



Fintech and Blockchain: The Digital Transformation of Financial Services

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Content

1. Traditional Finance and its Inefficiencies
2. Fintech, Blockchain, and Decentralized Finance
3. Regulation of Fintech

Traditional Financial Intermediaries

Most financial services are provided by centralized financial intermediaries



Inefficiencies of Centralized Financial Intermediation

1. Costly and slow

- High cost of Capital, Large Spread, Slow Transfers

2. Opacity

- Regulators, Banks, and Users
- May lead to financial crises

3. Low accessibility

- Non-negligible part of population is unbanked

4. Low interoperability

- Weak connectivity in the network of financial services

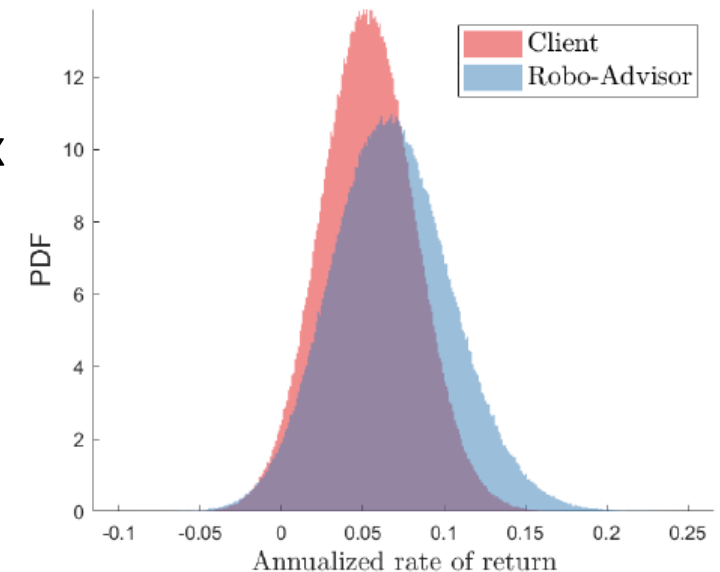
The Emergence of Fintech Companies

- Technological advances have brought major improvements to the operations of financial services
- Pros: quicker, cheaper, and more convenient
- Cons:
 - Rely on existing financial system
 - Opaque and not always accessible
 - Bottleneck on transaction efficiency
 - Social costs



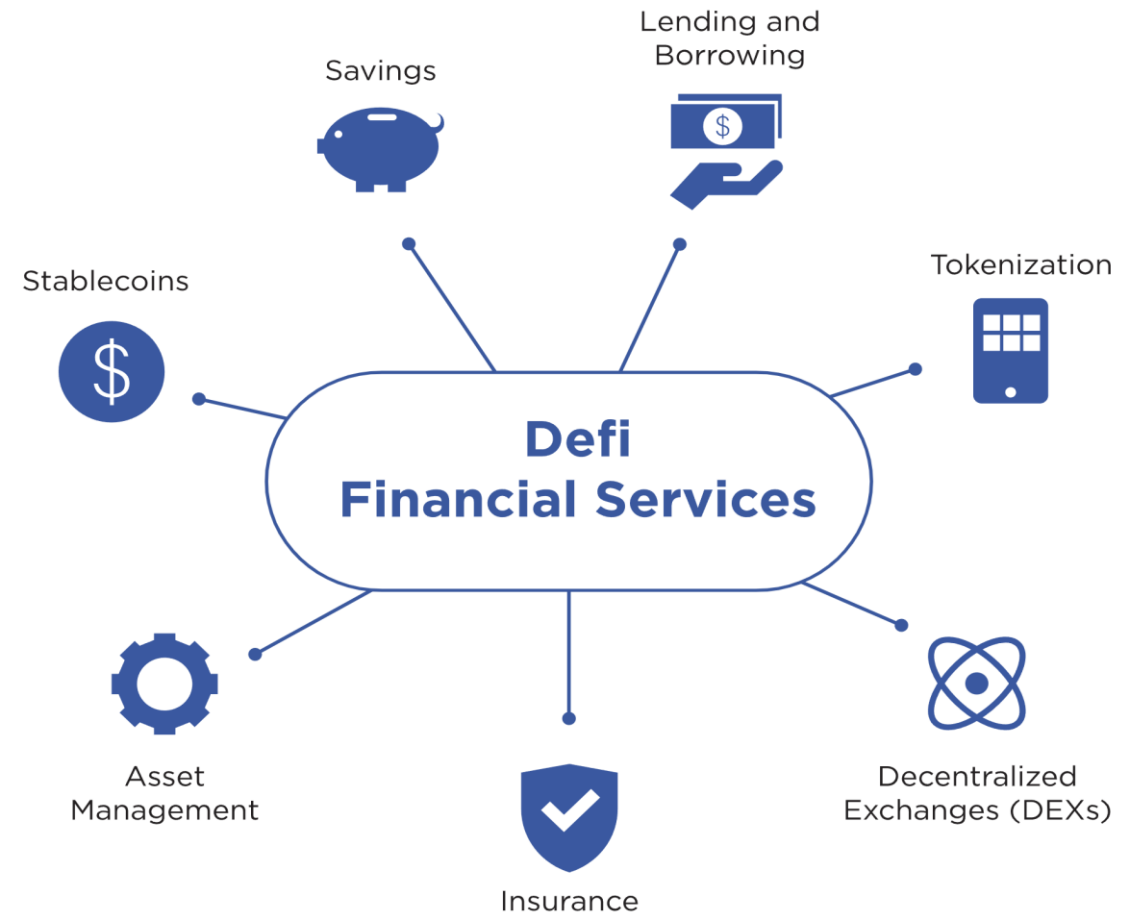
Fintech Services: Robo-Advising

- Algorithmic-driven financial planning, tailored to clients' risk preferences and characteristics, with automated execution
- Pros:
 - Invest in a diversified portfolios of ETFs
 - Use sophisticated algorithms for portfolio rebalancing and tax management
 - Low entry barriers
- Cons:
 - Advise is not always transparent
 - Algorithmic aversion
- Capponi et al. (2020) study mechanisms to improve transparency of robo advising



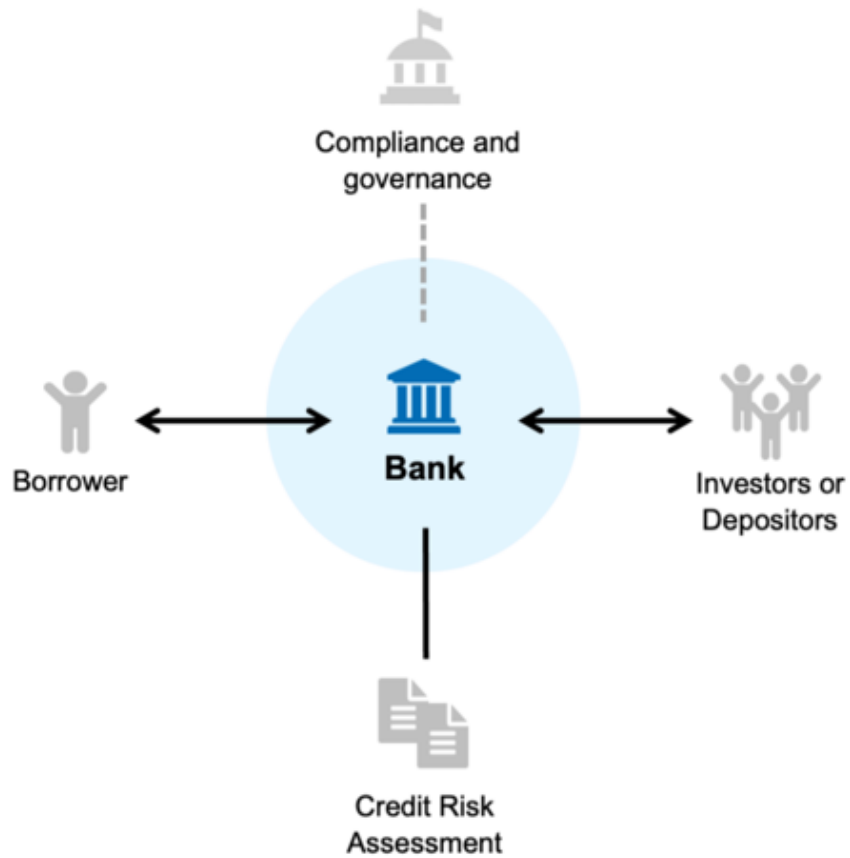
Fintech built on Blockchain

- **Blockchain:** decentralized database/ledger shared among nodes of a P2P network
- **Smart contracts:** computer programs running on blockchain in accordance with predefined conditions agreed by contracting parties



