



# Aave and Compound DeFi Protocols

## A Quantitative Assessment

### Executive Summary

This report is a comparative analysis of the Compound and Aave protocols. We assessed profitability and risk metrics of both. The report assesses characteristics from three different perspectives:

1. token holders,
2. depositors, and
3. borrowers.

**Section 1** covers investment metrics, specifically net interest margin (NIM) and annualized rate of return, in other words, yield associated with investment into the protocol.

**Section 2** covers risk metrics including market risk, liquidity risk, and operational risk. Credit risk is out of scope.

Based on the conducted analysis, Aave showed better results compared to Compound, subject to a disclaimer.

### Context

This report was commissioned by Coinshift.

### Investment Metrics

Cash flow assessment is part of the fundamental analysis used to derive the fair value of any organization.

An organization's market value is the total value of its outstanding shares or tokens (market cap). For the Aave and Compound protocols we have considered their token market cap.

Once the fair value of a token is known, it can be used to make asset management decisions. If the fair value is higher than the market value, the token should be bought, otherwise, it should be sold.

From a token holder's perspective, Aave is more attractive than Compound. Aave's margin is higher. Table 1 provides a quantitative summary of the analysis. As of 13 October 2021, Aave



has \$42M of monthly interest expenses<sup>1</sup> versus \$47M of monthly interest revenues<sup>2</sup>. This \$5M difference implies a 2.22% net interest margin (NIM) per annum.

Aave's NIM is 58 basis points (0.58%) higher than Compound's, therefore representing a better investment opportunity since NIM is expected to be distributed to token holders.

Table 1 - Net Interest Margin Analysis

Protocol	Monthly Cost in \$M	Monthly Revenue in \$M	Margin in \$M	NIM
AAVE	42.23	47.00	4.77	2.22%
Compound	18.48	21.04	2.56	1.63%

Table 2 provides information on the protocols' borrowing and lending rates. As could be seen from the data as of 13 October 2021, the weighted average borrowing rate for Aave is 2.85%, while the one for Compound is 1.43%, which is lower by 1.42%. For depositors (lenders) Aave is more attractive, but for borrowers, Compound is more attractive.

Table 2 - Weighted Average Funding and Lending Rates Comparison

Protocol	Borrowing rate	Lending rate	Spread
AAVE	2.85%	7.50%	4.65%
Compound	1.43%	4.45%	3.02%

## Summary

**Because Aave has a higher net cash inflow, it is a more attractive protocol from a token investment standpoint.**

**Aave & Compound have the same business model: both protocols attract deposits by offering interest payments, then lend out those same deposits at a higher rate. Profit to the protocol comes from the difference of interest paid out to lenders and interest paid by borrowers (the spread).**

## Risk Metrics

Credmark maintains a risk register of the main risks identified in DeFi protocols. The significant risks associated with Aave and Compound investigated in the current analysis are:

- **Market risk** – the risk of market price volatility measured in potential loss under normal conditions.
- **Liquidity risk** – the risk that an organization will have insufficient funds to meet its financial commitments on time.

<sup>1</sup> Interest paid to its depositors.

<sup>2</sup> Interest paid by its borrowers.



- **Operational risk** - the risk of losses caused by flawed or failed processes, policies, systems, or events that disrupt business operations.

Credit risk is the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations. Although material, Credit risk is not included in the current assessment due to its widespread nature in the DeFi space. Even first order protocols that are backed by fiat reserves, also known as stablecoins, are prone to significant credit risk. We recommend managing credit risk through diversification.

Risk assessment of a protocol is helpful in decision-making for all counterparties involved: token holders, depositors, and borrowers.

## Summary

**Credmark maintains a register of market, liquidity and operational risks in DeFi. We quantify and monitor these risks and recommend appropriate risk mitigating strategies.**

## Market Risk

Value-at-Risk (VaR) is a model to measure market risk. VaR is a statistical measure of financial exposure. It is defined as the maximum dollar amount expected to be lost over a given time horizon, at a pre-defined confidence level, given normal market conditions.

As an example, we computed the VaR for a theoretical holding of \$1M worth of Ethereum (ETH).

Based on 99% confidence level, 10-day holding period, and 1-year historical sampling window, the VaR of this position as of 6 October 2021 is equal to \$379k. Table 3 shows other VaR estimates for other historical windows and holding periods.

