Course III:

DeFi Deep Dive

Campbell R. Harvey
Duke University and NBER

Learning Experience Outline

Four courses in **DeFi and the Future of Finance:**

I. DeFi Infrastructure

II. DeFi Primitives

III. DeFi Deep Dive

IV. DeFi Risks and Opportunities

I. DeFi Deep Dive

Modules

1. **Credit and Lending**
   i. MakerDAO
   ii. Compound
   iii. Aave
2. Decentralized Exchange
3. Derivatives
4. Tokenization

Course III:

DeFi Deep Dive

1. Credit and Lending

(i) MakerDAO

(a) Creation of DAI

Credit/Lending: MakerDAO

Background

- As the name suggests, MakerDAO is a decentralized autonomous organization.
- The primary value-add is the creation of a crypto-collateralized stablecoin, pegged to USD called DAI. This means the system can run completely from within the Ethereum blockchain without relying on outside centralized institutions to back, vault and audit the stablecoin.
- Two token model: DAI = stablecoin and MKR = governance token

https://makerdao.com/whitepaper/White%20Paper%20-The%20Maker%20Protocol_%20MakerDAO%E2%80%99s%20Multi-Collateral%20Dai%20(MCD)%20System-FINAL-%20021720.pdf

Credit/Lending: MakerDAO

Mechanics of DAI

- DAI is generated as follows. A user can deposit ETH or other supported ERC-20 assets into a *Vault*.
- A Vault is a smart contract that escrows collateral and keeps track of the USD-denominated value of the collateral.
- The user can then mint DAI up to a certain collateralization ratio on their assets.
- This creates a “debt” in DAI that must be paid back by the Vault holder.

Credit/Lending: MakerDAO

Mechanics of DAI

- The DAI is the corresponding asset that can be used any way the Vault holder wishes.
  - Example 1: user can sell the DAI for cash
  - Example 2: use can use DAI to buy more of the collateral asset, and repeat the process, to create a levered position.
- Due to the volatility of ETH and most collateral types, the collateralization requirement is far in excess of 100% and usually in the 150-200% range.

Credit/Lending: MakerDAO

Collateralized debt position (CDP)

- The basic idea is not new; a homeowner in need of some liquidity can pledge their house as collateral to a bank and receive a mortgage loan structured to include a cash takeout.
- The price volatility of ETH is much greater than for a house and, as such, collateralization ratios for the ETH-DAI contract are higher.
- In addition, no centralized institution is necessary as everything happens within the Ethereum blockchain.

Credit/Lending: MakerDAO

Example

- Suppose an ETH owner needs liquidity but does not want to sell her ETH because she thinks it will appreciate.
- The situation is analogous to the homeowner who needs liquidity but does not want to sell her house.

Credit/Lending: MakerDAO

Example

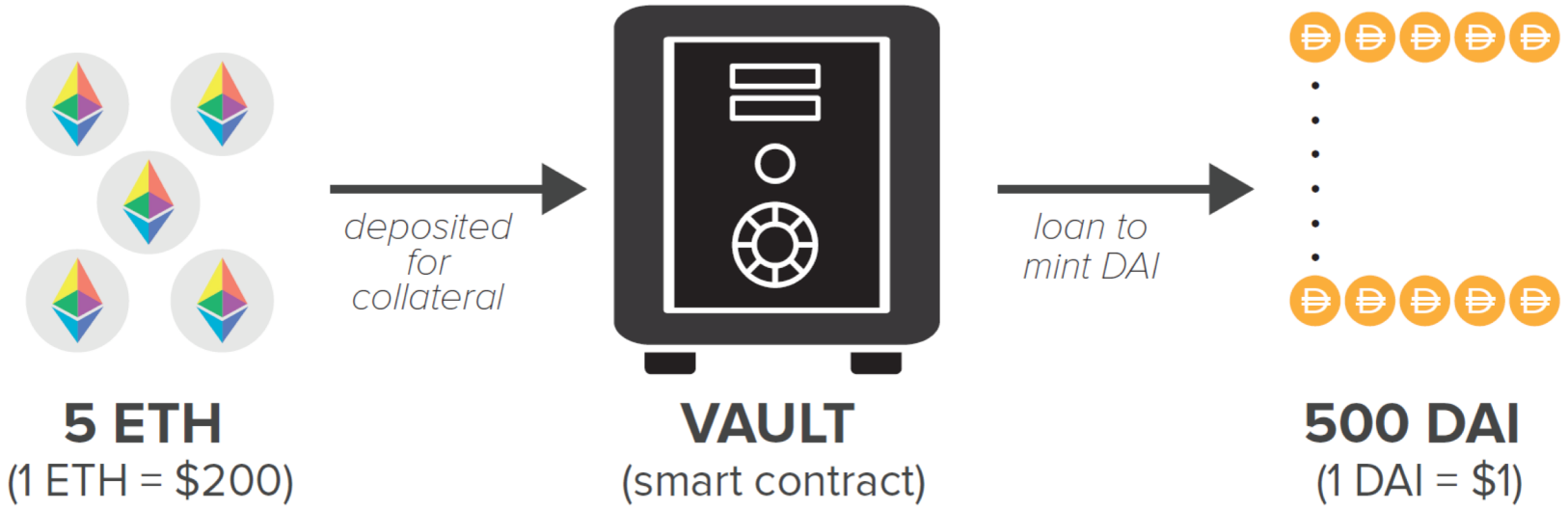
- Let's say an investor has 5 ETH at a market price of $200 (total value of $1,000).
- If the collateralization requirement is 150%, then the investor can mint up to 667 DAI ($1,000/1.5 with rounding).
- The collateralization ratio is set high to reduce the probability that the loan debt exceeds the collateral value, and for the DAI token to be credibly pegged to the USD, the system needs to avoid the risk that the collateral is worth less than $1=1 DAI.

