Introduction to DeFi

Table of Contents

Traditional Lending Process

If you want to buy a house in Taipei but lack sufficient capital, how can you borrow money from a bank?

Lending Category

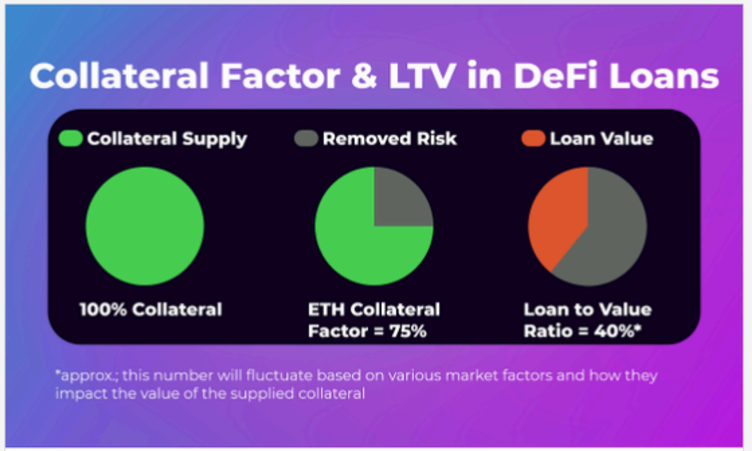
There are different types of lending based on the collateral provided

- Uncollateralized Loan: A loan issued without requiring the borrower to provide any collateral, such as a flash loan.
- Undercollateralized Loan: A loan where the collateral provided is worth less than the loan amount.
- Overcollateralized Loan: A loan where the borrower provides collateral that exceeds the value of the loan amount.

Overcollateralization

A loan where the borrower provides collateral that exceeds the value of loan amount

- To borrow $1,000 USDC from an on-chain lending protocol with a 150% collateral factor, you must provide at least $1,500 worth of collateral.
- Collateral Factor (CF)
- Loan-to-value (LTV)
- Collateralization Ratio (CR)



Overcollateralization

A loan where the borrower provides collateral that exceeds the value of loan amount

- Collateral Factor (CF): the maximum amount a user can borrow based on the amount of collateral that they supplied into the protocol.
- Loan-to-value (LTV): a ratio of borrowed funds to the supplied collateral
- Collateralization Ratio (CR):

Overcollateralization

A loan where the borrower provides collateral that exceeds the value of loan amount

- Collateral Factor = Maximum Loanable Value / Collateral Value
- More volatile and less liquid assets typically have lower collateral factors
  - If you want to borrow $500 USDC worth of a meme coin, you may need to supply $1,000 USDC worth of collateral, resulting in a collateral factor of 50%
- Less volatile and more liquid assets generally have higher collateral factors
  - if you want to borrow $500 USDC worth of ETH, you might need to supply $625 worth of ETH as collateral, giving a collateral factor of 80%

On-chain Lending

On-chain lending relies on the overcollateralized loan model, but why is on-chain lending necessary?

- If I need to supply collateral worth $120 to borrow $100 worth of assets, why wouldn't I just sell my collateral instead?
- Scenario: If I believe the price of LiaoToken will rise soon, I may not want to sell my LiaoToken and might even want to buy more. However, if I currently lack additional assets, what can I do?

On-chain Lending

In a lending protocol, you supply Token A as collateral and borrow Token B

- Scenario: If I believe the price of LiaoToken will rise soon, I may not want to sell my LiaoToken and might even want to buy more. However, if I currently lack additional assets, what can I do?
- I can supply LiaoToken as collateral in the lending protocol, borrow USDC, and use the borrowed USDC to purchase more LiaoToken.

Leverage Long

In a lending protocol, you supply Token A as collateral and borrow Token B

- Step 1: Supply LiaoToken as collateral
- Step 2: Borrow USDC from the lending protocol
- Step 3: Use the borrowed USDC to buy more LiaoToken

Debt: The borrowed USDC.

Position: The collateralized ETH + the purchased ETH

On-chain Lending

In a lending protocol, you supply Token A as collateral and borrow Token B

- Scenario: If I believe the price of LiaoToken will fall soon, I may want to short LiaoToken and profit from the price drop. However, if I currently lack additional assets, what can I do?
- I can supply USDC as collateral in the lending protocol, borrow LiaoToken, and use the borrowed LiaoToken to purchase more USDC

Leverage Short

In a lending protocol, you supply Token A as collateral and borrow Token B

- Step 1: Supply USDC as collateral
- Step 2: Borrow LiaoToken from the lending protocol
- Step 3: Use the borrowed LiaoToken to buy more USDC

Debt: The borrowed LiaoToken

Position: The collateralized USDC + the USDC from selling LiaoToken.

Leverage Long

If you own LiaoToken with a collateral factor of 80%, what is the maximum amount you can borrow from the lending protocol? (Imagine 1 LiaoToken = 1 USDC now)

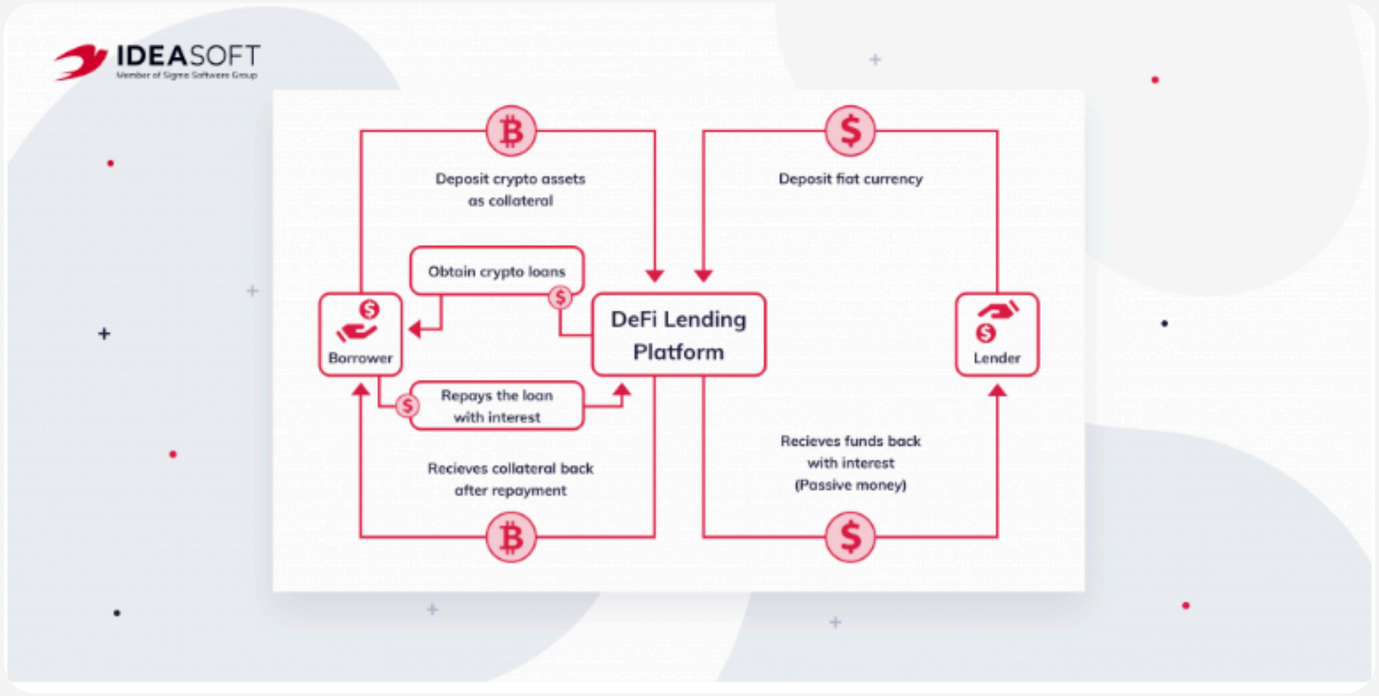
- Step 1: Supply 100 LiaoToken as collateral.
- Step 2: Borrow 80 USDC from the lending protocol.
- Step 3: Use the borrowed 80 USDC to purchase 80 LiaoToken.
- Step 4: Supply the additional 80 LiaoToken as collateral.
- Step 5: Borrow 64 USDC from the lending protocol.

