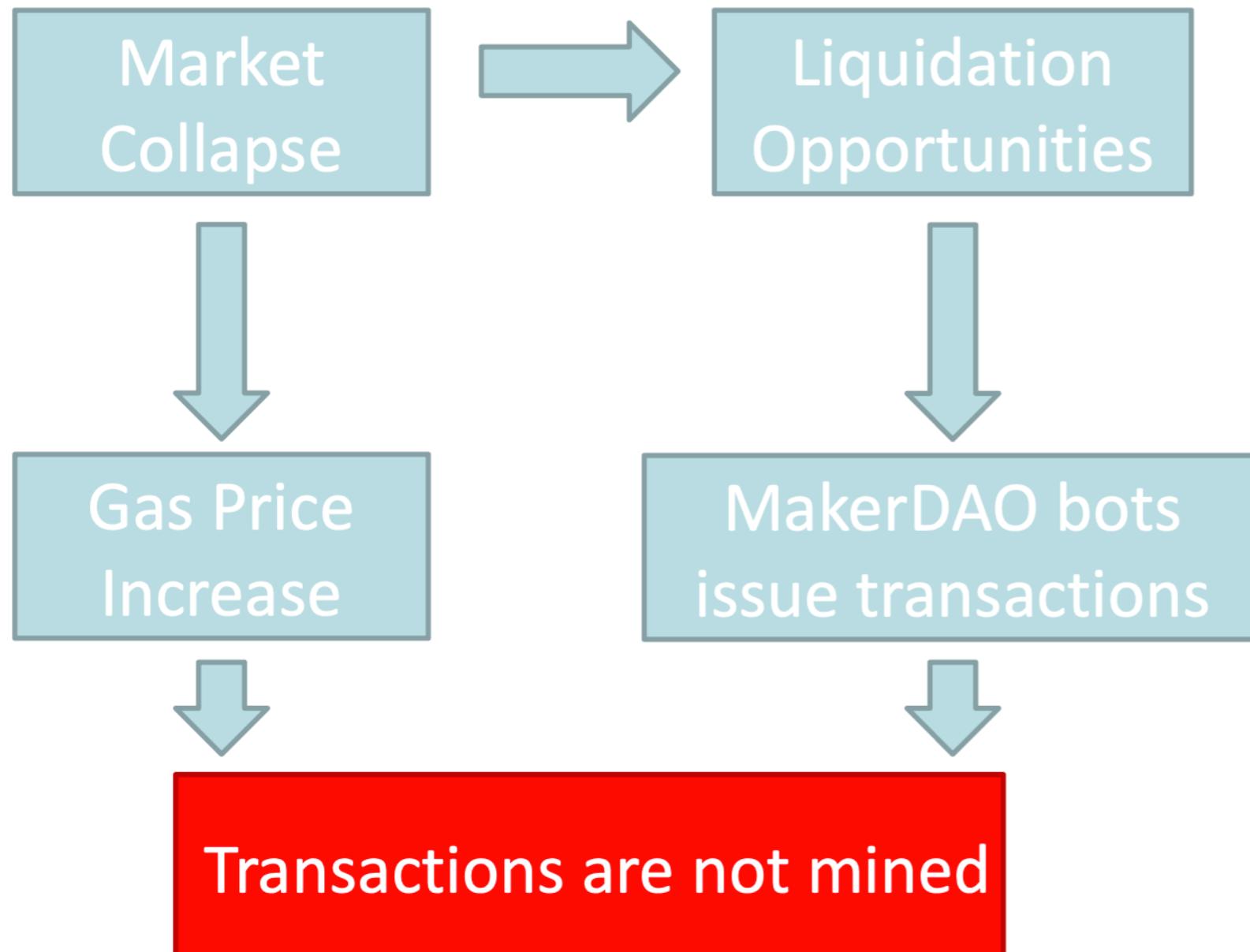


Lending and Borrowing II

Instructor: Paruj Ratanaworabhan

Source: “Lending and Borrowing” by A. Gervais,
UCB DeFi course

Maker DAO Bot Failure



**Black Thursday for MakerDAO:
\$8.32 million was liquidated for
0 DAI**

● whiterabbit Mar 15, 2020 · 6 min read



Photo by [slon_pics](#) on Pixabay

TL;DR

- Maker DAO liquidations on March 12 and 13 resulted in protocol losses of **5.67 million DAI**
- This happened due to the opportunity to win liquidation auctions with zero bids, which was **36%** of all liquidations
- The greatest Vault has lost ~35 000 ETH whereas the most successful liquidator has had a profit of **30 000 ETH**
- **\$8.32 million** was withdrawn through zero bids auctions in total

Liquidation Insights

■ Health Factor

- A fixed spread liquidation does not necessarily increase the health factor

■ Over-liquidation

- Liquidations sell excessive amounts of borrower's collateral

■ Optimal Liquidation strategy

- Liquidating up to the close factor is not necessarily the best strategy.
- Instead, two successive liquidations might offer more profits. 

Optimal Fixed Spread Liquidation Algorithm

Input : A liquidatable position $\mathcal{POS} = \langle C, D \rangle$, where C represents the collateral value, while D represents the debt value; Liquidation threshold LT; Liquidation spread LS; Close factor CF.

Output: Amount of debt to repay in the two optimal successive liquidations, $repay_1$ and $repay_2$.

Function Liquidatable(\mathcal{POS}):

| return $\frac{\mathcal{POS}.C \times LT}{\mathcal{POS}.D} < 1$;

end

Function Liquidate($\mathcal{POS}, repay$):

| $\mathcal{POS}' \leftarrow \langle C - repay \times (1 + LS), D - repay \rangle$;

| return \mathcal{POS}' ;

end

$repay_1 \leftarrow \text{argmax}_r \text{Liquidatable}(\text{Liquidate}(\mathcal{POS}, r))$;