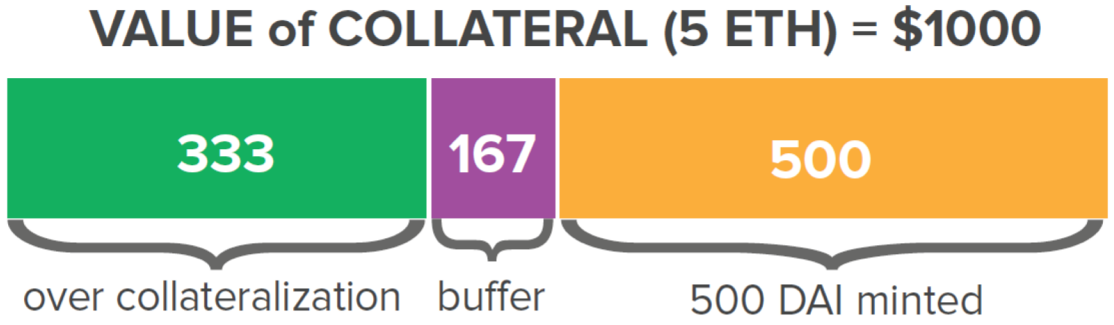
Credit/Lending: MakerDAO

Example

- Given the collateralization ratio of 1.5, it would be unwise to mint the 667 DAI because if the ETH ever dropped below $200, the contract would be undercollateralized, the equivalent of a "margin call".
- We are using traditional finance parlance, but in DeFi there is no communication from your broker about the need to post additional margin or to liquidate the position and also no grace period.
- Liquidation can happen immediately.

Credit/Lending: MakerDAO



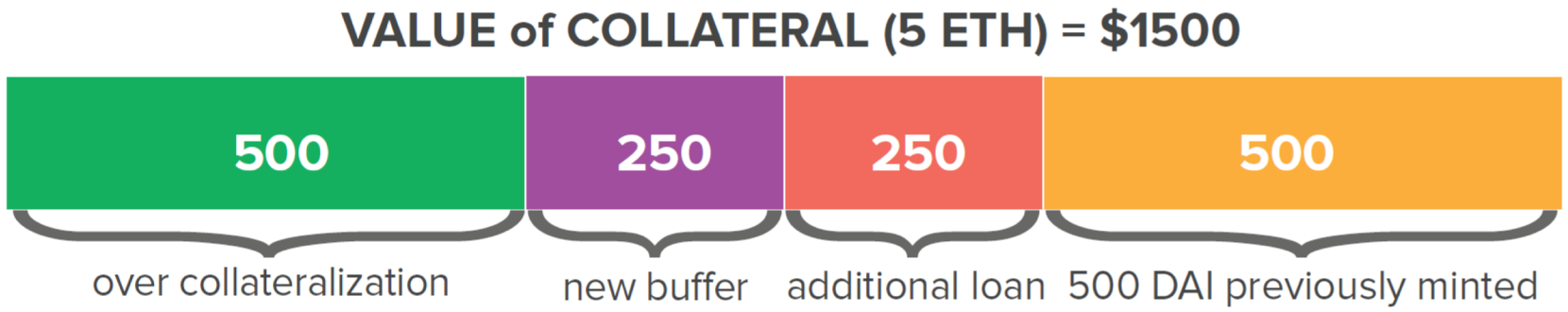


collateralization factor: **150%**
maximum loan: **1000/1.5 = 667 DAI**
actual loan: **500 DAI**

Credit/Lending: MakerDAO

Scenario 1 **ETH appreciates 50%** $200 —> $300

- Suppose ETH rises by 50% so collateral is worth $1,500.
- The investor can increase the size of her loan.
- To maintain the collateralization of 200%, the investor can mint an extra 250 DAI.



collateralization factor: **150%**
maximum loan: **1500/1.5 = 1000 DAI**
actual loan: **500 DAI** —> (ratio now 300%)
additional loan: **250 DAI**
new loan: **750 DAI** —> (ratio 200%)