By repeating this process, you can leverage up to 1 / (1 - 0.8)=5 times

of your initial LiaoToken

Mechanism

Roles in on-chain lending protocol



- Lender supplies assets to earn interest
- Borrower supplies collateral to obtain a loan and gain access to liquidity

What if we cannot repay the loan? In that case, we may require a liquidator

Liquidation

The market is volatile, causing the prices of both the collateral and the borrowed assets to fluctuate.

- Loan-to-Value (LTV): The ratio of the loan's current value to the collateral's value.
  - If the LTV approaches 100%, there is a risk that the loan amount could exceed the collateral's value, potentially resulting in losses for the lender.

Liquidation

The market is volatile, causing the prices of both the collateral and the borrowed assets to fluctuate.

Block	Collateral	Loan	Collateral - Loan	LTV
10,000	1000 USD	800 USD	1000 - 800	80%
10,020	600 USD (Drops 40%)	800 USD	600 - 800 = -200	133%

When the LTV exceeds 100%, the protocol incurs bad debt, leading to insolvency and an inability to repay lenders

Liquidation

The market is volatile, causing the prices of both the collateral and the borrowed assets to fluctuate.

Block	Collateral	Loan	Collateral - Loan	LTV
10,000	1000 USD	800 USD	1000 - 800	80%
10,020	1000 USD	1200 USD	600 - 800 = -200	133%

When the LTV approaches 100%, it becomes unmanageable and must be addressed before reaching this condition

Liquidation

Liquidation Factor: The threshold percentage at which a borrower's collateral may be forcibly liquidated to cover their debt.

- The liquidation factor is always set higher than the collateral factor.
  - If the collateral factor is 80% and the liquidation factor is 70%, the borrower would be liquidated immediately after borrowing.
- Setting the liquidation factor too close to 100%
  - Increases the risk of bad debt
  - The collateral's value may drop below the loan amount by the time liquidation occurs.

Liquidation

The liquidation happens when the LTV exceeds the liquidator factor, what might be the scenario for the LTV increases?

Block	Collateral	Loan	Collateral - Loan	LTV
10,000	1000 USD	800 USD	1000 - 800	80%
10,020	600 USD (Drops 40%)	800 USD	600 - 800 = -200	133%

Scenario 1: the price of the collateral token decreases

Liquidation

The liquidation happens when the LTV exceeds the liquidator factor, what might be the scenario for the LTV increases?

Block	Collateral	Loan	Collateral - Loan	LTV
10,000	1000 USD	800 USD	1000 - 800	80%
10,020	1000 USD	1200 USD (Increase 150%)	1000 - 1200 = -200	120%

Scenario 2: the price of the loan token increases

Liquidation

What happens in the liquidation process?

- The exact mechanism of liquidation varies across protocols.
- If one user supplies ETH as collateral and borrow USDC from lending protocol and the liquidation process occurs
    - In a straightforward scenario, the liquidator repays the borrower's USDC loan and receives a portion of the collateral at a discounted rate.

Close factor = maximum portion of a borrower's debt that can be repaid during a single liquidation event

Aave

What happens in the liquidation process?

- Health factor measures the ratio of a borrower's collateral to their debt.
- An health factor of 1 or higher indicates a safe loan, while an health factor below 1 signals risk, making the loan eligible for liquidation
- When the liquidation happens, up to 50% of the loan can be liquidated (Aave v2)

Health Factor = Total Collateral Value * Liquidation Threshthold / Total Borrowed Asset

