chart

892×414 27.6 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/3/b/3b8c30c92f431eb7ddd9543c7cbc929c8b4a1764.png)

This would result in the following rates:

- Initial rate = EDSR = 5%
- LR Spread equal to 0.25%, 0.00% for different vault types depending on their LR
- Exposure spread of 1.49% (Since WSTETH underlying asset is ETH)
- Asset spread of 0.32%

[

image

1221×155 38.4 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/3/b/3b2f23d489078abb1f641d9f7f8d4b5cc56fadca.png)

Which would end up in the following stability fees:

[

image

967×157 30.1 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/b/b/bb64d78519b9b71a8e539f67702e61547ebdfd4a.png)

WBTC Exposure Spread (WBTC-A, WBTC-B, WBTC-C)

Based on the parameters chosen, these would be the Exposure Spreads applied to WBTC-A, WBTC-B, WBTC-C vault types:

[

Chart

796×414 26.1 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/f/f/ff5a147c149a946b3d202a9fa17e1270d50a9d45.png)

This would result in the following rates:

- Initial rate = Yield Benchmark = 5.46%
- LR Spread equal to 0.25%, 0.75%, 0.00% for different vault types depending on their LR
- Exposure spread of 1.00%
- Asset spread of 0.00%

[

image

1222×207 49.3 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/d/7/d79a8959d8fdb49f709883e2fbb4c024e37eb892.png)

Which would end up in the following stability fees:

[

image

972×208 38.7 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/5/3/536068038085044d465f210a47b00a6d3682a636.png)

- SF Recalculated with the old methodology applying LR spread to the Yield Collateral Benchmark (3M T-Bills) in light of its new value, thus not reflecting the current SFs

Spark Exposure Spread

Based on the parameters chosen, these would be the additional exposure spreads for Spark:

[

Chart

892×414 25.1 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/9/8/981321a455ca826c3c9554354cf24db872df5836.png)

This would result in the following rates:

- Initial rate = EDSR = 5.00%
- LR Spread equal to 0.50%
- Exposure spread of 0.00%
- Asset spread of 0.60%

[

image

1221×107 25.1 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/a/9/a98ba5813d9daa4a13b112d39a693c7ad062ff19.png)

Which would end up in the following Effective Borrow APY:

[

image

971×107 17.6 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/e/b/eb32351fe71100e5b930e10281326121c5bc0e38.png)

Proposed Stability Fees

Based on the model, these would be the new stability fees:

[

image

971×511 84.1 KB

](//makerdao-forum-backup.s3.dualstack.us-east-1.amazonaws.com/original/3X/6/1/6156c987f7e6b336dab4a4530fb703052f88d55b.png)

Other Models Explored

Model 1: Vaults SF = x3RiskPremium * Utilization + Original SF * (1-Utilization)

Benchmarks

Rate

Yield Collateral Yield Benchmark

5.43%

Stability Collateral Yield Benchmark

1.33%

Base Rate

5.43%

DSR Spread

0.25%

DSR

5.18%

EDSR Upper limit

5.00%

EDSR

5.00%

Vaults

High LR Spread

0.00%

Normal LR Spread

0.25%

Low LR Spread

0.75%

Vault Types

Final Rate

3x RiskPrem

Utilization

Original SF

ETH-A

5.52%

22.70%

1.57%

5.25%

ETH-B

8.00%

13.60%

28.60%

5.75%

ETH-C

7.04%

19.20%

14.40%

5.00%

WSTETH-A

18.69%

43.10%

35.50%

5.25%

WSTETH-B

31.59%

70.00%

40.90%

5.00%

WBTC-A

5.59%

4.70%

8.84%

5.68%

WBTC-B

6.18%

6.20%

7.73%

6.18%

WBTC-C

5.17%

1.90%

7.24%

5.43%

This approach, even though interesting, results in unfeasible Stability fees, because of the two WSTETH vaults and the fact that ETH-C has a higher SF compared to ETH-A. Additionally the Risk Premium (RP) depends on the external model, which itself is arbitrary to some extent in terms of which parameters are chosen and how they are configured.