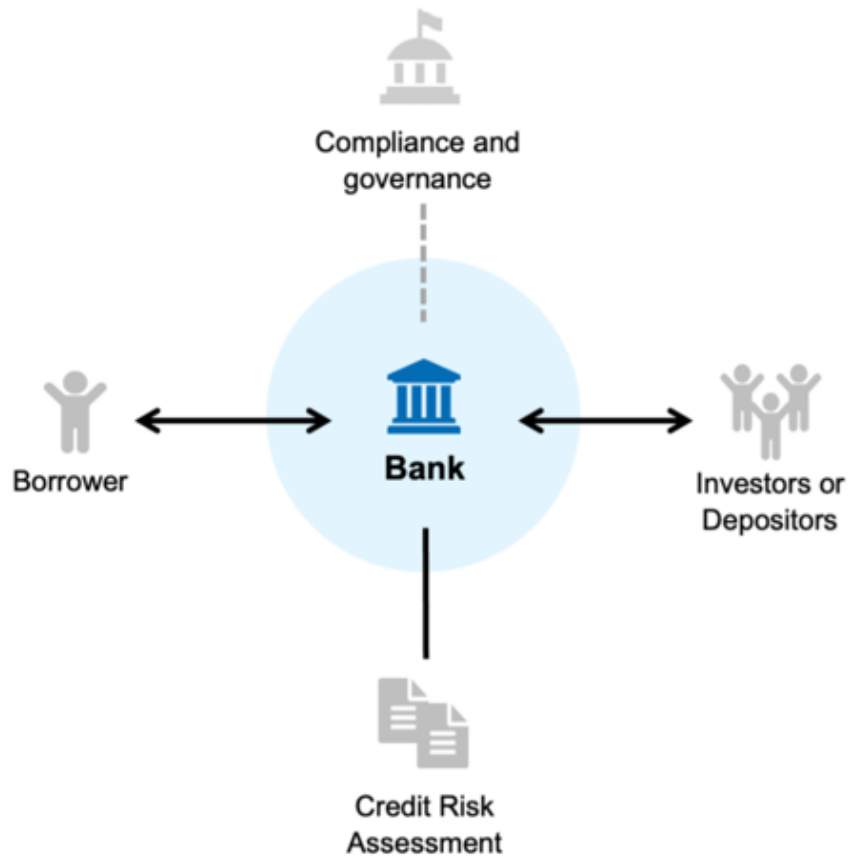
Lending: Traditional vs. Blockchain

Traditional Credit

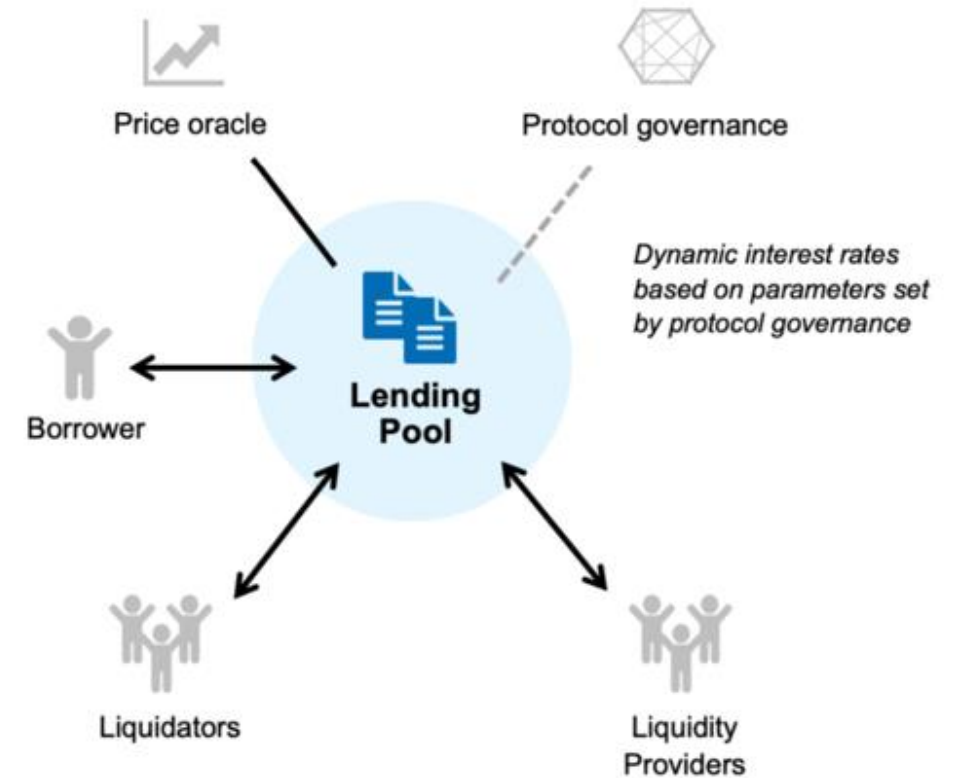


Lending: Traditional vs. Blockchain

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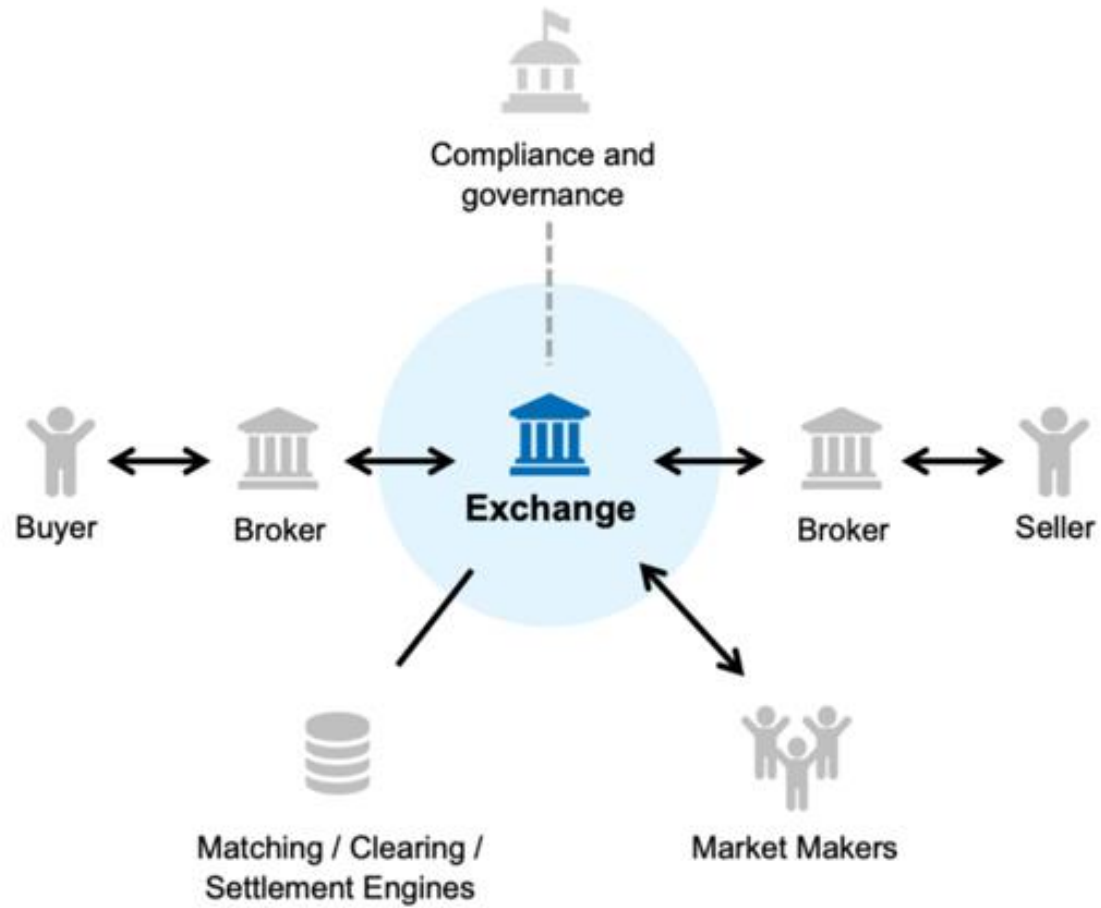


