

# DeFi Liquidations

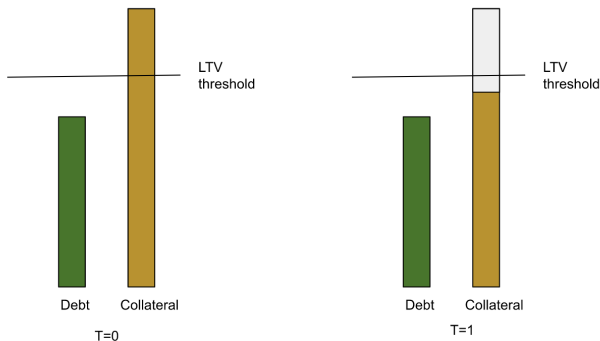
Amit Chaudhary

Workshops on Digital Currencies, The Frontiers of AI and FinTech  
Warwick Gillmore Centre for Financial Technology  
Warwick Business School

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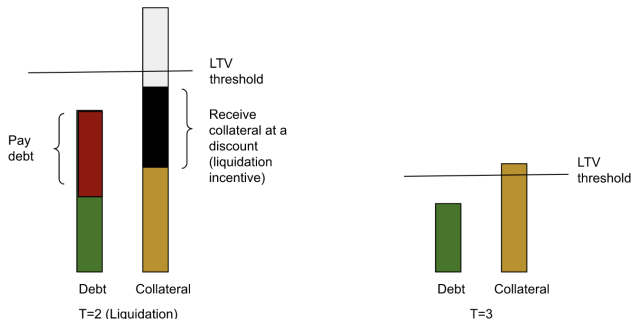
# DeFi Lending

- ▶ Lending in DeFi is mostly overcollateralized.
- ▶ Price decline of collateral token, price increase of borrowed token and even interest accrual can trigger liquidations.



# How liquidations work?

- ▶ Liquidations are mechanism to avoid bad debt of over-collateralized lending protocols.
- ▶ Liquidation incentives provide competition.



## Critiques of DeFi

- ▶ Systematic risk by contagion brought about by the liquidation spirals.
  - ↓ In the liquidation step, liquidators need to immediately sell collateral to claim profits.
  - ↓ Selling collateral likely triggers price impact if the market is illiquid.
  - ↓ This price impact might trigger further liquidations.
  - ↓ Borrowers need to liquidate other crypto assets to save their fallen positions.
- ▶ Systematic risk by contagion brought about by the liquidation spirals.

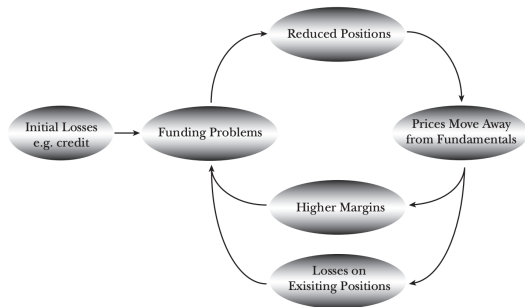
This sounds familiar: “systemic risk” during the financial crisis

## Systemic risk during the financial crisis

Liquidity spirals: When asset prices drop, financial institutions capital erodes and, at the same time, lending standards and margins tighten.

Both effects cause fire-sales, pushing down prices and tightening funding even further. <sup>1</sup>

**The Two Liquidity Spirals: Loss Spiral and Margin Spiral**



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<sup>1</sup>Brunnermeier, M.K., 2009. Deciphering the liquidity and credit crunch 2007–2008. *Journal of Economic perspectives*, 23(1), pp.77-100.

## Preference in reference for systematic risk (2007-2008)



# Systematic risk: How DeFi differs from CeFi?

## 1. Flash loans

- ▶ Smart contracts functionality can execute the series of liquidation arbitrage transaction into single sequence.
- ▶ Assures that arbitrage either gains or transaction is not executed.
- ▶ Efficiency enhancing by reduction in the arbitrage risk. Solves "limits to arbitrage" problem.
- ▶ But the aggressive and efficient liquidations bots can increase the intensity of contagion in illiquid markets.
- ▶ Flash loans are the major source of attack vectors in the past.