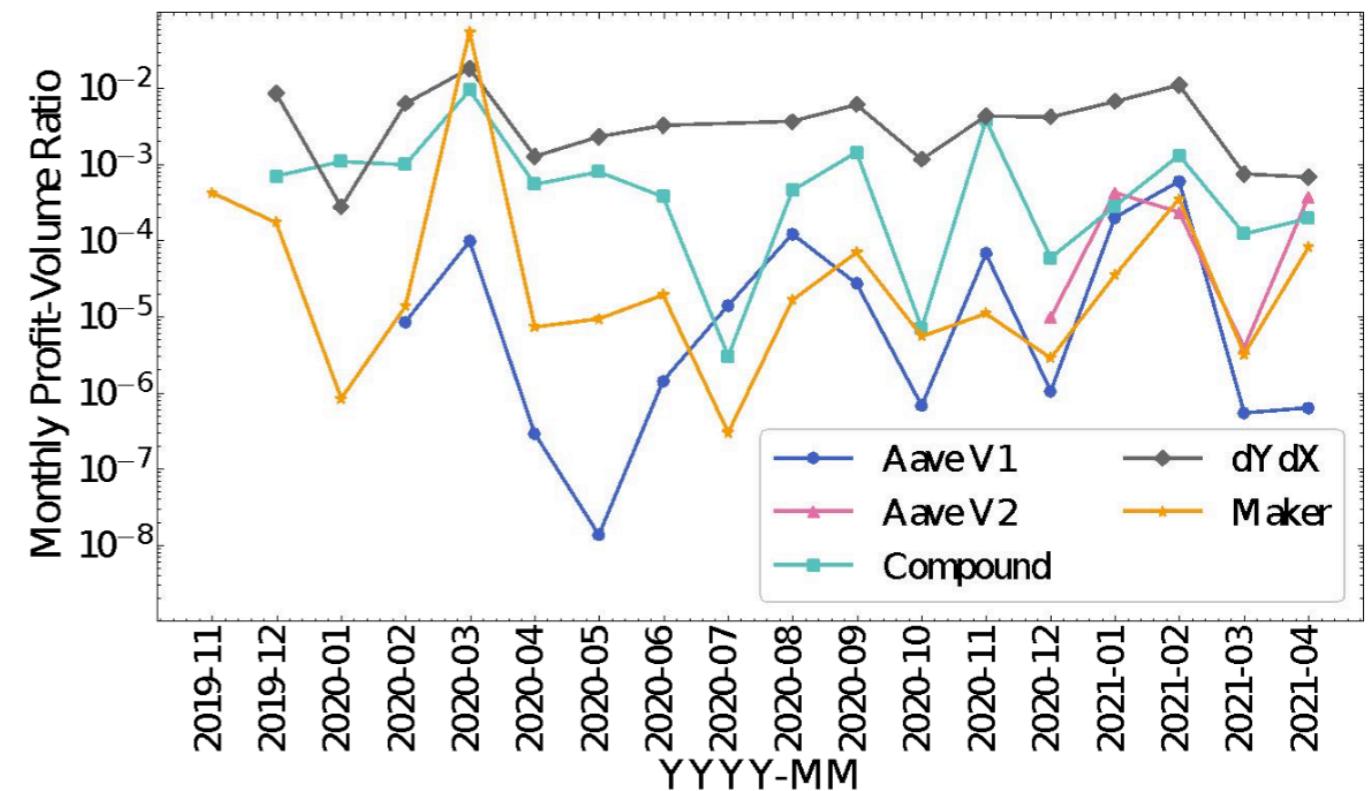
$\mathcal{POS}' \leftarrow \text{Liquidate}(\mathcal{POS}, repay_1)$;

$repay_2 \leftarrow \mathcal{POS}'.D \times CF$;

Liquidation Insights

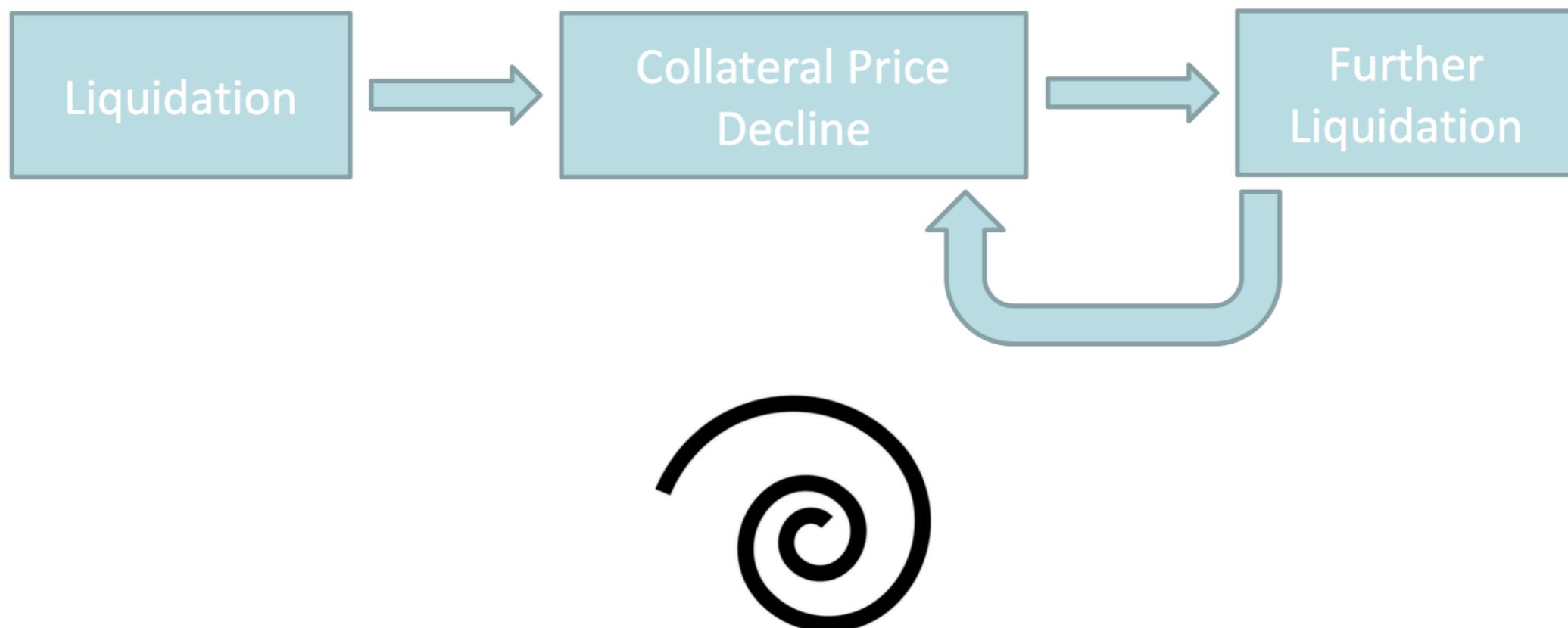
Comparison of liquidation mechanisms

- **Metrics:** the ratio between monthly liquidation profit and volume
- Data suggests that auction liquidations might be more borrower friendly
- dYdX does not have a close factor



Liquidation Insights

- Deleveraging Spiral



Case Study: Optimal Fixed Spread Liquidation

- Compound
- November 26, 2020
- $LT = 0.75$

Token	Collateral	Debt	Price (USD)	
			Block 11333036	After price update
DAI	108.51M	93.22M	1.08	1.095299
USDC	17.88M	506.64K	1	1
Total Collateral (USD)			135.07M	136.73M
Borrowing Capacity (USD)			101.30M	102.55M
Total Debt (USD)			101.18M	102.61M