DeFi Decentralized Credit Pools



Trading: Traditional vs. Blockchain

Centralized Exchanges

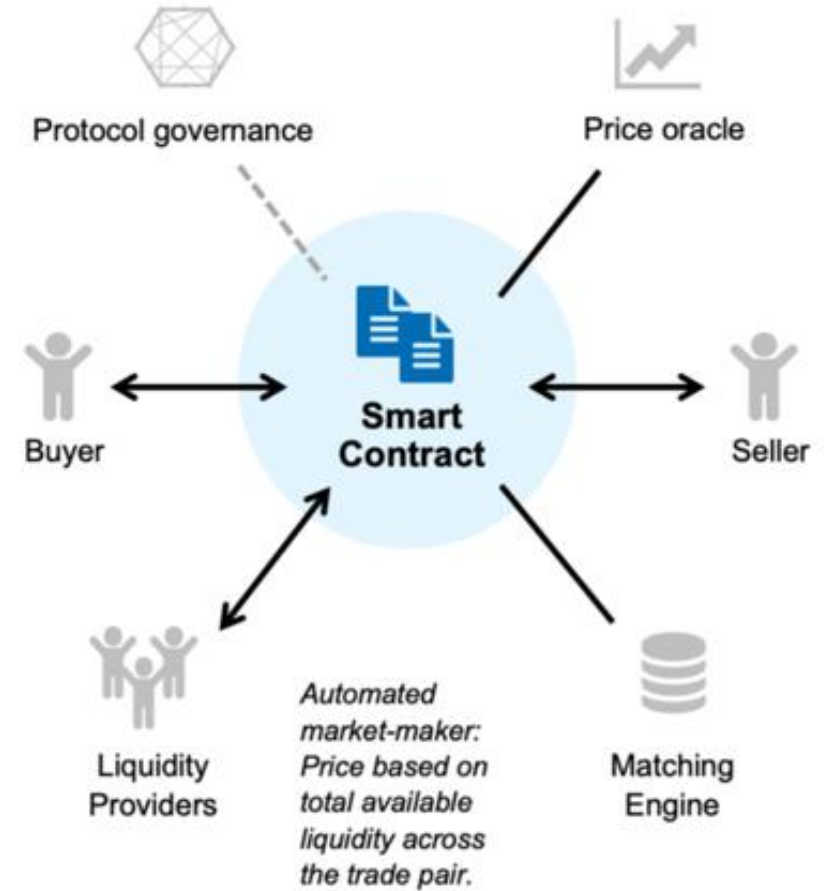


Trading: Traditional vs. Blockchain

Centralized Exchanges

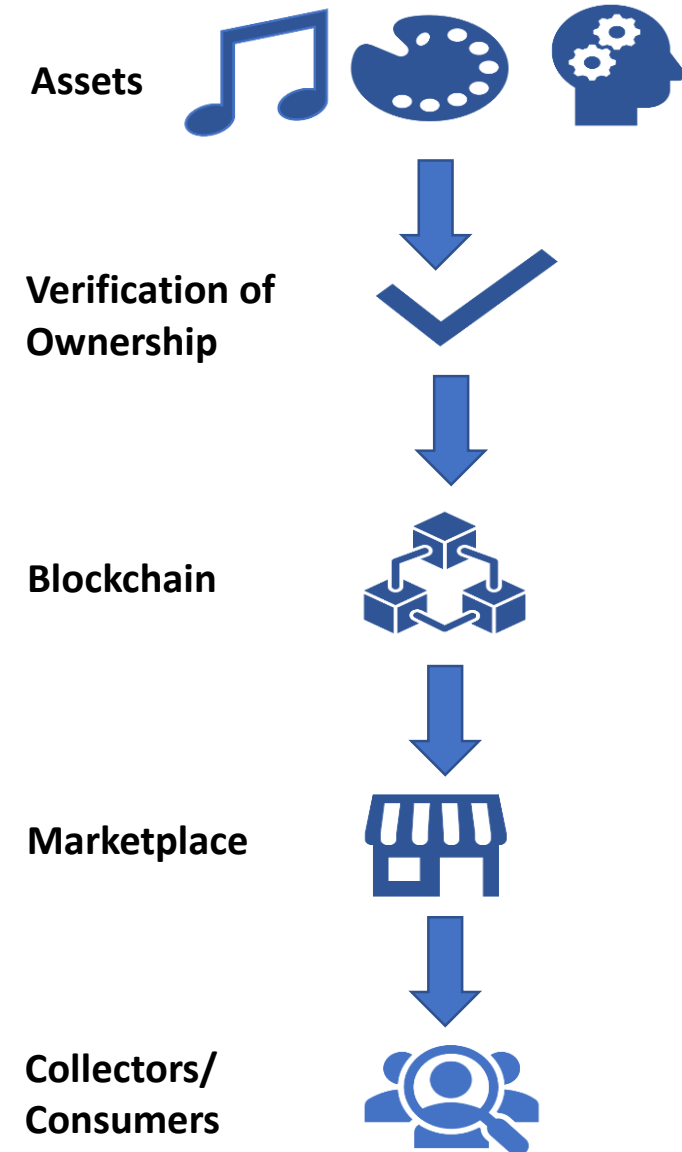


DeFi Decentralized Exchange



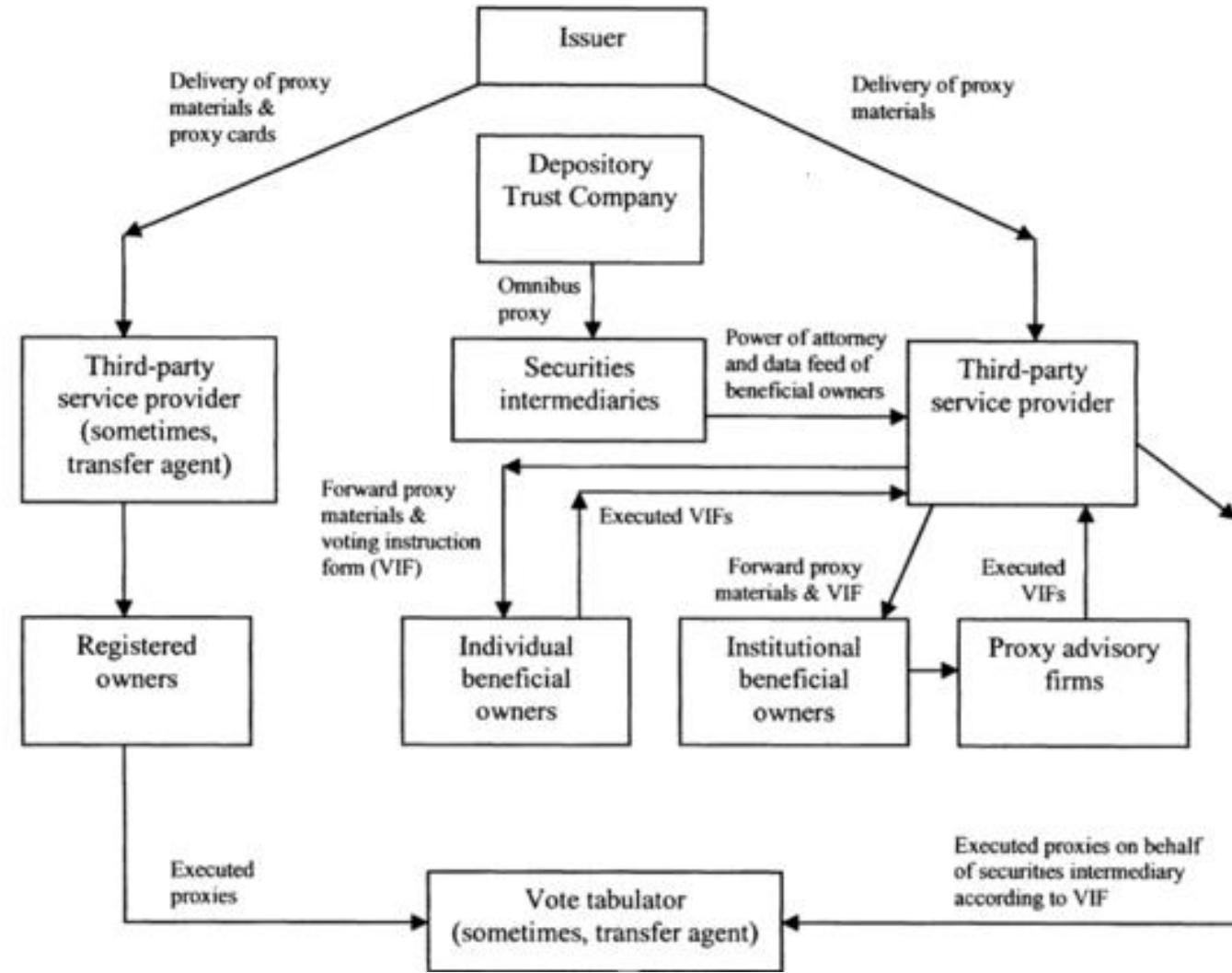
Marketplaces for non-fungible Assets

- Non-fungible assets: Art, Music, Intellectual Property
- Traditional Marketplaces (e.g. gallery, auction houses):
 - Limited price discovery
 - Fragmentation
 - Authenticity and Ownership
 - Limited revenue passed to artists/inventors
- Blockchain Marketplace: asset tokenization
 - NFTs
 - Transparency
 - Improved liquidity
 - Reduced inefficiencies



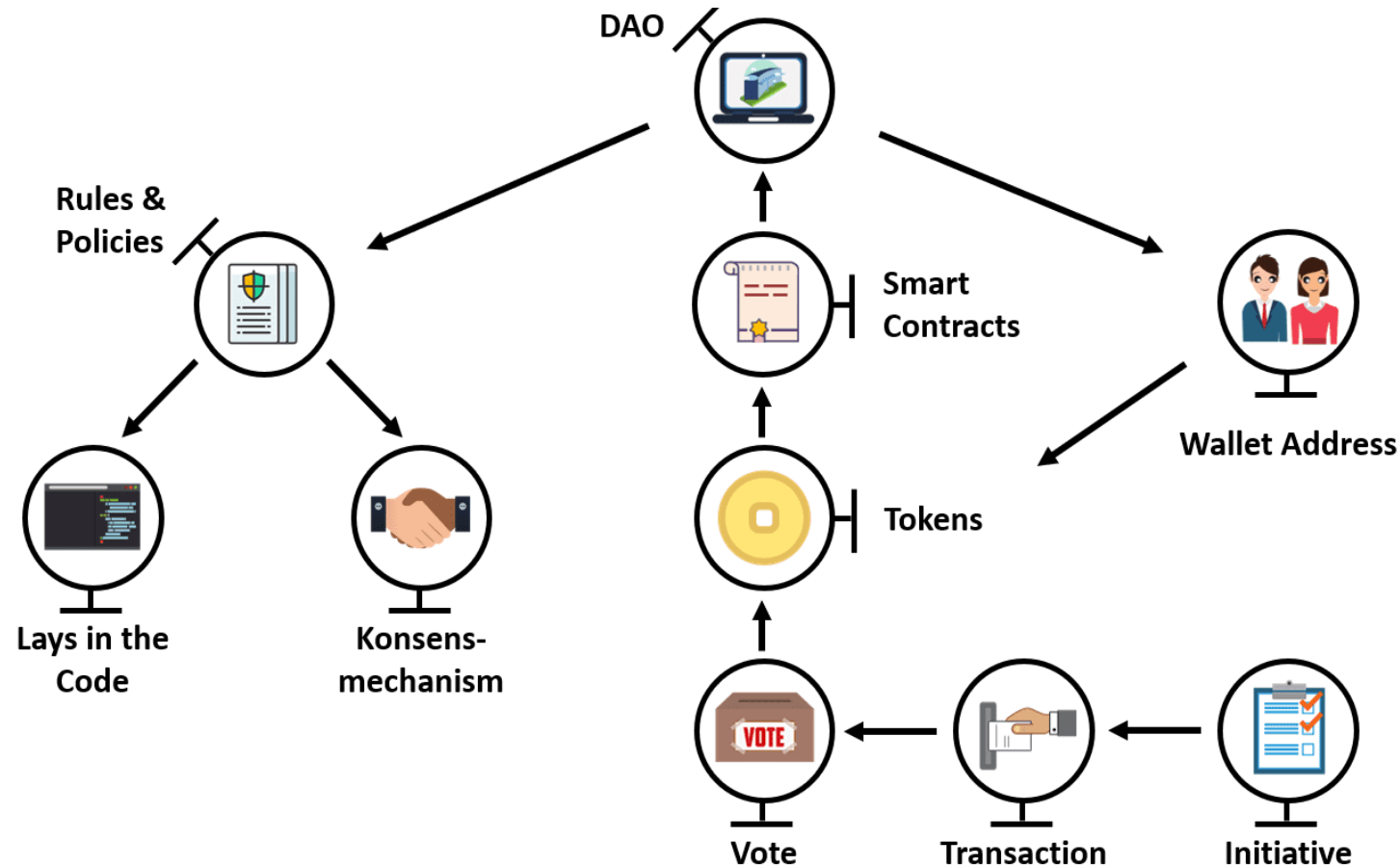
Governance of Traditional Financial Intermediaries

- Governance of publicly traded companies on NYSE and Nasdaq is based on shareholder voting
- *Empty-voting* or *Over-voting* are problems of traditional proxy-vote systems



Blockchain Governance

Decentralized Autonomous Organization (DAO) provides rule-based, transparent, decentralized governance structure.