*Table 3 – 1 Day and 10 Day VaR Based on Last Year and All-Time History*

<b>Metrics</b>	<b>Last year</b>	<b>All-time</b>
1 Day VaR	139,908	150,148
10 Day VaR	379,003	377,376

The distribution in Figure 1 compares the VaR during a 10-day holding using data from the past year as well as all the historical data. The past year's values are more skewed and platykurtic than the ones for the whole history.

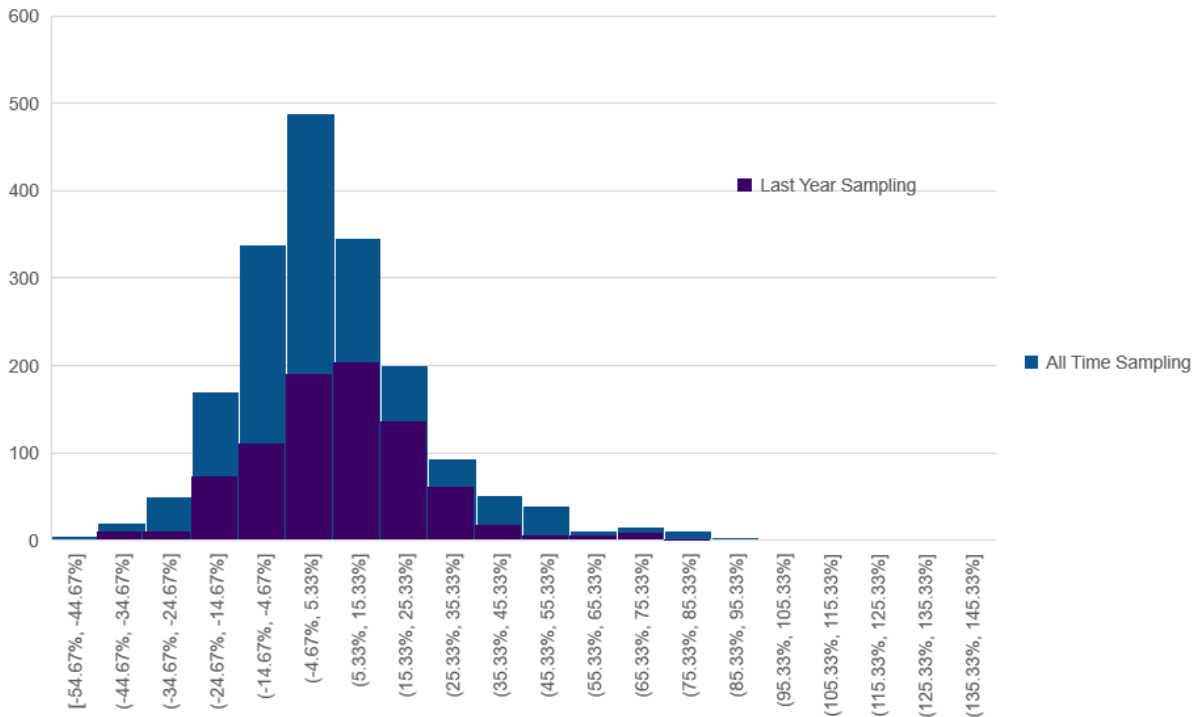


Figure 1 - Historical Distribution

These calculations exclude gas prices and transaction fees, which at times could exceed \$5,000. We plan to compute the VaR for the protocols' total portfolio.

### Summary

**Value at Risk (VaR) is used to measure the maximum potential loss caused by market movement under business-as-usual circumstances.**

**Applied theoretically to ETH, both Aave and Compound have equal VaR. Future research will focus on applying VaR to Aave and Compound's complete portfolios.**

### Liquidity Risk

Liquidity risk is the risk that a business will have insufficient funds to meet its financial commitments in a timely manner.