→

Healthy

Liquidatable

Case Study: Optimal Fixed Spread Liquidation

Original liquidation	Repay 46.14M DAI	
	Receive 49.83M DAI	
	Profit 3.69M DAI	
<hr/>		
Up-to-close-factor strategy	Repay 46.61 DAI	
	Receive 50.34M DAI	
	Profit 3.73M DAI	
<hr/>		
Optimal strategy	Liquidation 1	Liquidation 2
	Repay 296.61K DAI	Repay 46.46M DAI
	Receive 320.34K DAI	Receive 50.18M DAI
<hr/>		
Profit 23.73K DAI		
Profit 3.72M DAI		

Optimal strategy yields 3.743M DAI instead of 3.69M DAI

[Overview](#)[Internal Txns](#)[Logs \(41\)](#)[State](#)[Comments](#)

② Transaction Hash: [0x53e09adb77d1e3ea593c933a85bd4472371e03da12e3fec853b5bc7fac50f3e4](#) 

② Status:  Success

② Block: [11333037](#)  3200478 Block Confirmations

② Timestamp:  496 days 8 hrs ago (Nov-26-2020 08:55:16 AM +UTC)

💡 Transaction Action:

- ▶ Collected 18.173238846643955645  COMP For Borrowing 0  DAI On  Compound
- ▶ Liquidator Repay 46,142,428.59504894  DAI To  Compound
- ▶ Collected 17.005128176019374667  COMP For Supplying 0  DAI On  Compound
- ▶ Liquidation 49,833,822.879152641119617024  DAI On  Compound
- ▶ Withdraw 46,281,272.41228579739217653  DAI From  Compound

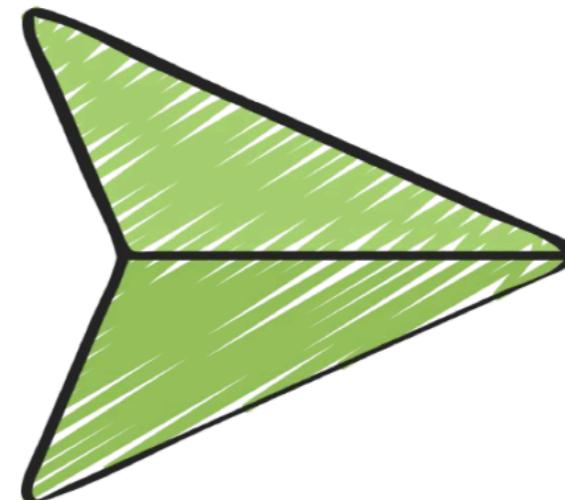
② From: [0x945e6743663de47ac5cf7985c46bd41119b025e6](#) 

② Interacted With (To):  Contract [0xe8468f05550563aa5bfc5fbcb344bf87aa2f6b84](#)  