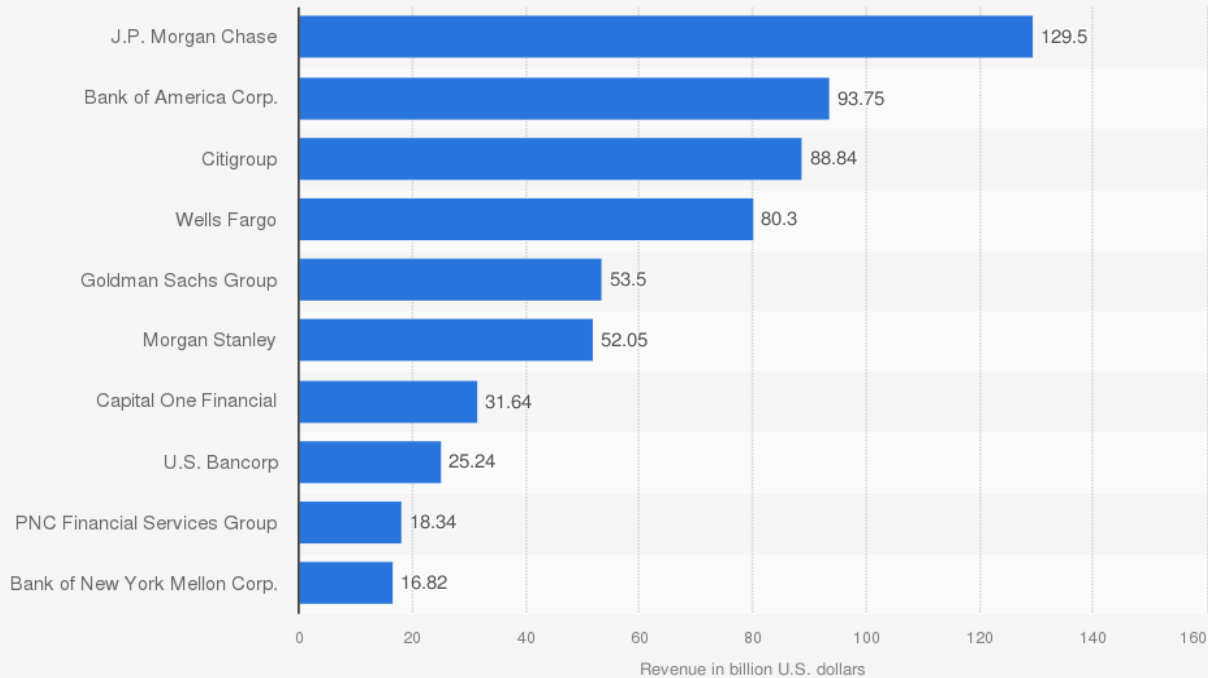


Advantages of Fintech built on Blockchain

1. Reduced intermediation costs
2. Fast settlement
3. Full transparency
4. Accessibility
5. Crowdsourcing liquidity
6. Interoperability

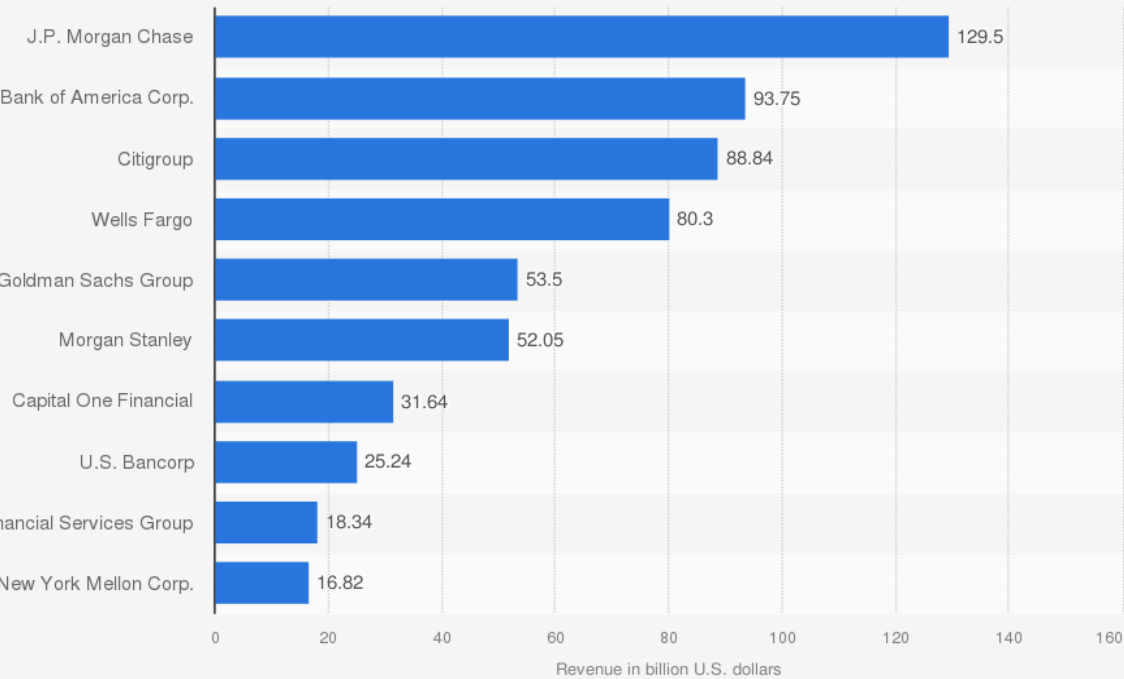
Reduced Intermediation Costs

Largest commercial banks in the United States in 2020, by revenue (in billion U.S. dollars)

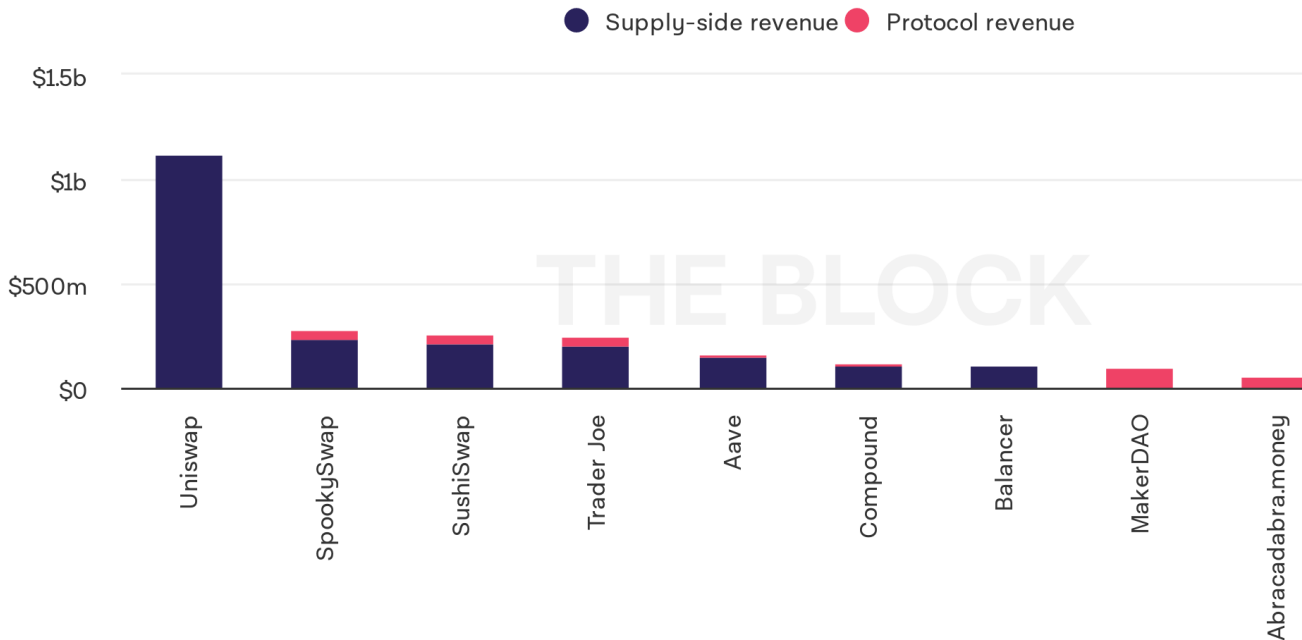


Reduced Intermediation Costs

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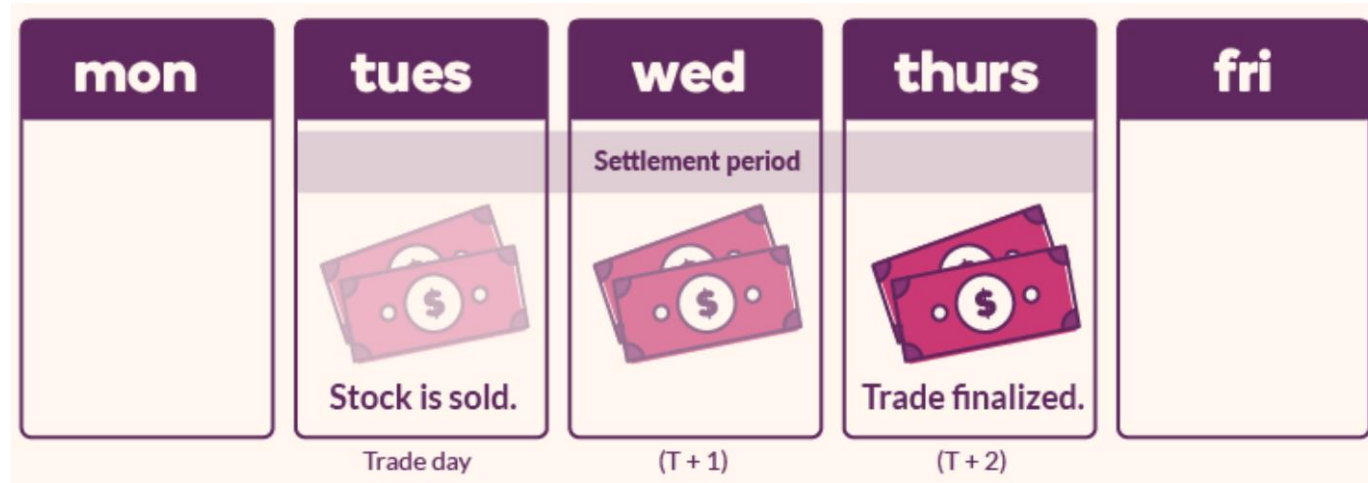
Annualized DeFi revenue by protocol (30-day sample)