Simulator News

Morpho

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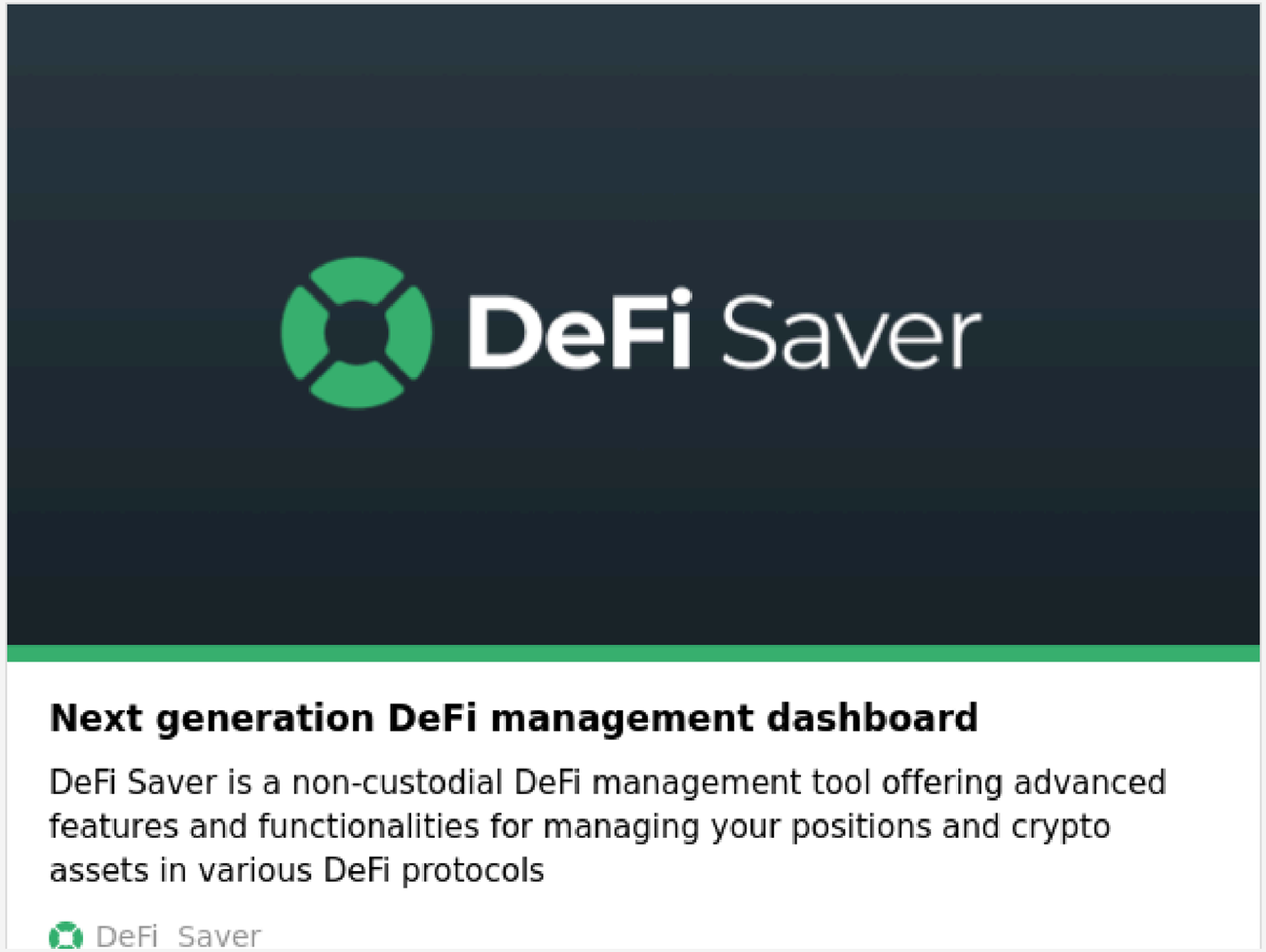
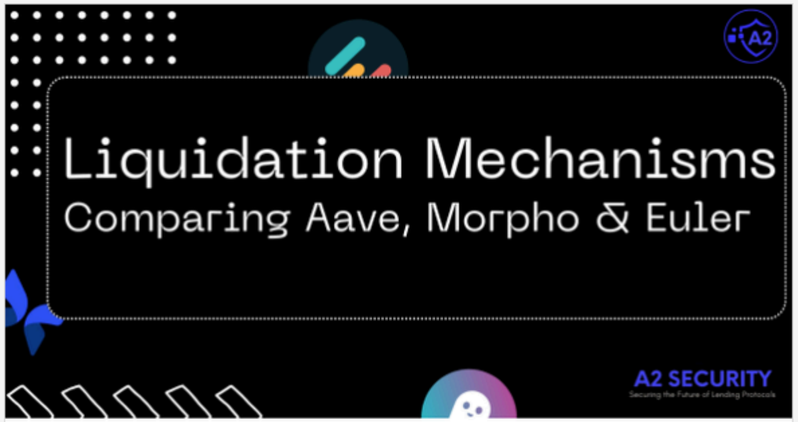
Simulator


DeFi Saver
Next generation DeFi management dashboard
DeFi Saver is a non-custodial DeFi management tool offering advanced features and functionalities for managing your positions and crypto assets in various DeFi protocols
DeFi Saver

More on Liquidation



Liquidation Mechanisms in DeFi : A Study of Aave, Morpho, and Euler💡

In this article, we explore 🔍 the mechanics of liquidation and how top lending protocols—like AAVE, Morpho, and Euler V2 implement these essential processes.

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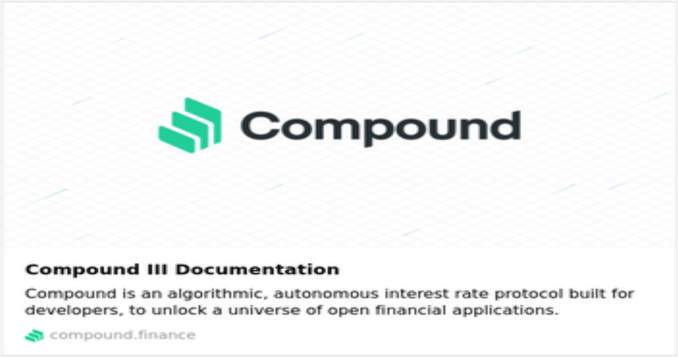
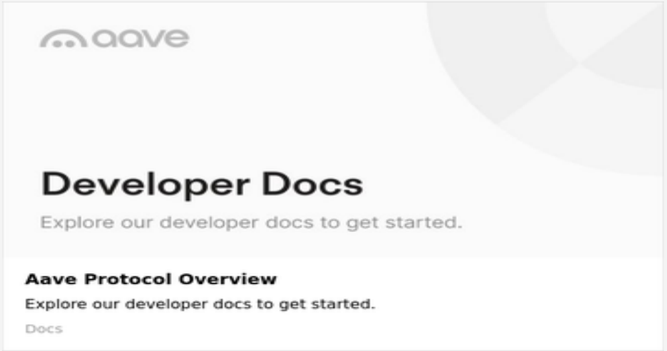
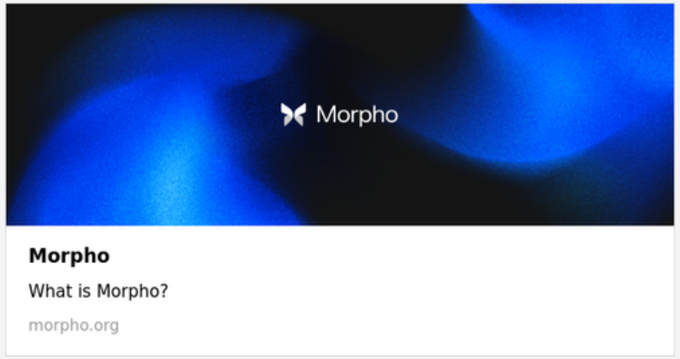