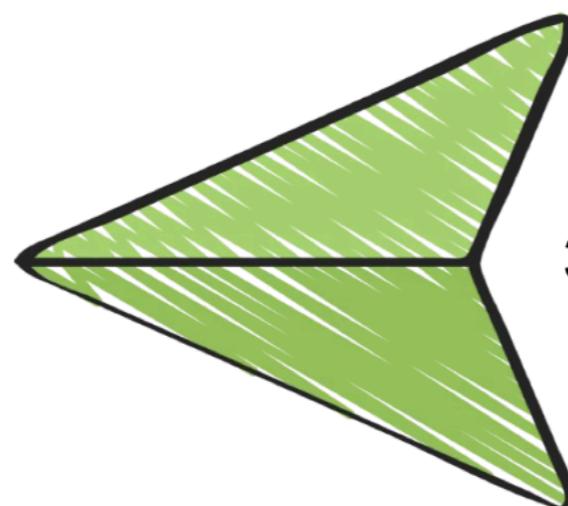
Flash Loan



1. Take flash loan

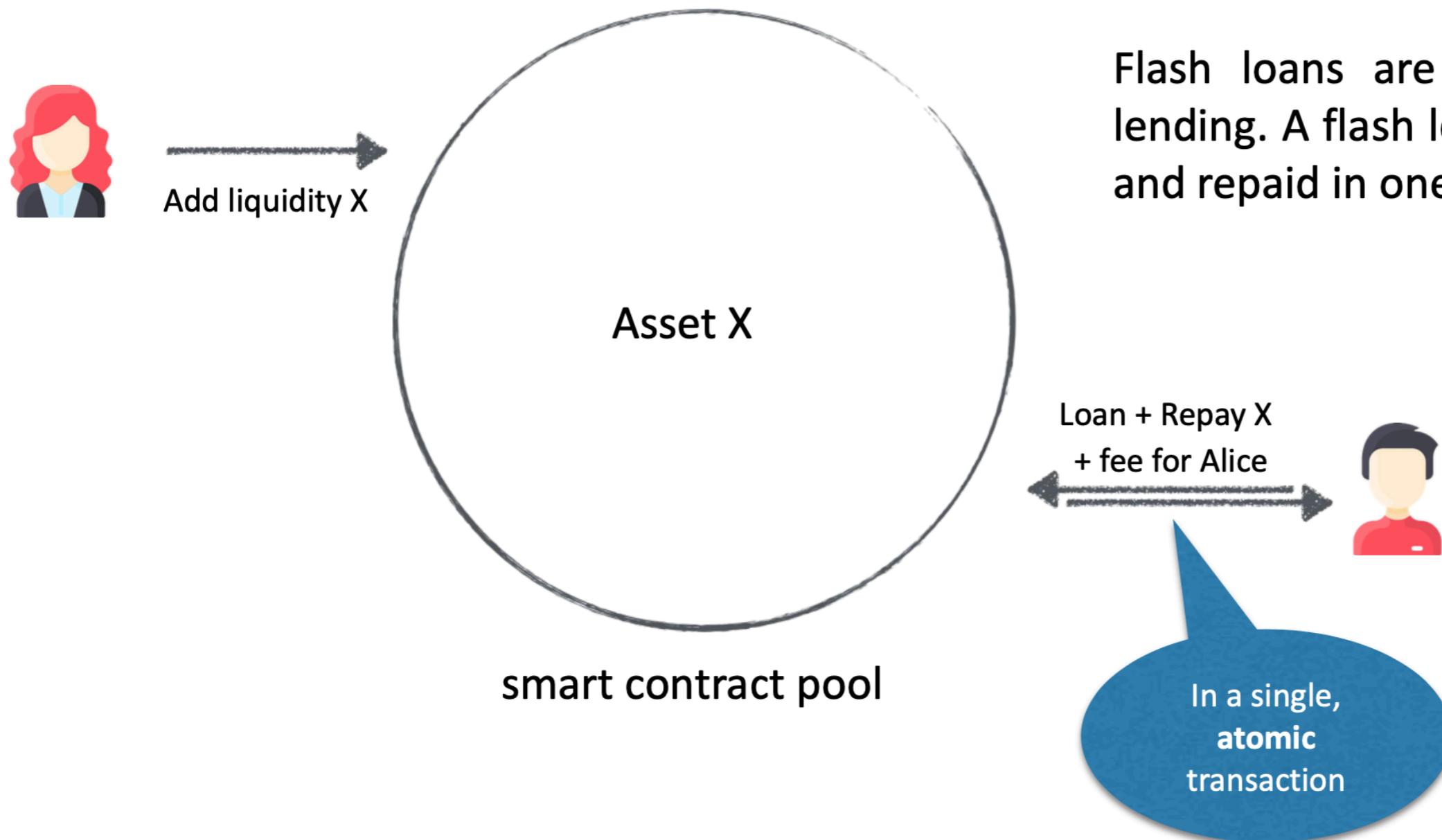


2. go-Wild(loan);



3. Repay loan + interest

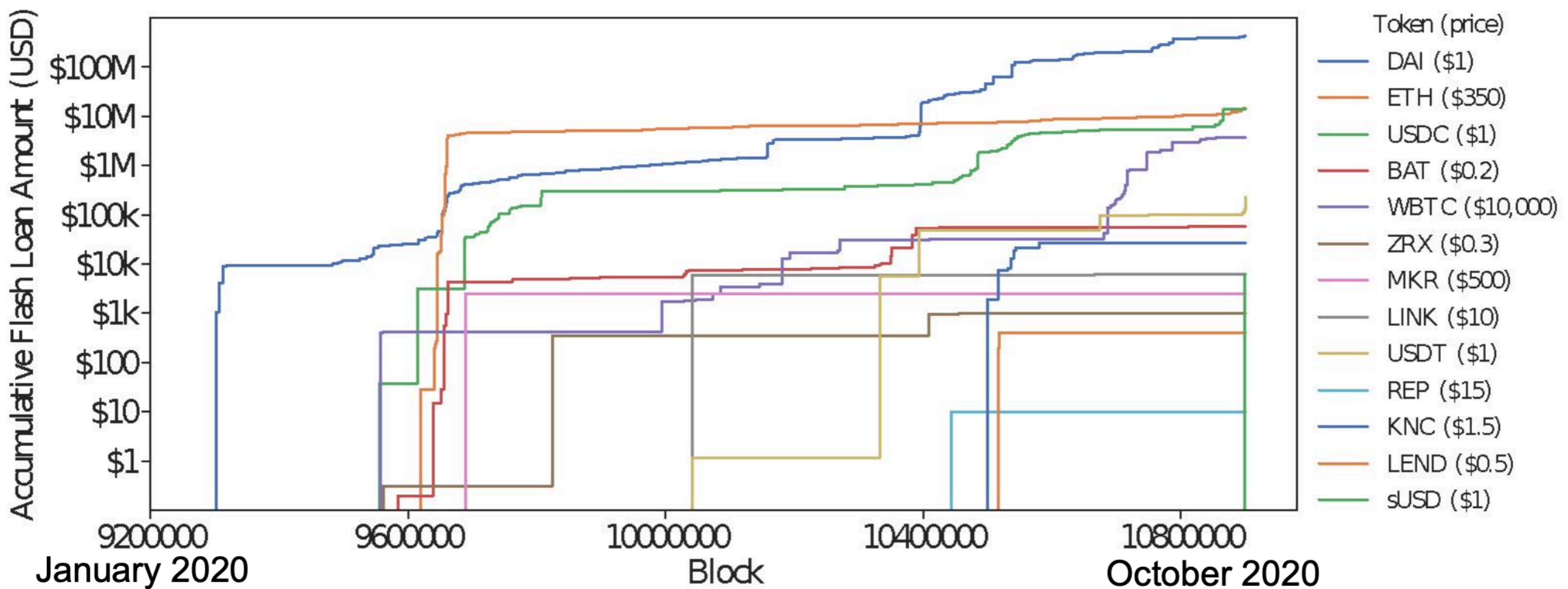
Flash Loan



Flash Loan Pools

- Uniswap – 0.3% fees
 - V2 - 5B USD
 - V3 - 2.2B USD
- Aave – 0.3% fees
 - 10B USD
- dYdX – constant fee of 1 Wei
 - about 100M USD