SOURCE: CRYPTOFEEES
UPDATED: MAR 2, 2022

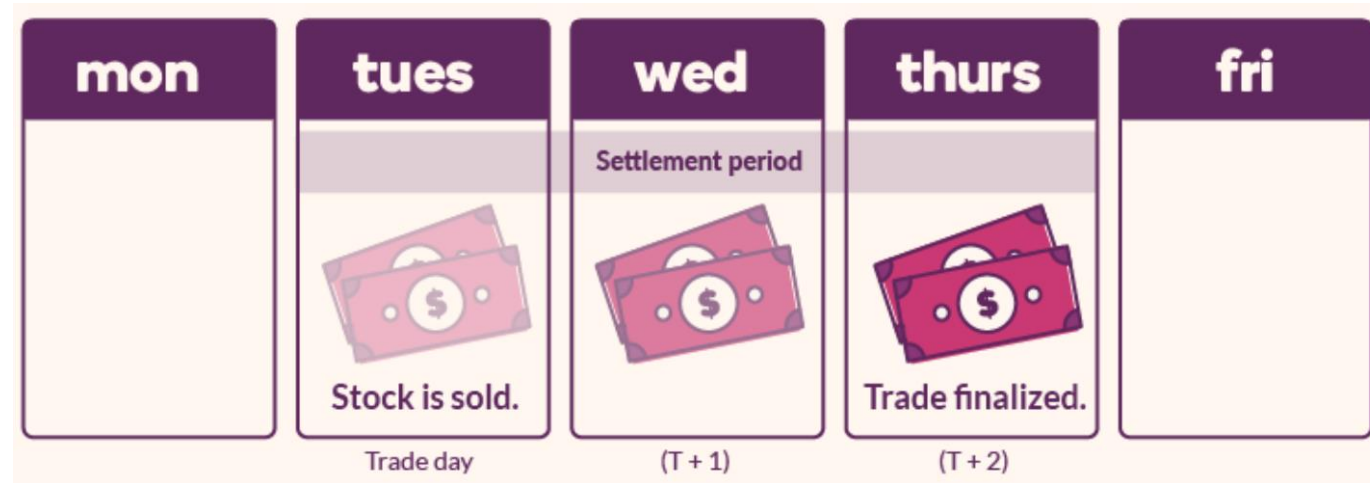
Fast Settlement

Stock on Exchange:
2 days



Fast Settlement

Stock on Exchange:
2 days



Ethereum Blockchain:
instantaneous settlement
for any transaction



Transparency: Ownership and Transaction History

Transaction Hash: 0x7b54d61f6e4624bb704ccd510da460fa80301428994b45ef92f74c9b7caea222

Status: Success

Block: 13680579 41 Block Confirmations

Timestamp: 9 mins ago (Nov-25-2021 01:21:11 AM +UTC) | Confirmed within 30 secs

Transaction Action: Swap 235.998068 ALICE For 1.43229536454691122 Ether On Uniswap V2

From: 0xbf5ae133b9a0fc1a07952a7df2afa21f7f69ef58

Interacted With (To): Contract 0x7a250d5630b4cf539739df2c5dacb4c659f2488d (Uniswap V2: Router 2)

Tokens Transferred: 2

- From 0xbf5ae133b9a0fc... To Uniswap V2: ALIC... For 235.998068 (\$6,114.71) ALICE (ALICE)
- From Uniswap V2: ALIC... To 0xbf5ae133b9a0fc... For 1.43229536454691122 (\$6,200.86) Wrapped Ethe... (WETH)

Value: 0 Ether (\$0.00)

Transaction Fee: 0.01677753 Ether (\$72.64)

Transparency: Contractual Obligations through Smart Contracts

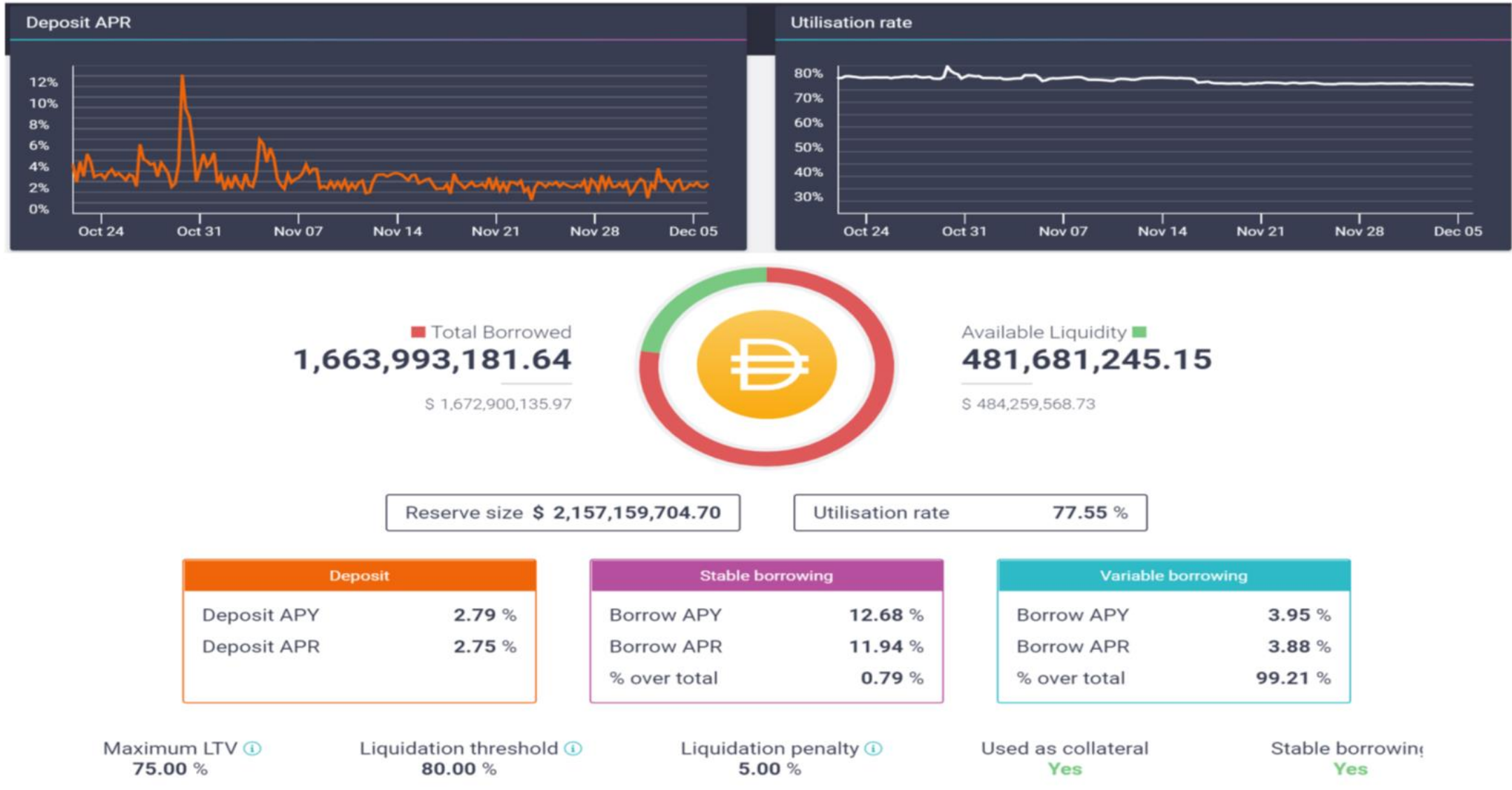
Smart Contracts are open-source, hard-coded algorithms:

UniswapV2Pair.sol

[This contract](#) implements the actual pool that exchanges tokens. It is the core Uniswap functionality.

```
73     function _update(uint balance0, uint balance1, uint112 _reserve0, uint112 _reserve1) private {
74         require(balance0 <= uint112(-1) && balance1 <= uint112(-1), 'UniswapV2: OVERFLOW');
75         uint32 blockTimestamp = uint32(block.timestamp % 2**32);
76         uint32 timeElapsed = blockTimestamp - blockTimestampLast; // overflow is desired
77         if (timeElapsed > 0 && _reserve0 != 0 && _reserve1 != 0) {
78             // * never overflows, and + overflow is desired
79             price0CumulativeLast += uint(UQ112x112.encode(_reserve1).uqdiv(_reserve0)) * timeElapsed;
80             price1CumulativeLast += uint(UQ112x112.encode(_reserve0).uqdiv(_reserve1)) * timeElapsed;
81         }
```

Full Transparency: Liability, Liquidity, and Price



Accessibility and Crowdsourcing Liquidity

- **Access to Liquidity:** gain immediate access to liquidity by interacting with smart contracts
- **Crowdsourcing Liquidity:**
 - Algorithm sets market prices
 - Democratization of liquidity provision benefits liquidity demanders