Compound v3



Aave

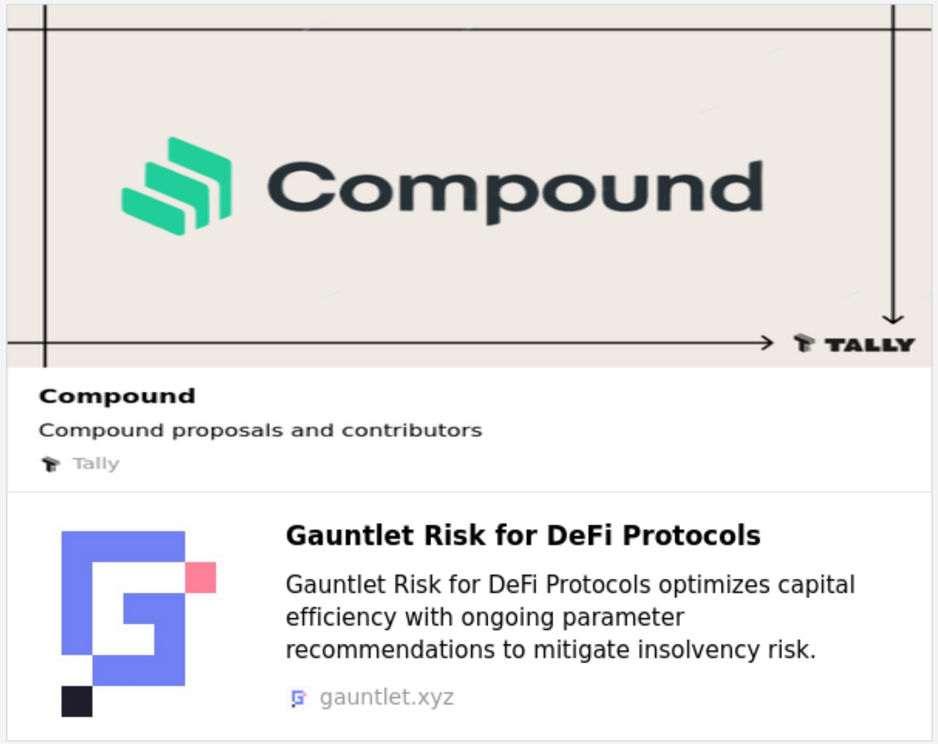
Compound v2



Morpho

Risk Parameter Configuration

How do they configure the collateral factor, liquidator factor and other important parameters?

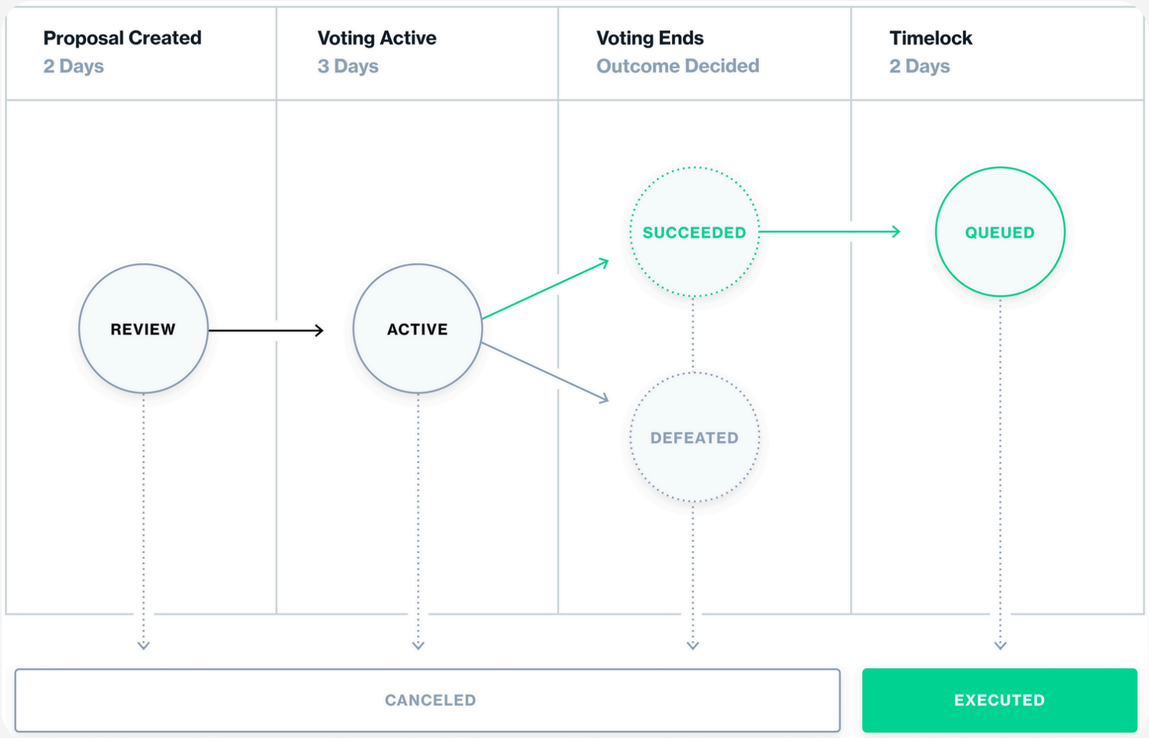


The configurations can be reset -

does this imply that the protocol is controlled by a centralized entity?

DAO

DAO stands for Decentralized Autonomous Organization



Incentives for Lending

What incentivizes lenders to provide liquidity to lending protocols?

- In traditional finance, what is the incentives for bank to supply borrowing service
- In on-chain lending services:
  - Borrowers are required to pay interest
  - Lenders earn profits from the interest payments

- Borrowers: Pay interest on their loans
- Lenders: Earn interest based on the liquidity (funds, capital) they provide

How do the protocol earn money?

Incentives for Lending

How do lending protocol profit from providing the service

- Borrowers: Pay interest on their loans
- Lenders: Earn interest based on the liquidity (funds, capital) they provide

Reserve Factor: a portion of the supplied capital from which interest is redirected to the protocol instead of the lenders, often referred to as the “spread”

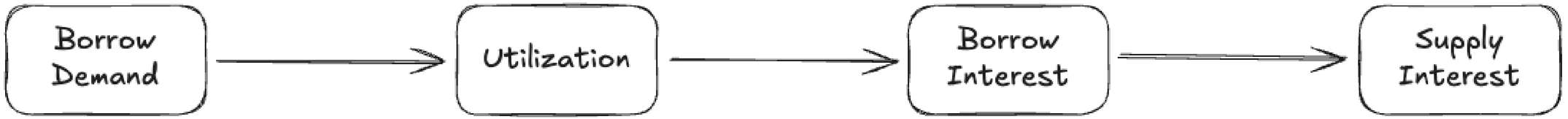
Incentives for Lending

How do lending protocol profit from providing the service

- Scenario
  - A borrower takes a loan of $1,000 USDC with an annual interest rate of 5%.
  - The total interest generated over a year is: $1000 * 5% = 50 USDC
- Reserve Allocation:
  - 10% of the interest goes to the protocol: 50 * 10% = 5 USDC
  - 90% is distributed to the lenders: 50 * 90% = 45 USDC

Interest Rate Model

How to determine the interest of lender and borrower?



If borrow demand surges, capital utilization increases, causing borrow interest rates to rise accordingly, which in turn affects supply interest rates.

Interest Rate Model

How to determine the interest of lender and borrower?