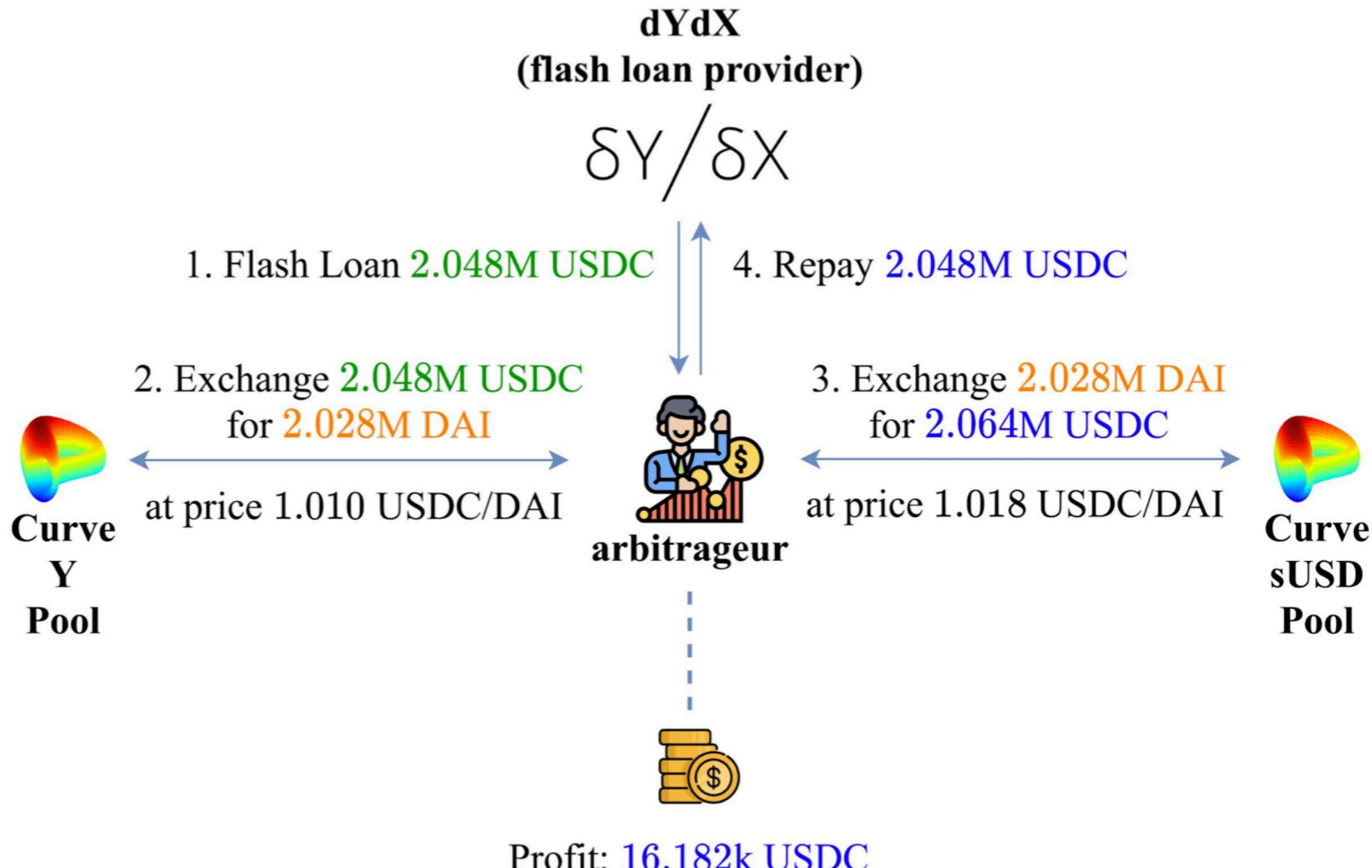
Flash Loan Sizes



Flash Loan Use Cases

- DeFi attacks
 - Price Oracle Manipulation
 - Pump and Dump
- (Risk-free) Arbitrage
- Washtrading
- Flash Minting
- Collateral swapping

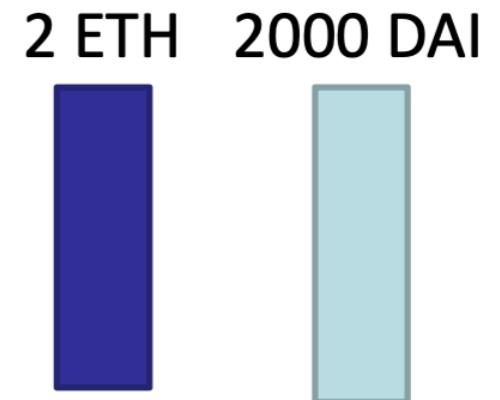
Flash Loan Arbitrage



Flash Loan Based Liquidation

- When a liquidator does not have the cryptocurrency upfront to repay
- Only works when the liquidation completes in one transaction

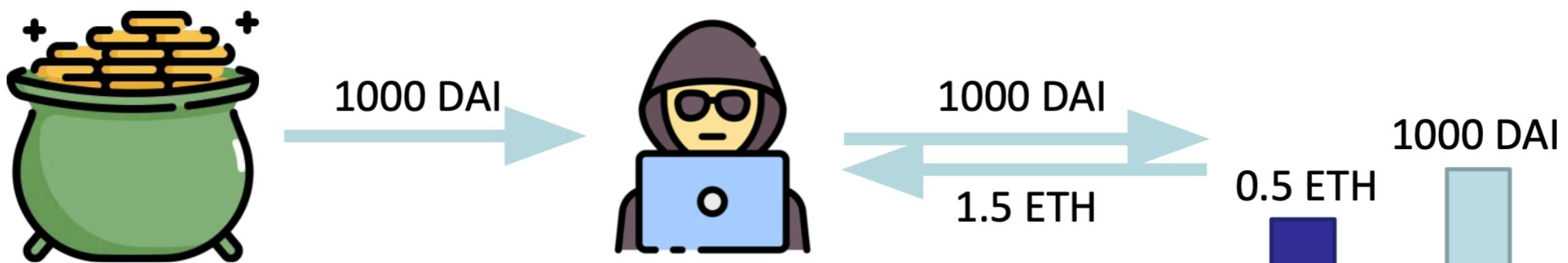
Given a liquidatable borrowing position with a debt of 2000 DAI collateralized by 2 ETH



Flash Loan Based Liquidation

- When a liquidator does not have the cryptocurrency upfront to repay
- Only works when the liquidation completes in one transaction

Given a liquidatable borrowing position with a debt of 2000 DAI collateralized by 2 ETH