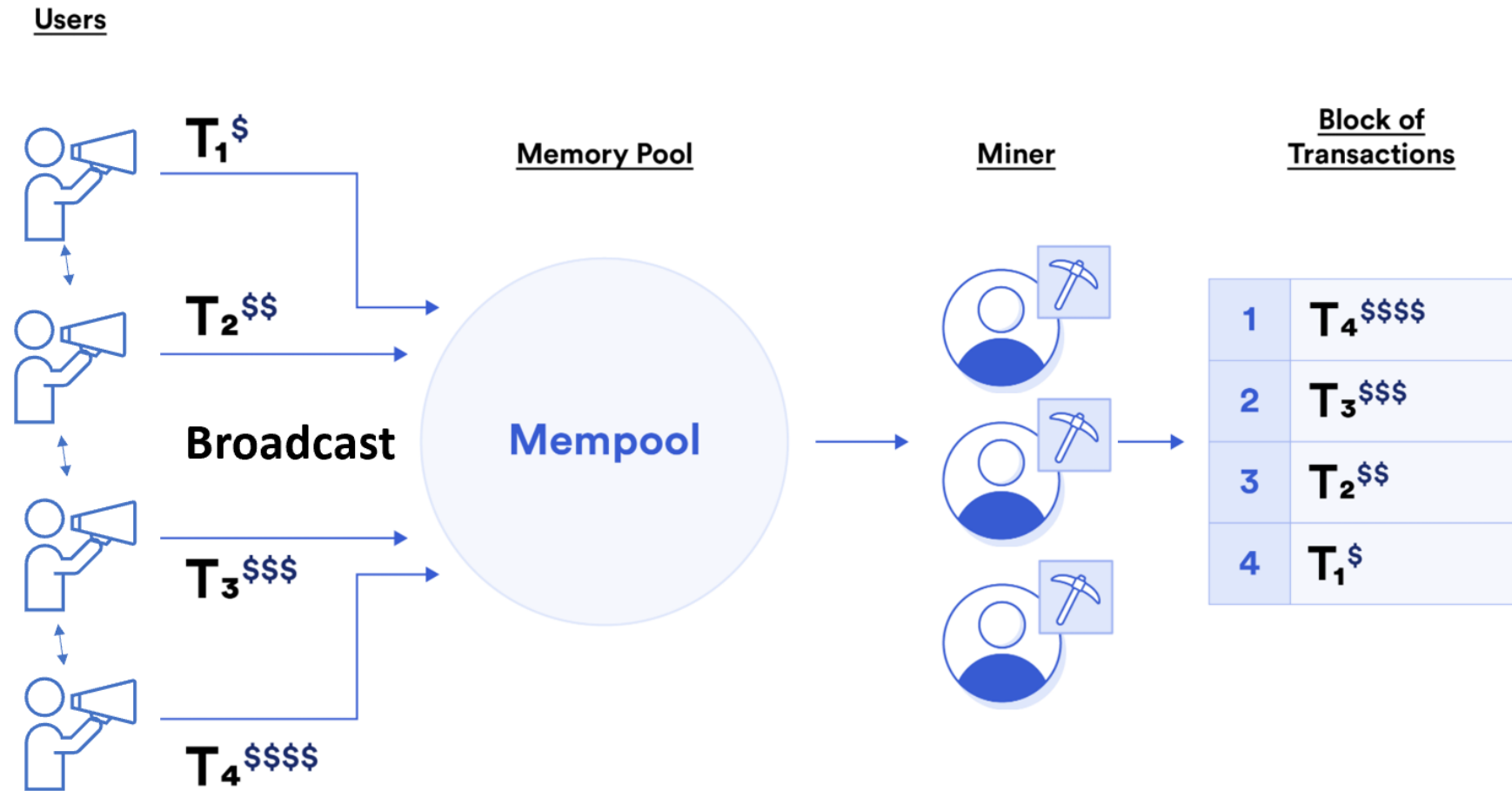


Cons of Fintech built on Blockchain

1. Settlement → Capacity and Transaction Costs
2. Full transparency → Arbitrage
3. Crowdsourcing liquidity → Hidden Risk
4. Interoperability → Systemic Risk
5. Decentralized governance → Misalignment of Incentives

Blockchain Order Execution Mechanism

Miners prioritize transactions based on the submitted fees



Processing Capacity



Processing Capacity



	 SOLANA	 ETHEREUM	 EOS	 CARDANO	 TEZOS	 STELLAR
Transaction Throughput	59,000 tps	17 tps	3900 tps	~250 tps	50 tps	~2000 tps
Transaction Fee	\$0.000001	~\$2	Free (need bandwidth by staking)	~\$0.02	\$0.00232	\$0.000001
Transaction Finality	0.4 sec (1 block)	5 mins (35 blocks)	2.5 mins 2/3 of BPs	~2 mins	30 mins	4 sec
Consensus Mechanism	Proof of Stake	Proof of Work	Delegated Proof of Stake	Ouroboros Proof of Stake	Liquid Proof of Stake	Federated Byzantine Agreement

Transaction Costs

- Transaction costs arise because of current limitations in processing capacity
- Trading is relatively expensive for small transactions

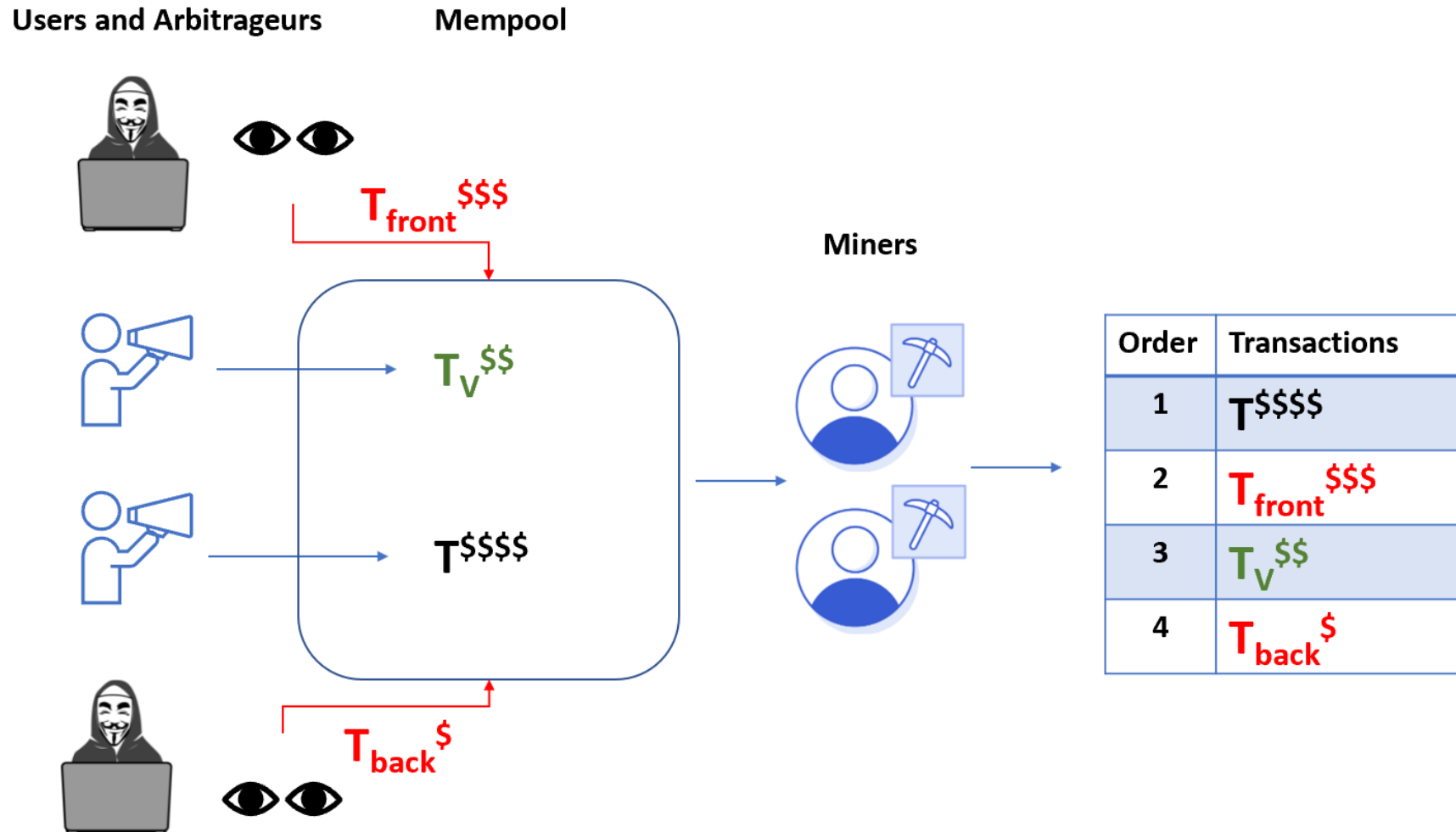
[EDIT](#)