Model 2: Vaults SF = Original SF + (Utilization * Current RP)

Benchmarks

Rate

Yield Collateral Yield Benchmark

5.43%

Stability Collateral Yield Benchmark

1.33%

Base Rate

5.43%

DSR Spread

0.25%

DSR

5.18%

EDSR Upper limit

5.00%

EDSR

5.00%

Vaults

High LR Spread

0.00%

Normal LR Spread

0.25%

Low LR Spread

0.75%

Vault Types

Final Rate

Current RiskPr

Utilization

Original SF

ETH-A

5.27%

1.10%

1.57%

5.25%

ETH-B

6.09%

1.20%

28.60%

5.75%

ETH-C

5.03%

0.20%

14.40%

5.00%

WSTETH-A

5.43%

0.50%

35.50%

5.25%

WSTETH-B

5.00%

0%

40.90%

5.00%

WBTC-A

5.70%

0.20%

8.84%

5.68%

WBTC-B

6.21%

0.40%

7.73%

6.18%

WBTC-C

5.44%

0.10%

7.24%

5.43%

Model 3: Vault’s SF = MAX(Yield Collateral Benchmark; EDSR) + Spread

Benchmarks

Rate

Yield Collateral Yield Benchmark

5.43%

Stability Collateral Yield Benchmark

1.33%

Base Rate

4.14%

DSR Spread

0.25%

DSR

3.89%

EDSR Upper limit

5.00%

EDSR

5.00%

Vaults

High LR Spread

0.00%

Normal LR Spread

0.25%

Low LR Spread

0.75%

Vault Types

Final Rate

ETH-A

5.68%

ETH-B

6.18%

ETH-C

5.43%

WSTETH-A

5.68%

WSTETH-B

5.43%

WBTC-A

5.68%

WBTC-B

6.18%

WBTC-C

5.43%

Model 4: Increase SF Spread by 0.25%

Benchmarks

Rate

Yield Collateral Yield Benchmark

5.43%

Stability Collateral Yield Benchmark

1.33%

Base Rate

4.14%

DSR Spread

0.25%

DSR

3.89%

EDSR Upper limit

5.00%

EDSR

5.00%

Vaults

High LR Spread

0.25%

Normal LR Spread

0.50%

Low LR Spread

1.00%

Vault Types

Final Rate

ETH-A

5.50%

ETH-B

6.00%

ETH-C

5.25%

WSTETH-A

5.50%

WSTETH-B

5.25%

WBTC-A

5.93%

WBTC-B

6.43%

WBTC-C

5.68%

Conclusion

Given the analysis, this is what we suggest as potential methods to update vault Stability Fees in order to price in the additional risks related to the vault types:

Stability Fee Spreads dependent on %Exposure

SF = Initial Rate + LR Spread + Exposure Spread + Asset Spread

Pros: individual risks priced in; scalable; easy to change parameters; transparent; allows to adopt to changing rate and competitive environment

Cons: might overreact to small changes in exposures

Other Models explored consist in:

1. Incorporate Risk Premia based on Utilization and Debt Ceiling

a. SF = x3 Risk Premium * DC Utilization + Original Stability Fee * (1 - DC Utilization)

b. SF = Initial Rate + Current Spreads + (DC Utilization * Current Risk Premium)

Pros: pricing in additional vault-related risks; scalable

Cons: constant maintenance; data precision; either huge or limited effect; hard to justify; subjective RP; assumes limited DCs

1. Arbitrary increase in Stability Fee Spreads

a. SF = Initial Rate + Current Spreads + Increase

Pros: easy to implement; justifiable; low resources needed for monitoring

Cons: under- or overestimation of risks; not adaptive to different vault types

1. Change in Initial Rate based on market conditions

a. SF = MAX(Yield Benchmark; EDSR) + Current Spreads

Pros: easy implementation

Cons: limited by EDSR upper limit and Benchmarks; no individual risk priced in

After analyzing the potential alternatives, BA Labs believes that the Exposure Model would be the most appropriate for Maker to build a scalable and transparent rate system, that would be based on market conditions and exposures driven by market demand/supply. We would like to highlight that this is the first iteration of this model and it will be improved going forward and eventually be replaced by a purely automated model. This model is meant to address the need to adjust stability fees according to the trend of increasing exposure towards crypto assets in the Maker Ecosystem until the new automated model will take place in further stages of the Endgame. In general, for Maker is very important that crypto-based collateral has higher Stability Fees compared to the benchmarks, while the Spark Effective Borrow APY is lower than Maker Core Vaults in order to incentivize migrations towards SparkLend.

This is why BA Labs would recommend going with the Exposure Model described at length, and as such we will prepare the language for the MIP104 amendment via MIP102c2-SP.

Resources

Atlas Rate System for Stability Fee Exposure Public

makerburn.com

makerburn.com

Dashboard for watching DAI minting and MKR token burning in real time.

maker.blockanalitica.com

Maker Risk | Block Analitica

Maker Risk from Block Analitica