To measure this risk, we use a metric called liquidity coverage ratio (LCR). LCR is defined as the proportion of highly liquid assets held by an organization to ensure that they maintain an ongoing ability to meet their short-term obligations (cash outflows for 30 days) in a stress situation. It is one of the essential liquidity risk measures in traditional finance. The mathematical formula is:

$$LCR = \frac{\text{Liquidity Buffer}}{\text{Total net cash outflows for 30 days under stress}}$$



**Net cash outflows** – net outflows from depositors removing funds and early loans liquidations under stress.

**Liquidity buffer** – the funds held in the safety module for each protocol.

Aave and Compound have similar business models. They borrow funds from depositors and lend these funds at a higher rate. This margin is then distributed to the token holders.

Most of the funds collected from the sale of tokens are held in a diversified portfolio of highly liquid cryptocurrencies and act as a buffer for contingent liabilities. This buffer is often called a 'Safety Module'. Except for 'Safety Module' liquidity, the protocol can raise money through additional token issuances. However, this option is less favorable due to its negative effect on token price in a stress situation.

To parameterize LCR, we came up with the following assumptions on the stress scenario:

- High net worth individuals and wholesale clients withdraw their funds, representing 20% of the total deposit portfolio.
- Observed market volatility results in a 10% net loss in volatility-triggered liquidations.
- The safety module is down by 30% due to a market crash and subsequent sell-off of the native token.

Table 4 lists a comparative analysis of Aave2 and Compound protocol LCR with the breakdown of its components. Aave2 LCR is assumed to be the same for all Aave protocols.

*Table 4 - Liquidity Coverage Ratio of AAVE2 and Compound*

	<b>AAVE2</b>	<b>Compound</b>	<b>Diff</b>
<b>LCR</b>	<b>42.03%</b>	<b>35.80%</b>	<b>6.23%</b>
Assets Net Outflows, in \$M	752	568	33%
Liabilities Net Outflows, in \$M	3,553	3,111	14%
Safety Module, in \$M	1,809	1,317	37%

Aave has an LCR 42.03%, which is 6.23% higher than Compound's. Aave's liquidity management is clearly more robust than Compound's. This is primarily explained by Aave's Safety Module being 37% higher than Compound's.

Credmark is continuing to refine the LCR framework and investigating ways to monitor the metric in real time.

## Summary

**Liquidity Coverage Ratio is used to assess how well a protocol could mitigate a scenario where more money is owed to borrowers than collateral held by the platform. Aave outperforms Compound because they hold more money in their Safety Module proportionate to money withdrawn by borrowers.**



## Operational Risk

We verified historical events that have resulted in a loss of funds from decentralized banking protocols and would like to emphasize the following two major operational risk event types:

- Oracle manipulation flash loan attacks. In these attacks, malicious attackers use liquidity from flash loans to manipulate the price of an asset on pricing oracles used by a lending protocol. This enables the attacker to take out an undercollateralized loan on a protocol. Even though the collateral is lost, the lending protocol still loses money because of the undercollateralized nature of the loan.

Based on historical events, flash loan attacks can steal up to 2.3% of the total value locked of the protocol.

- Smart Contract Bugs. In this instance, an individual with an in-depth understanding of smart contract logic can find and exploit a vulnerability in the protocol.

Based on historical events, Smart Contract bug exploits can steal up to 2.5% of the total value locked of the platform

The potential risk of these events as of 13 October 2021 is shown below (Table 5 and Table 6).

*Table 5 - Major Operational Risk Event Types for AAVE Protocol*

<b>AAVE</b>	<b>Flash Loan Attack</b>	<b>Smart Contract Bug</b>
Impact, in \$M	367	399
Probability, in %	0.7%	1.0%
Risk, in \$M	2.4	4.0

*Table 6 - Major Operational Risk Event Types for Compound Protocol*

<b>Compound</b>	<b>Flash Loan Attack</b>	<b>Smart Contract Bug</b>
Impact, in \$M	255	277
Probability, in %	0.8%	1.1%
Risk, in \$M	2.1	2.9

The risk can be mitigated by diversification of the market data sources and collateral base. In both cases, Aave is perceived to be better positioned due to having access to having more resources to build a mitigation strategy.

Under normal market conditions, operational risk events can cause losses of up to 12% of the annual profit. For Aave this is \$6.9M, and for Compound it is \$3.7M.



## Summary

**All Crypto projects are subject to industry-specific operational risks. Flash Loan attacks and Smart Contract bug exploits are common examples. In both instances, Aave is better situated to respond than Compound due to a proportionately higher amount of assets available to respond compared to funds at risk.**

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