Utilization = total borrowed / total deposited

Interest Rate Model

How to determine the interest of lender and borrower?

- When utilization increases:
  - Borrow Interest: Increases to discourage borrowing.
  - Supply Interest: Increases to encourage more liquidity.
- Result: Higher idle liquidity and reduced borrow demand, leading to a lower utilization level.

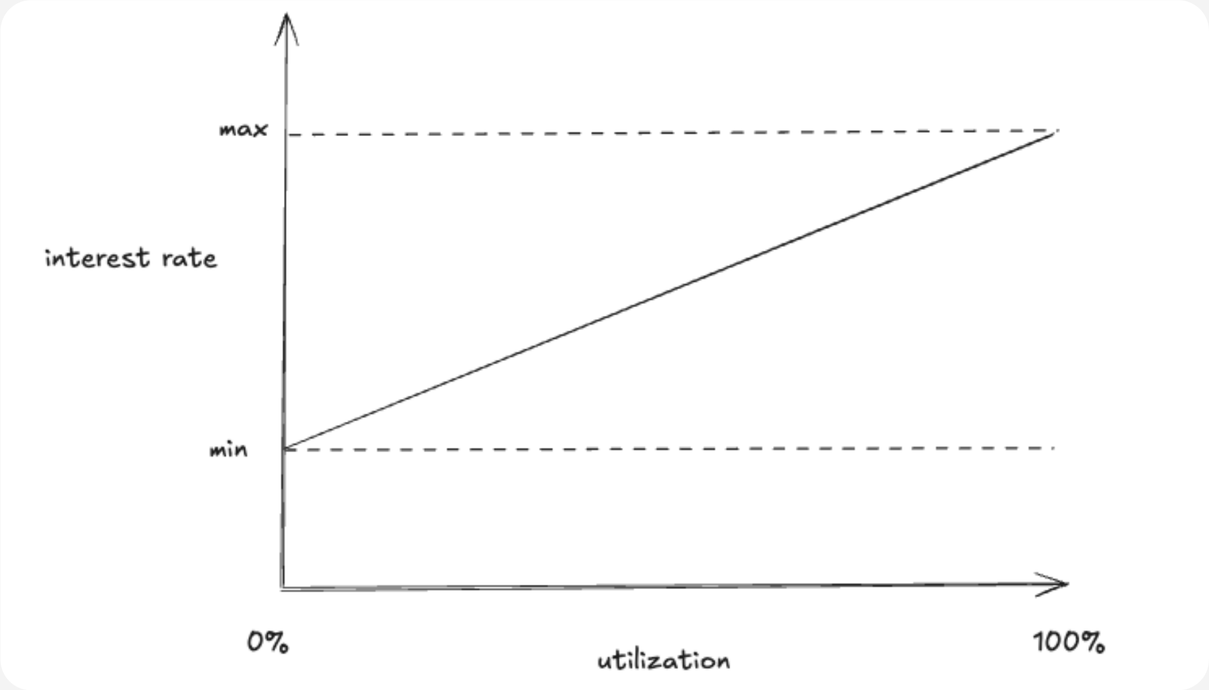
Interest Rate Model

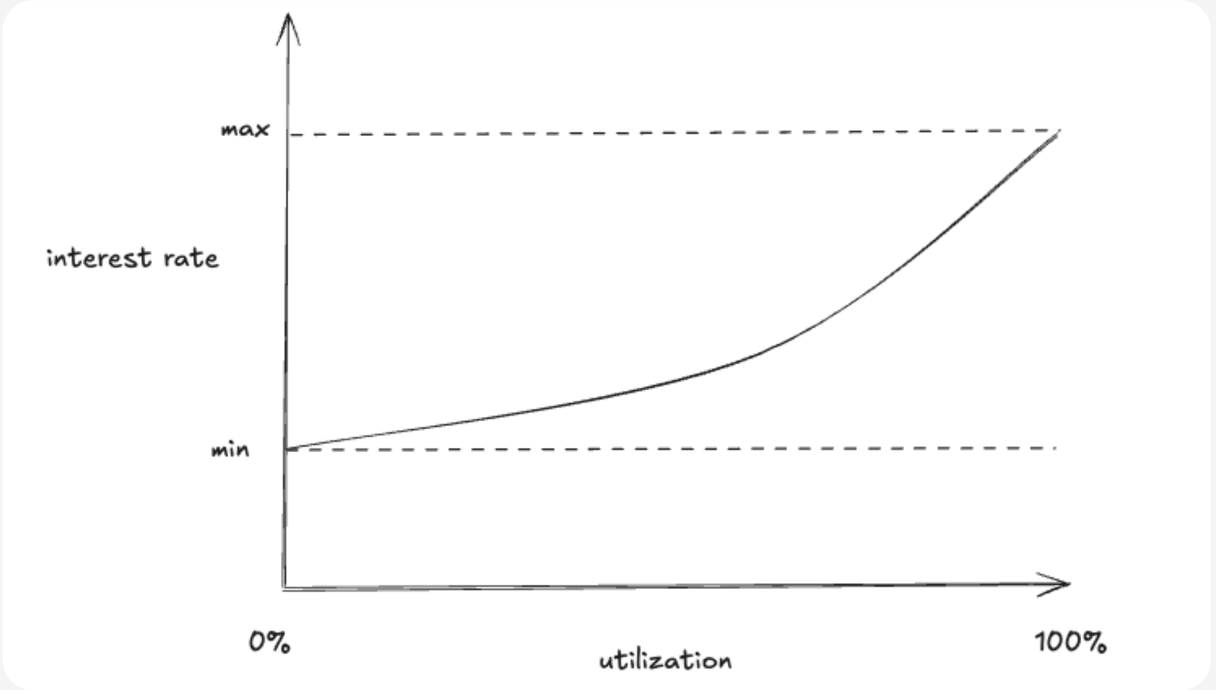
How to determine the interest of lender and borrower?

- When utilization decrease:
  - Borrow Interest: Decrease to encourage borrowing.
  - Supply Interest: Increases to discourage supplying more liquidity.
- Result: Lower idle liquidity and enhance borrow demand, leading to a higher utilization level.