# Systematic risk: How DeFi differs from CeFi?

## 2. Complete information or transparency of transactions in blockchain

- ▶ A single person having no capital can liquidate very large leverage position.
- ▶ Democratization of risk management with low cost bringing financial efficiency.
- ▶ Collusion within large entities can be avoided.
- ▶ "Predatory trading"<sup>2</sup> effects as traders can observe each other's positions

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<sup>2</sup>Brunnermeier, M.K. and Pedersen, L.H., 2005. Predatory trading. The Journal of Finance, 60(4), pp.1825-1863.



## Systematic risk: How DeFi differs from CeFi?

Automated and transparent liquidations as a concepts of neutrality, impartiality, equity and equality.



**Figure 1:** "Contemplation of Justice" Statue on the Supreme Court Plaza by James Earle Fraser.

# Few challenges in DeFi

## Challenge 1

- ▶ The liquidation spiral is more prominent due to liquidity fragmentation in cryptoassets

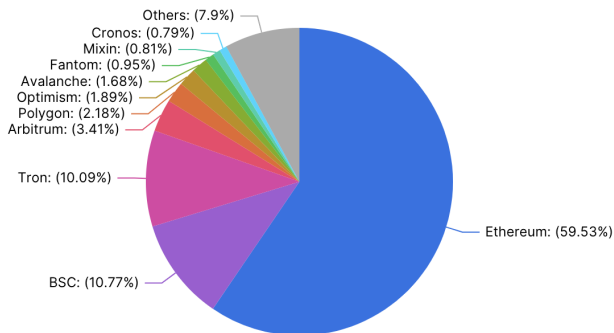


Figure 2: Total Value Locked (TVL) in all chains: \$ 47 B as of 15 March 2022

## Few challenges in DeFi

Overcoming challenge 1 by generalized cross-chain messaging protocols for blockchain interoperability

- ▶ Cross-chain lending protocols enabling unified liquidity pool design

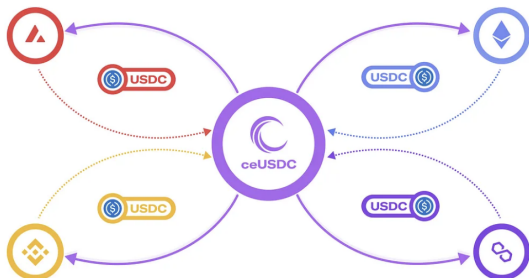


Figure 3: Unified liquidity lending through cross-chain message parsing <sup>3</sup>

<sup>3</sup><https://cedro.finance/> , in beta

# Few challenges in DeFi

Challenge 2: Making economic incentives as a centerpiece of protocol design.

- ▶ Designing better liquidation logic: liquidation incentives are less studied.
- ▶ Why liquidation incentives are important?
- ▶ Major lending protocol incurred bad debt resulting from a major liquidation event involving a single user who had borrowed close to \$40M of CRV tokens using USDC as collateral.
- ▶ Toxic liquidation spirals <sup>4</sup> caused this event.

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<sup>4</sup>Warmuz, J., Chaudhary, A. and Pinna, D., 2022. Toxic Liquidation Spirals: Evidence from the bad debt in DeFi, arXiv preprint arXiv:2212.07306.

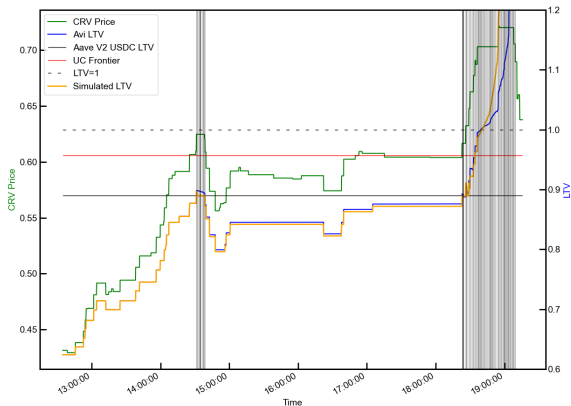
## Toxic liquidation spirals

Liquidations are toxic when  $LTV_{final} > LTV_{initial}$   
Conditions when this is true