Revisiting the previous Compound liquidation case

Case Study: Optimal Fixed Spread Liquidation

- Compound
- November 26, 2020
- $LT = 0.75$

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Healthy

Liquidatable

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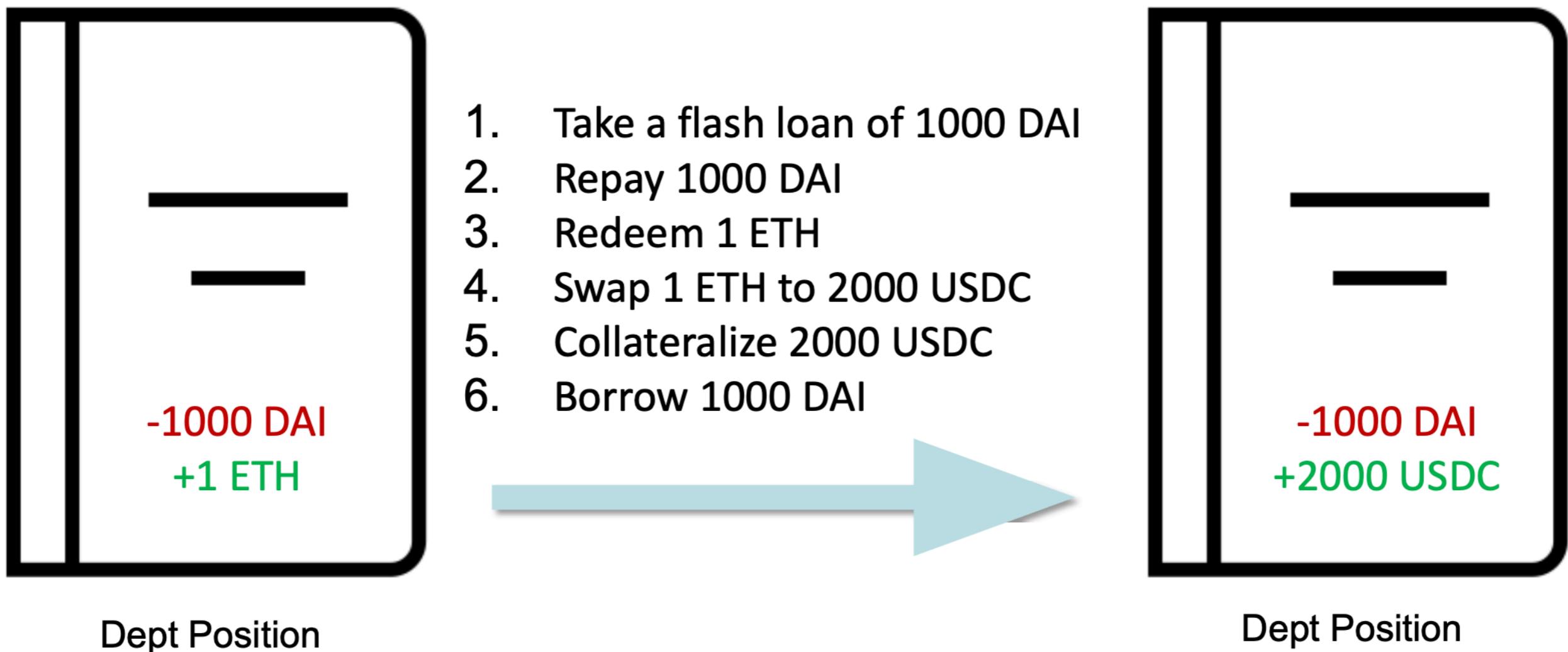
Overview	Internal Txns	Logs (41)	State	Comments
② Transaction Hash:	0x53e09adb77d1e3ea593c933a85bd4472371e03da12e3fec853b5bc7fac50f3e4			
② Status:		Success		
② Block:	11333037	3200478 Block Confirmations		
② Timestamp:	⌚ 496 days 8 hrs ago (Nov-26-2020 08:55:16 AM +UTC)			
💡 Transaction Action:	<ul style="list-style-type: none">▶ Collected 18.173238846643955645 COMP For Borrowing 0 DAI On Compound▶ Liquidator Repay 46,142,428.59504894 DAI To Compound▶ Collected 17.005128176019374667 COMP For Supplying 0 DAI On Compound▶ Liquidation 49,833,822.879152641119617024 DAI On Compound▶ Withdraw 46,281,272.41228579739217653 DAI From Compound			
② From:	0x945e6743663de47ac5cf7985c46bd41119b025e6			
② Interacted With (To):	Contract 0xe8468f05550563aa5bfc5fbcb344bf87aa2f6b84			

<https://etherscan.io/tx/0x53e09adb77d1e3ea593c933a85bd4472371e03da12e3fec853b5bc7fac50f3e4>

- ② Tokens Transferred: 9
- ▶ **From** Uniswap V2: DAI **To** 0xe8468f0555056... **For** 46,142,428.59504894 (\$46,188,571.02) Dai Stableco... (DAI)
 - ▶ **From** Compound: Compt... **To** 0x909b443761bbd... **For** 18.173238846643955645 (\$2,514.45) Compound (COMP)
 - ▶ **From** 0xe8468f0555056... **To** Compound: cDAI ... **For** 46,142,428.59504894 (\$46,188,571.02) Dai Stableco... (DAI)
 - ▶ **From** Compound: cDAI ... **To** Null Address: 0x00... **For** 46,142,428.59504894 (\$46,188,571.02) Dai Stableco... (DAI)
 - ▶ **From** Compound: Compt... **To** 0x909b443761bbd... **For** 17.005128176019374667 (\$2,352.83) Compound (COMP)
 - ▶ **From** 0x909b443761bbd... **To** 0xe8468f0555056... **For** 2,396,825,127.93648786 (\$52,646,263.94) Compound Dai (cDAI)
 - ▶ **From** Null Address: 0x00... **To** 0xe8468f0555056... **For** 46,281,272.41228579739217653 (\$46,327,553.68) Dai Stableco... (DAI)
 - ▶ **From** 0xe8468f0555056... **To** Compound: cDAI ... **For** 2,225,960,407.2447303 (\$48,893,220.35) Compound Dai (cDAI)
 - ▶ **From** 0xe8468f0555056... **To** Uniswap V2: DAI **For** 46,281,272.41228579739217653 (\$46,327,553.68) Dai Stableco... (DAI)

<https://etherscan.io/tx/0x53e09adb77d1e3ea593c933a85bd4472371e03da12e3fec853b5bc7fac50f3e4>

Collateral Swap

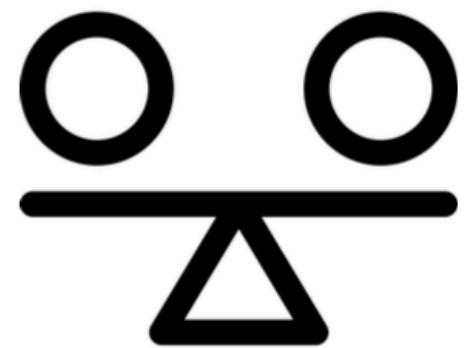


Stable Coins

- Crypto assets whose values are pegged to those of real world (a.k.a. fiat) assets, e.g., USD, Gold, etc.
 - Can be bought, sold, transferred, and traded on an exchange just like any other crypto coin
- Designed to counter crypto's price volatility
 - Provide a convenient way for crypto traders to preserve their real world currency value without having to cash out of the crypto world
- Allow users to pay for everyday goods and services in crypto without all the price volatility

What is “stable”?

- **Stability:**
 - ..is a relative metric
 - Volatility, standard deviation of returns
 - Worst drop over a timeframe
 - Fiat, e.g. EUR, GBP have a volatility of 6-12%
- Volatility alone does not capture the range of prices



Stable and Pegged coins



USDC



USDT



DAI



WBTC



renBTC



sETH



stETH

USD derivatives

Pegged coins

- **Stablecoin Types**

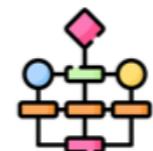
- Reserve-based



- Collateral-based



- Algorithmic



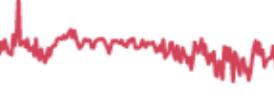
Stable Coin Ranking

Top Stablecoin Tokens by Market Capitalization

This page lists the most valuable stablecoins. They are listed by market capitalization with the largest first and then descending in order.