Borrow Interest

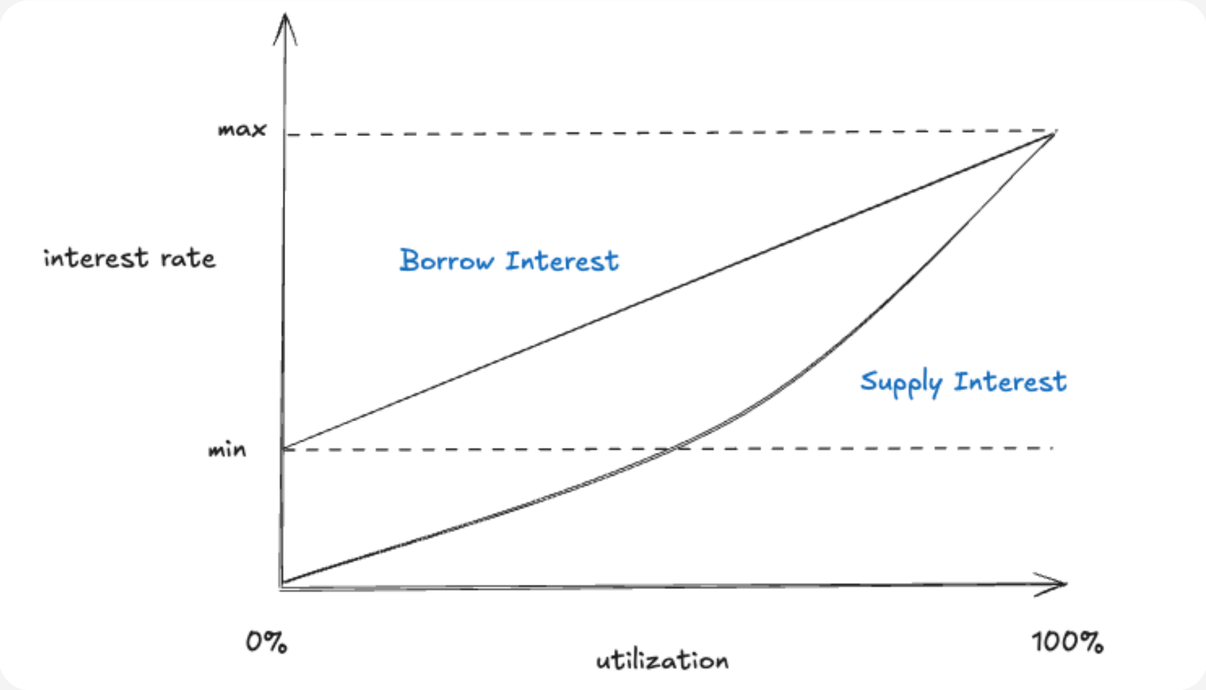
How to determine the interest of lender and borrower?





Supply Interest

How to determine the interest of lender and borrower?



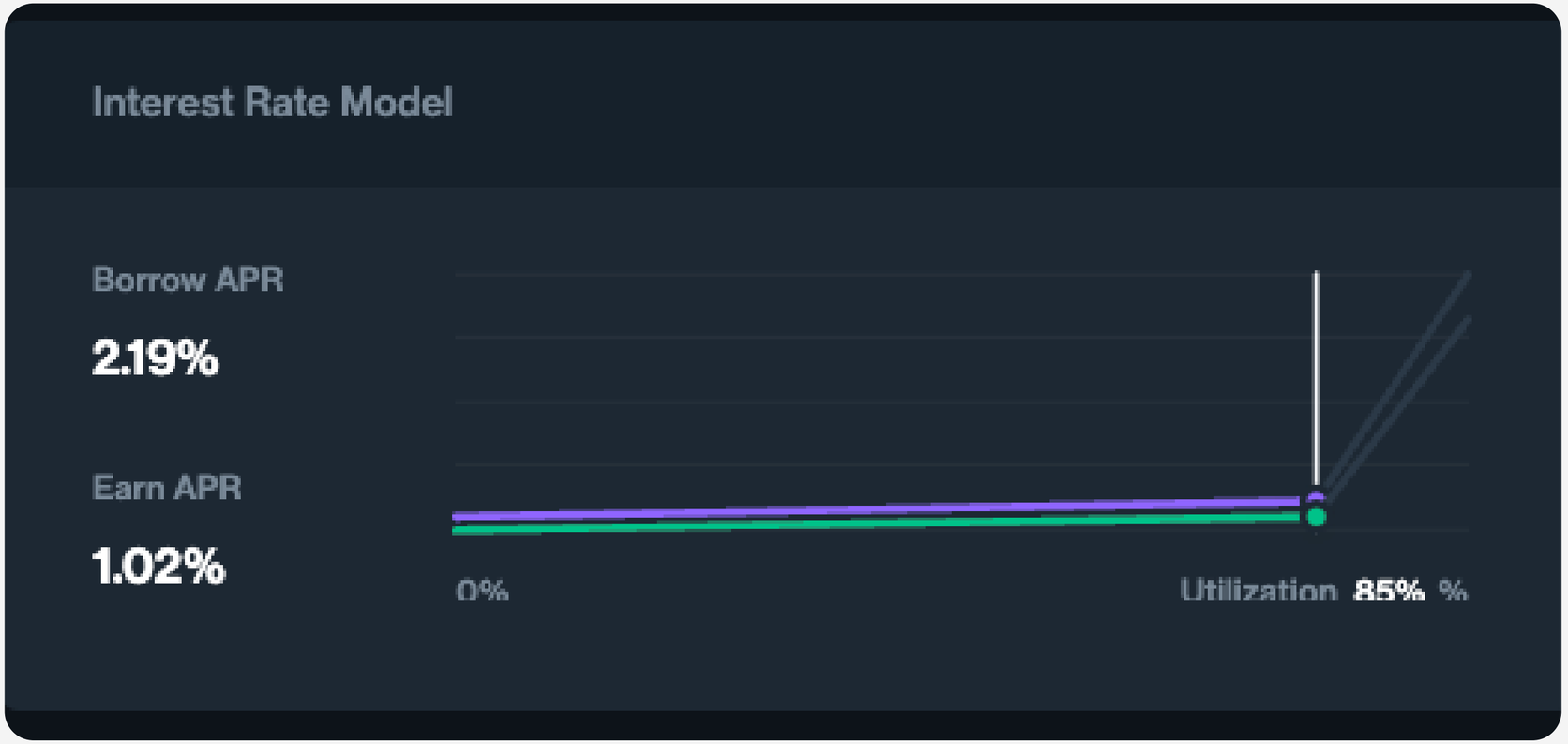
There are different versions

Supply Interest = Borrow Interest * Utilization

If 50% of the funds are borrowed at a 10% interest rate, lenders earn 5% on their capital.