$$LTV_{initial} > \frac{1}{1+i}$$

$i$ : liquidation incentive

# Toxic liquidation spirals



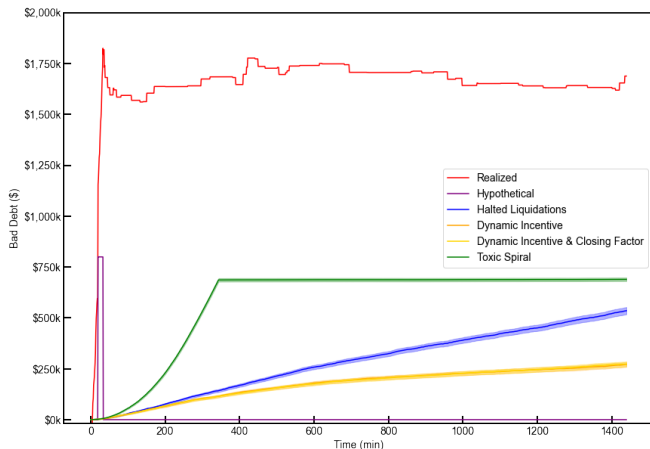
**Figure 4:** Users loan-to-value (LTV) ratio (blue; right axis) and CRV/USDC price (green; left axis) as a function of time on November 22nd, 2022. The plot follows a 6-hour timespan of activity leading to the bad debt creation event. Our simulator's reproduction of Avi's portfolio LTV is shown in gold. A thin black horizontal line marks the 89% LTV threshold above which Avi becomes liquidatable. A red horizontal line marks the threshold beyond which liquidations become toxic (the undercollateralization frontier).

## Toxic liquidation spirals

Animation of the change in LTV between the liquidation calls.  
Blue marks shows normal liquidations when and red shows toxic liquidations

**Link**

# Mitigating toxic liquidation spirals by dynamic liquidation incentives



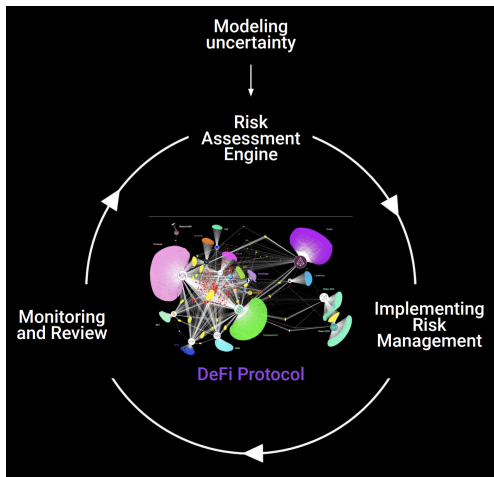
**Figure 5:** Average bad debt in various liquidation regimes that could have statistically expected (simulation performed over 20k CRV/USDC historical price trajectories).



## Few challenges in DeFi

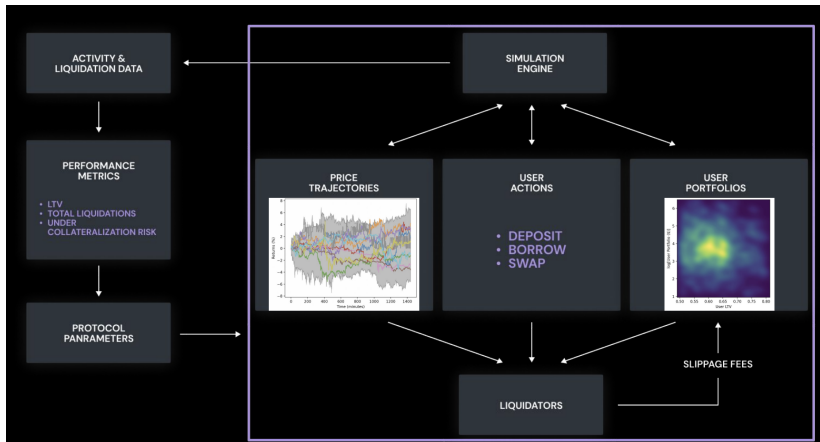
Challenge 3: How to perform risk assessment of DeFi protocols?

- ▶ Transparent risk control measures by Decentralized Autonomous Organisation (DAO).



# Risk assessment framework in DeFi

- ▶ Transparency and protocol parameter optimisation <sup>5</sup>.



<sup>5</sup>Chaudhary, A. and Pinna, D., 2022. Market risk assessment: A multi-asset, agent-based approach applied to the DeFi lending protocol. arXiv preprint arXiv:2211.08870.

*Thank You*