GAS FEE **0.077143**
\$29.57

Gas Price (GWEI) i Gas Limit i

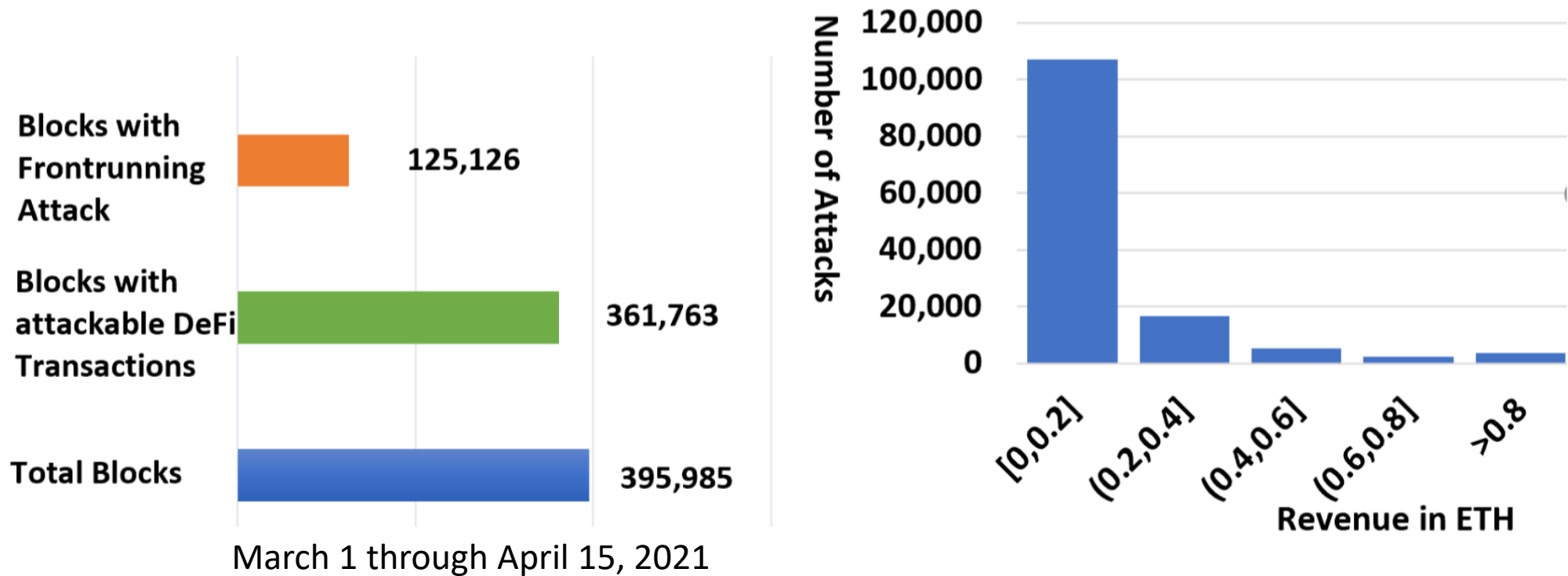
145 ^
v 532020 ^
v

Arbitrage



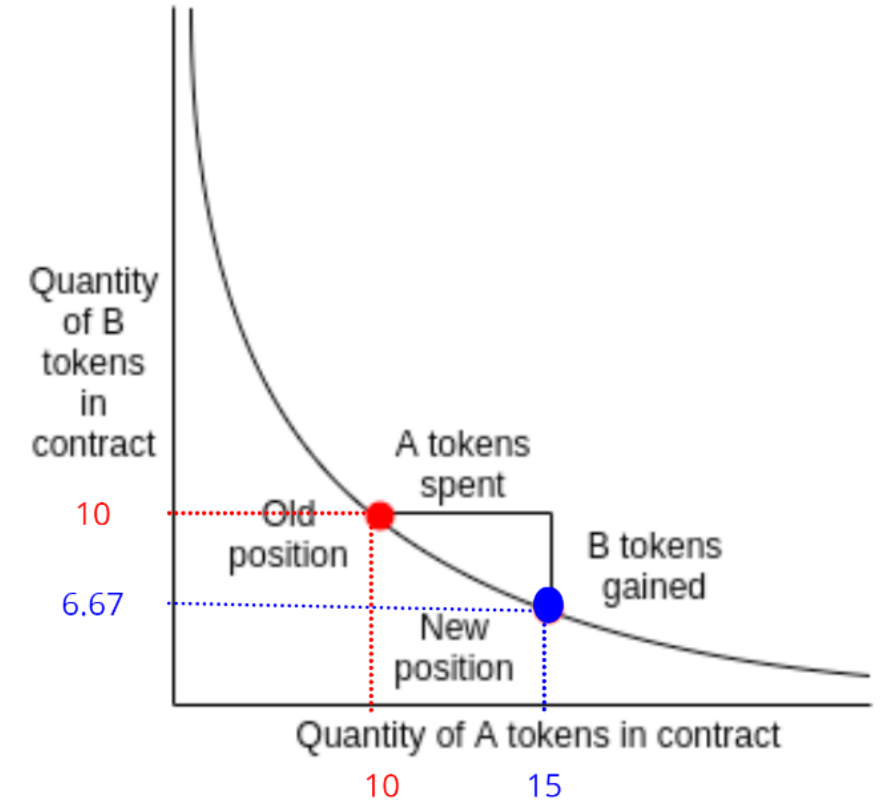
Profitability of Arbitrage

- A third of blocks contain frontrunning arbitrage attacks, which on average cost \$600 (0.2 ETH) to users (Capponi, Jia, and Wang (2022))

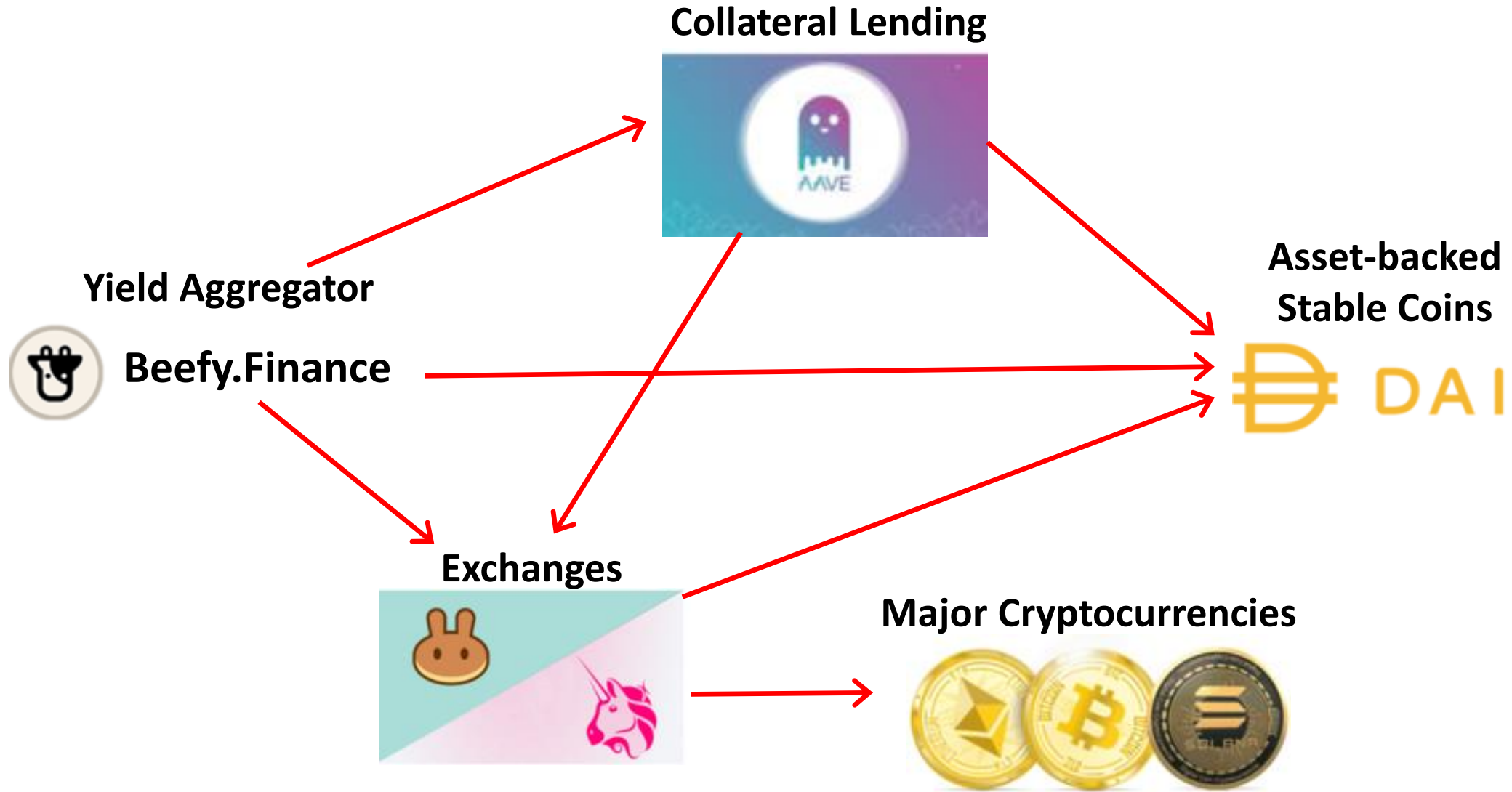


Risk of Liquidity Provision

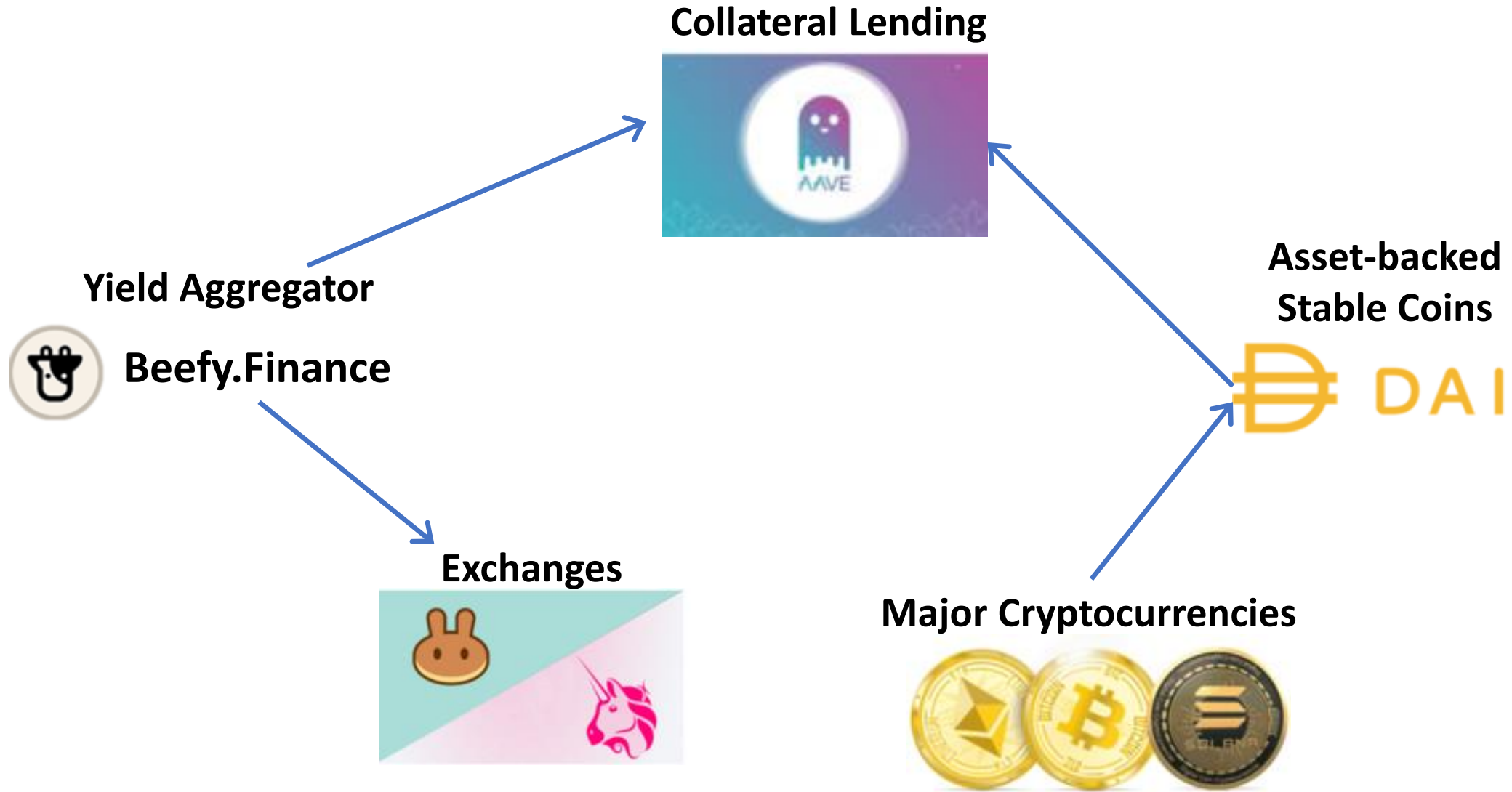
- Capponi and Jia (2021) develop a model of liquidity provision on DeFi exchanges
- The model demonstrates that arbitrageurs exploit liquidity providers, because of liquidity crowdsourcing and blockchain order processing mechanism