Market Cap
\$186,355,381,812
▼ 0.07%

Trading Volume
\$117,806,926,489
▲ 29.18%

#		Name	Price	24h %	7d %	Market Cap ⓘ	Volume(24h) ⓘ	Circulating Supply ⓘ	Last 7 Days	Show rows	100 ▾
☆	3	Tether USDT	\$1.00	▼ 0.01%	▼ 0.03%	\$82,435,386,732	\$87,213,774,738 87,201,654,513 USDT	82,423,930,566 USDT		⋮	
☆	5	USD Coin USDC	\$1.00	▲ 0.02%	▼ 0.02%	\$51,280,123,721	\$5,459,358,620 5,462,721,479 USDC	51,311,711,283 USDC		⋮	
☆	13	Binance USD BUSD	\$0.9995	▼ 0.06%	▼ 0.20%	\$17,752,322,902	\$6,070,189,300 6,073,237,897 BUSD	17,761,238,552 BUSD		⋮	
☆	14	TerraUSD UST	\$1.00	▲ 0.08%	▼ 0.12%	\$16,724,977,563	\$724,415,622 724,245,392 UST	16,721,047,377 UST		⋮	
☆	20	Dai DAI	\$1.00	▲ 0.08%	▼ 0.00%	\$9,443,382,089	\$422,186,797 422,275,353 DAI	9,445,362,886 DAI		⋮	
☆	76	TrueUSD TUSD	\$1.00	▲ 0.05%	▲ 0.04%	\$1,347,595,344	\$167,686,575 167,653,026 TUSD	1,347,325,729 TUSD		⋮	

<https://coinmarketcap.com/view/stablecoin/>

Stable?

Inflation Calculator

If in (enter year)

I purchased an item for \$

then in (enter year)

that same item would cost: **\$3.32**

Cumulative rate of inflation: **232.0%**

CALCULATE

“Stablecoins” are not “stable”, but relatively more stable than other cryptocurrencies.

How do Stablecoins work?



