Executive Summary

E-mode allows the Aave community to increase capital efficiency on related assets. In this post, we discuss this relationship, how to test for it, and what it means for E-mode risk parameters.

We argue there are two key properties we must require for E-mode assets:

1. Pairwise prices must be historically mean reverting
2. the sampled mean exchange rate of any two tokens is stable. If the exchange between two assets doesn't mean-revert (e.g., it drifts up), users will experience liquidations, and bad debt might be accrued.
3. Pairwise prices must mean-revert fast
4. from the moment prices diverge, they must take less than 24 hours to converge back to the mean. This way, Aave has some confidence it won't be left holding debt for long.

Furthermore, major price deviations between E-mode assets may lead to bad debt, either from missed or adverse liquidations (as we explain below). We set our LT/LTV values sufficiently low to mitigate bad debt and preserve a good user experience for retail traders.

Testing Methodology

We consider USDC, USDT, DAI, and LUSD for the stablecoins class and stETH, cbETH, and rETH for the ETH liquid staking derivatives class.

We measure for mean-reversion and mean-reversion speeds using 1 year of Chainlink data

, including the latest collapse of SVB and subsequent depeg of USDC. Our analysis is based on rigorous statistical tests that are common in the financial engineering literature. We describe these and how we used them in our full-length paper found here.

Setting Risk Parameters

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DAI-USDC-DePeg

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Fig 1: DAI/USDC exchange rate during the USDC de-peg.

LT:

As a conservative measure, we set LT/LTV ratios according to the most significant deviation we've observed for any two assets. For DAI/USDC, we saw a deviation of ~3.6% after the USDC de-peg this weekend. As we discuss in our full-length paper, we can set the liquidation threshold such that we minimize the accrual of bad debt from adverse liquidations or potential attacks from arbitrageurs:

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LTV:

We can minimize the chances that retail traders are liquidated by increasing the gap between LT and LTV. This way, even during major depeg events, retail traders will not be harmed by liquidations (and we further minimize the chances of accruing bad debt):

For USDC/DAI, we get an LTV of 93%. If we included USDT, we would have to decrease LT/LTV to 0.87 and 0.76,

respectively, which we explain below.

Results

We find that all stablecoins are mean-reverting at 99% confidence, whereas there is insufficient data

to assert the same for ETH LSDs. Furthermore, we find that LUSD has historically taken too long to mean-revert and is therefore not considered.

Fig 2: Results from our ADF and Hurst Exponent tests on mean-reversion for stablecoins. We find that all pairs considered mean-revert within a 99% confidence interval.

Fig 3: Historical time to mean reversion for stablecoins. We measure how long prices take to converge to 0.1% of the long-term mean once they have diverged by 0.1% from the long-term mean.

Fig 4: Stablecoin mean-reversion results. We find that there is insufficient data to assert that stablecoins mean-revert at a 99% confidence interval, likely due to their brief lifespans and the underlying redemption mechanisms (which differ from stablecoins).

A Note on Bad Debt

Bad debt can be accrued in two ways:

1. Missed liquidations:

The prices of borrowed and collateral assets diverge and don’t converge. In this case, if liquidations were not profitable as the prices diverged, Aave is left with a debt that cannot be repaid with the current collateral.

1. Adverse liquidations:

Adverse liquidations occur as prices converge: liquidators are rewarded with all the collateral but only repay part of the outstanding debt. This likely occurs when prices are converging (because there is more buy-side liquidity on the collateral asset).

We have accounted for both risks in our methodology: we recommend choosing assets that have a history of mean-reverting quickly (1), and we set the LT sufficiently low such that debt can be repaid at deflated prices (2).