Real World Interest Rate Model

Is achieving 100% utilization always beneficial?



kink interest rate model

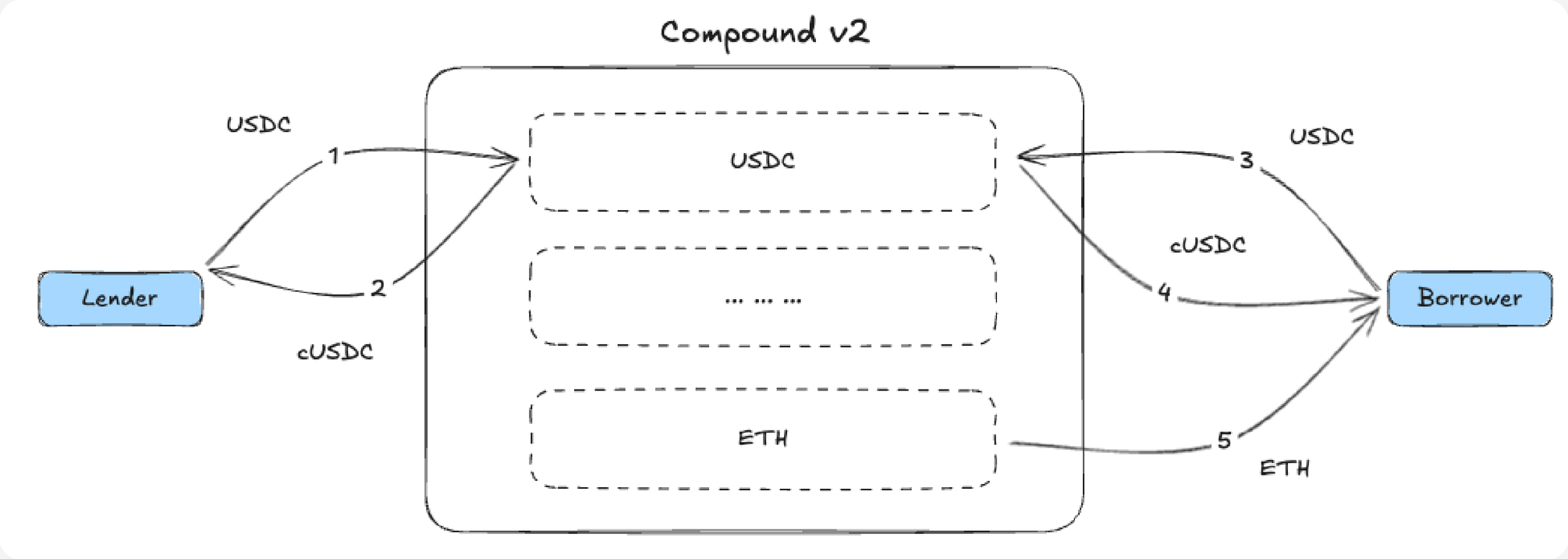
Compound v3 as Example

Compound III

A full featured dashboard to interface with the Compound III protocol directly. Earn interest, borrow against your assets, and participate in community governance.

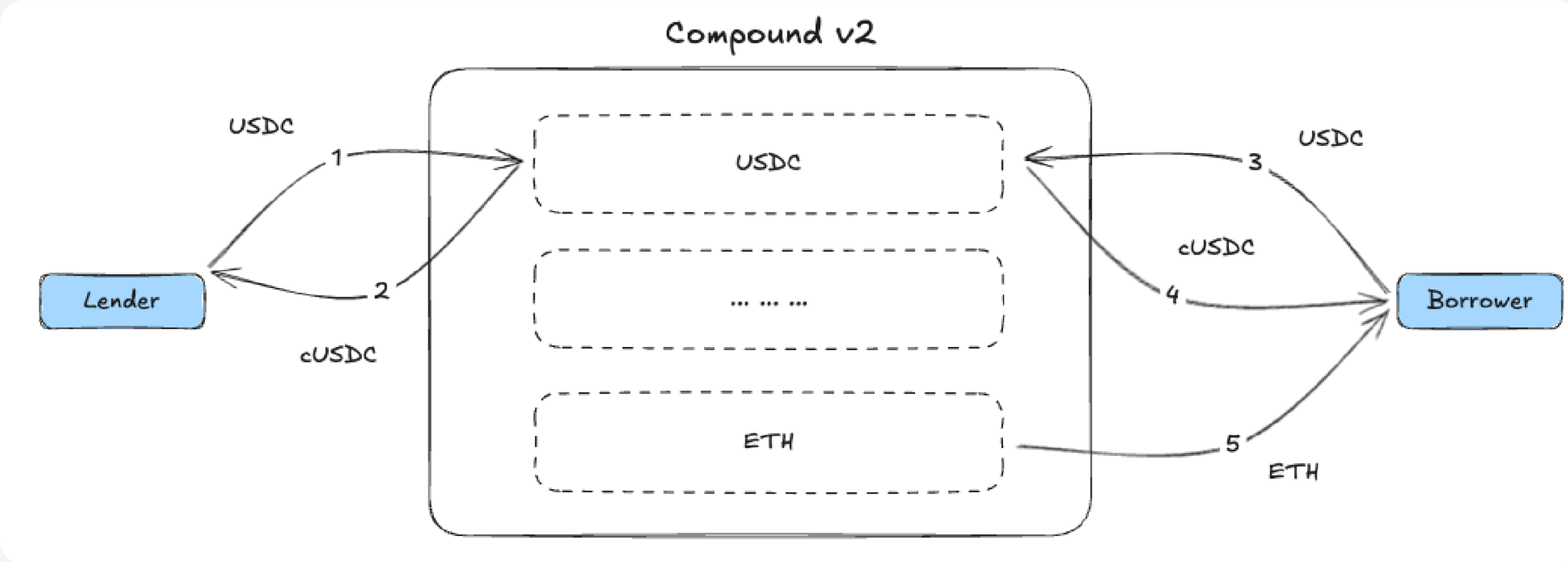
compoundfinance

Compound v2 as Example



Morpho

The rising star in the lending space, what is the difference between Morpho and Compound, Aave?