MakerDAO



Synthetix



AMPL



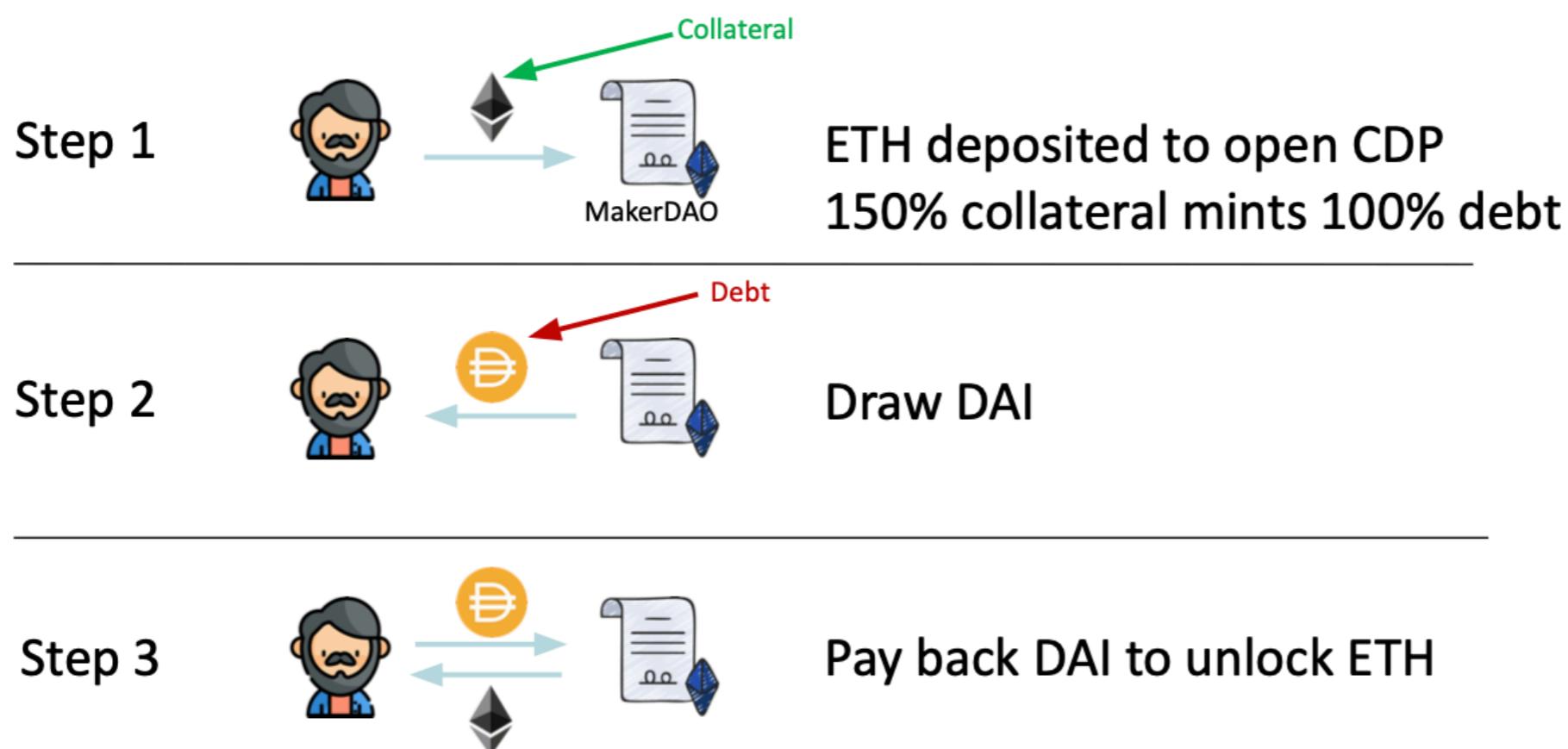
USDC



USDT

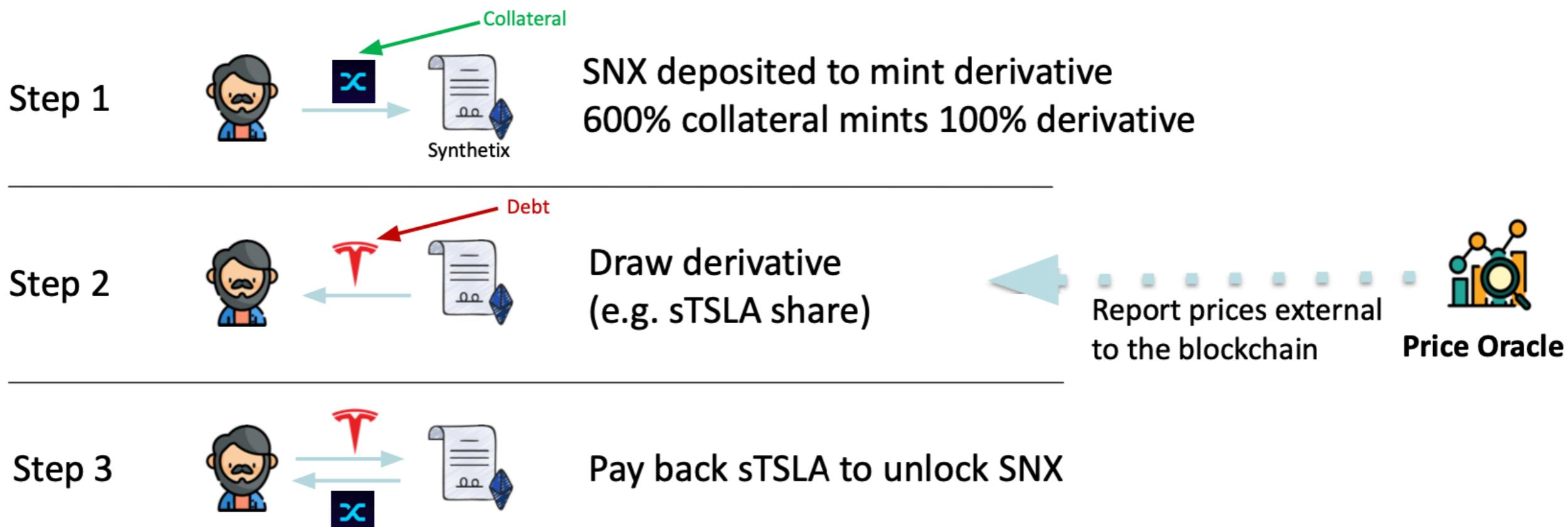
MakerDAO

Stablecoin



Synthetix

Mint a derivative asset

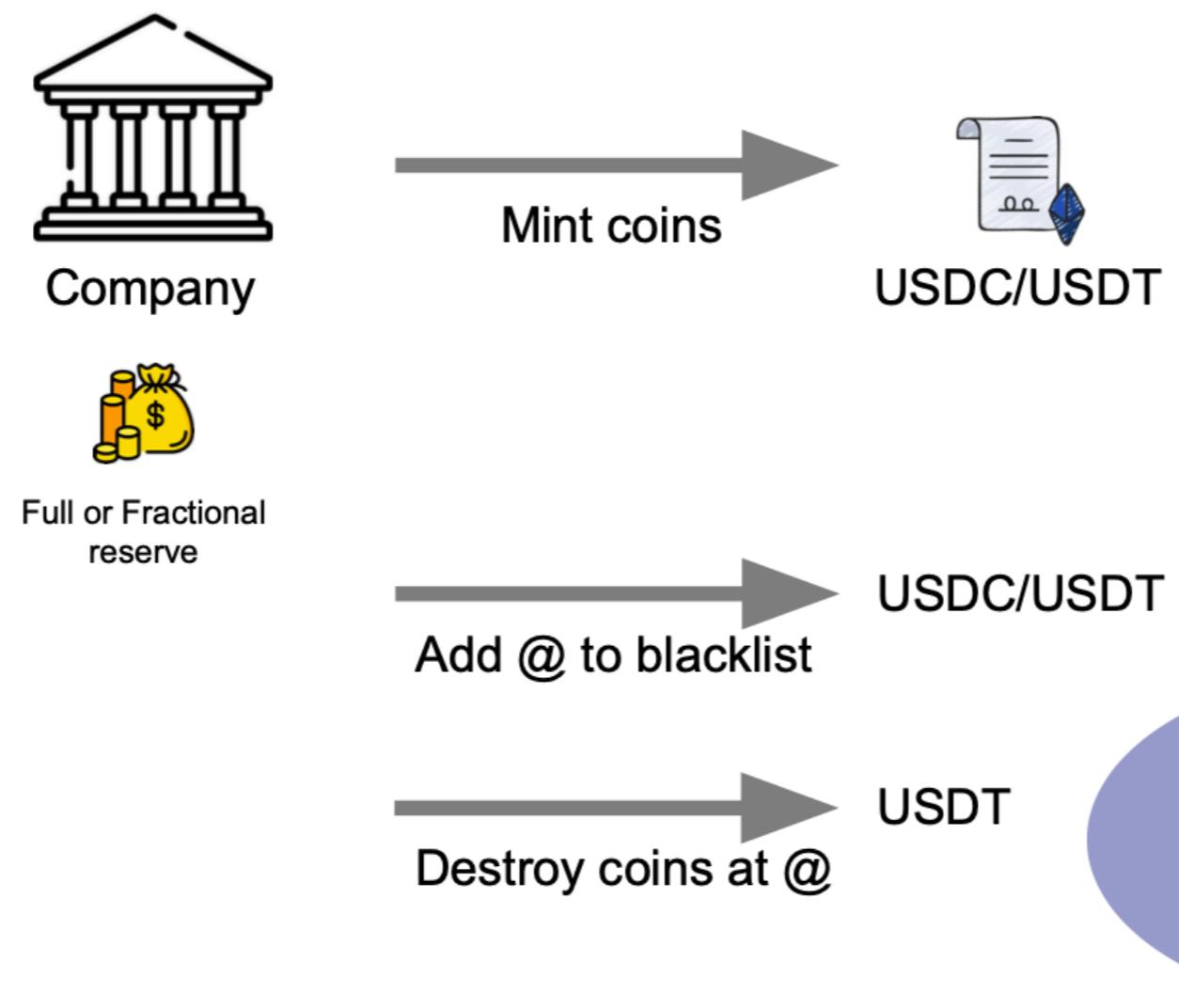


<https://docs.synthetix.io/litepaper/> **Synthetix litepaper**

<https://grafana.synthetix.io/d/pjPJZ6x7z/synthetix-system-stats?orgId=1&kiosk=full> **Synthetix pool info**

<https://kwenta.io/> **Synthetix asset trading**

USDC and USDT



USDC and USDT

```
1  function transfer(address _to, uint _value) public
2    whenNotPaused {
3      require(!isBlackListed[msg.sender]);
4      if (deprecated) {
5        return UpgradedStandardToken(upgradedAddress).
6          transferByLegacy(msg.sender, _to, _value);
7      } else {
8        return super.transfer(_to, _value);
9      }
10    }
11  function addBlackList (address _evilUser) public
12    onlyOwner {
13      isBlackListed[_evilUser] = true;
14      AddedBlackList(_evilUser);
15    }
16  function destroyBlackFunds (address _blackListedUser)
17    public onlyOwner {
18      require(isBlackListed[_blackListedUser]);
19      uint dirtyFunds = balanceOf(_blackListedUser);
20      balances[_blackListedUser] = 0;
21      _totalSupply -= dirtyFunds;
22      DestroyedBlackFunds(_blackListedUser, dirtyFunds);
23    }
```

Ampleforth (AMPL)



- Three design states
 - Expansion: if $1 \text{ AMPL} > 1 \text{ USD}$, add supply
 - Contraction: if $1 \text{ AMPL} < 1 \text{ USD}$, remove supply
 - Equilibrium: no action taken

Systemic implications!

What We Have Learned

- More studies and real world examples of liquidations
- Flash loan and example use cases
- Stable coins