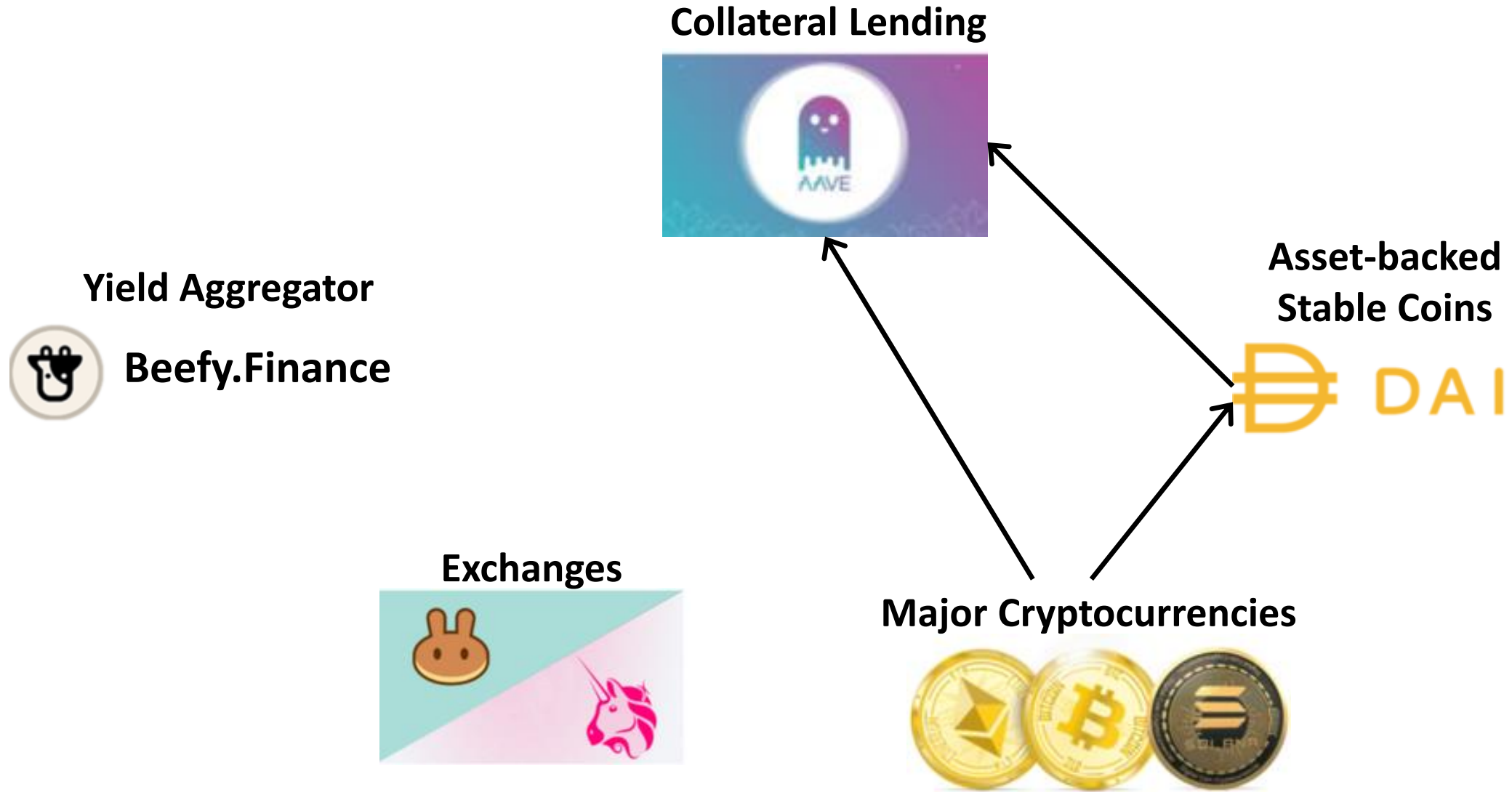
Systemic Risk: Protocol Risk



Systemic Risk: Oracle Risk



Systemic Risk: Liquidation Risk



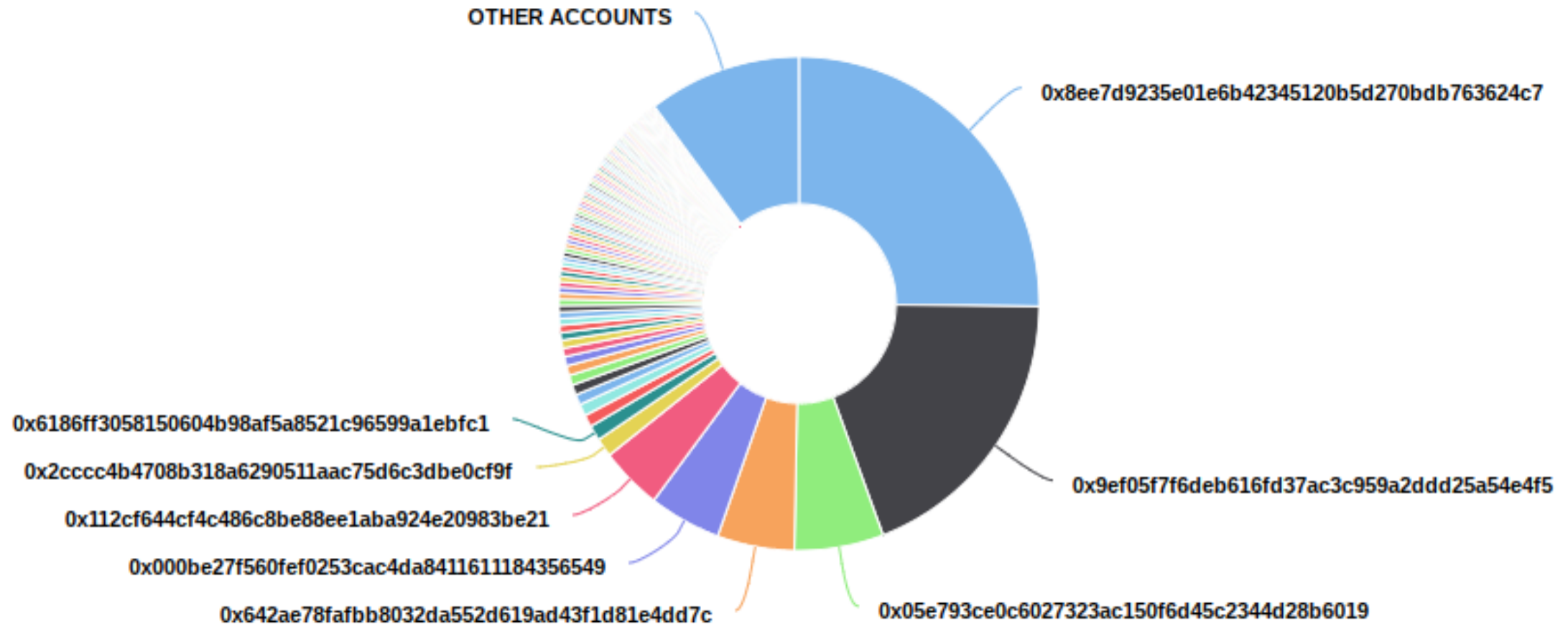
Decentralized Governance: Misalignment of Incentives

- Some users want to extract high interest
- Other users want cheap fund and low interest rate
- Speculators care about pumping the governance token price
- Attackers want to manipulate protocol to extract large profits

Decentralized Governance: Risk of Centralization

Maker Top 100 Token Holders

Source: Etherscan.io



Regulation of Fintech Blockchain

- What risks should regulators address?
 - scam, manipulation (e.g., pump/dump)
 - tax evasion, money laundry (anonymity)
 - Interoperability and connectivity of DeFi applications
- What are barriers faced by regulators?
 - World-wide decentralization, anonymity, fast-changing, technology education, lack of legal framework

Regulation of Fintech Blockchain

- Trade-off faced by regulators
 - Tighter Regulation → less financial innovation
 - More accurate regulation → slow and costly regulation
- How to best regulate?
 - Understand new technology and leverage transparency of blockchain
 - Create new measures for different risks

Conclusion

- Existing financial Intermediaries are being challenged by fintech companies
- Fintech companies built on existing financial services mitigate but not eliminate all inefficiencies
- More improvements needed to attain higher efficiency and wide adoption of Fintech blockchain

- ***New Initiative – Center for Digital Finance and Technologies within SEAS***
 - Starting Date: August, 2022
 - Director: Agostino Capponi
 - Activities: Executive Education, Roundtable Discussions, Seminar Series, post-graduate, graduate, and undergraduate research opportunities
 - Affiliates: Global Risk Institute, Capital Fund Management, Ripple, Ethereum, Stellar, Arcane Group