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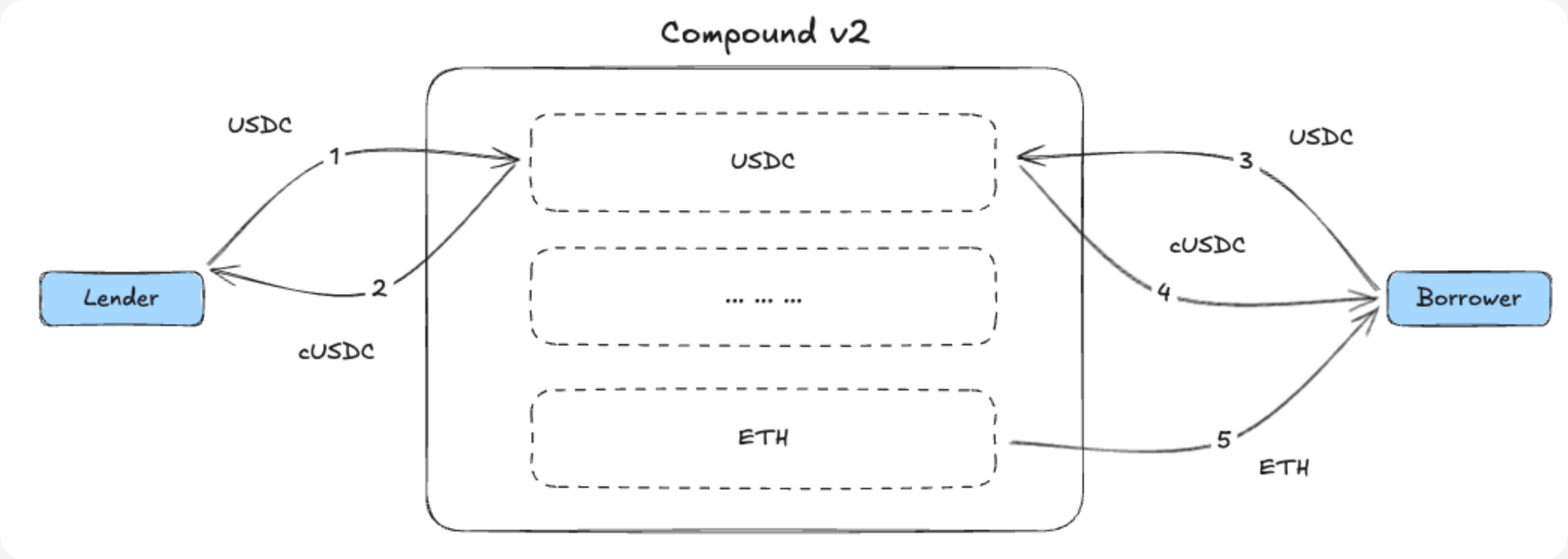
What sets Morpho apart from Compound and Aave in the lending space? Let's answer by a simple question, can you borrow meme token in Compound or Aave?



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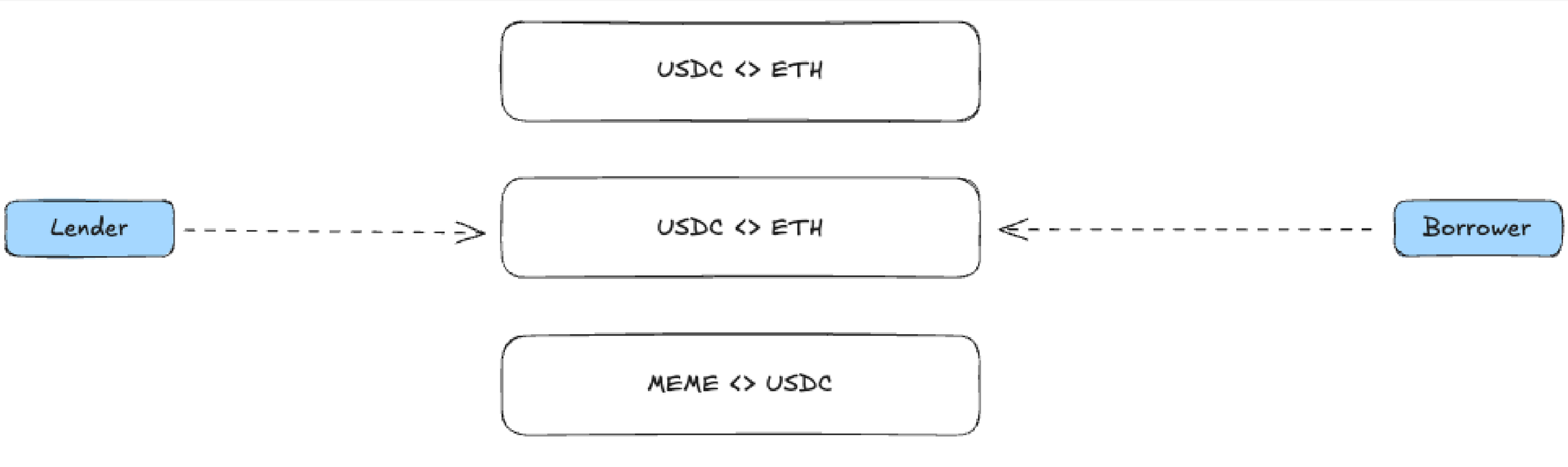
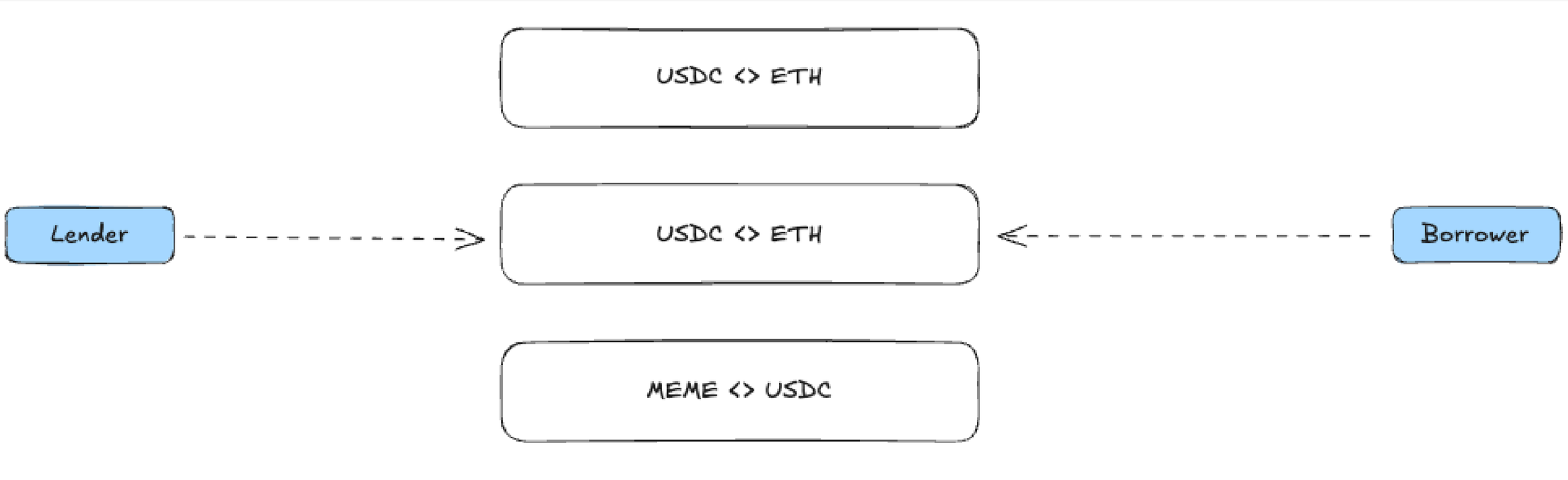


Morpho

Anyone can create a market, consist of a pair of token with customized parameters

- Liquidation Loan To Value (LLTV), Interest Rate Model (IRM), Oracle.



Morpho

- In Compound and Aave, risk parameters are set by prestigious institutions
- can we trust these configurations when anyone can create a market?

Risk Management

Homework 4