

Lesson 21: DeFi

Mini-Lecture Version (30 min)

Digital Finance

Learning Objectives: Understand key concepts and applications

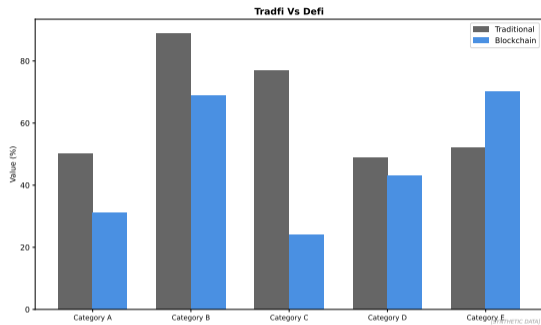
DeFi: Decentralized Finance Revolution

Traditional Finance (TradFi):

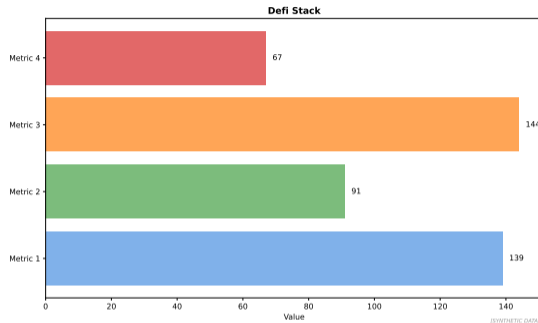
- Banks, brokers, exchanges
- Intermediaries control access
- Centralized custody
- Limited hours, geographic restrictions
- (See full lecture for details)

DeFi:

- Smart contracts replace intermediaries
- Permissionless access (anyone with wallet)
- Self-custody
- 24/7 global access
- (See full lecture for details)



Historical context helps explain current DeFi landscape.



Core Building Blocks:

- **Asset Layer:** Tokens (ERC-20, stablecoins)
- **Protocol Layer:** Lending, DEXs, derivatives
- **Application Layer:** Aggregators, wallets, dashboards
- **Composability:** “Money Legos” – protocols interact seamlessly

This concept is fundamental to understanding DeFi.

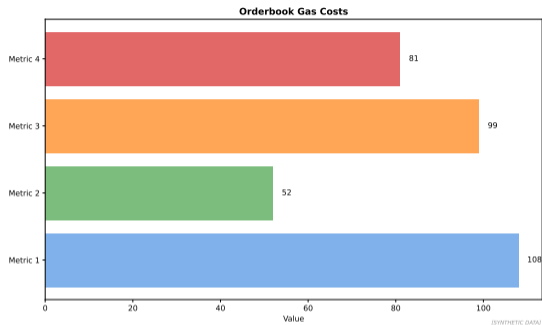
Decentralized Exchanges (DEXs): The Problem

Centralized Exchanges (CEXs):

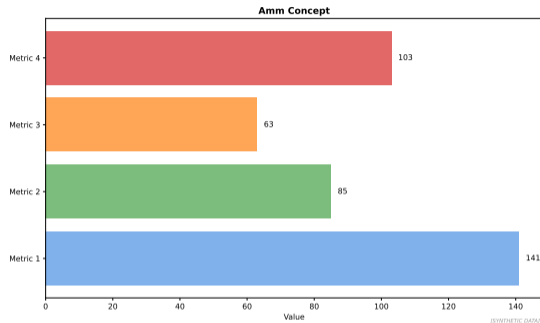
- Order book model
- Custodial (exchange holds funds)
- Counterparty risk (FTX collapse)
- KYC requirements
- (See full lecture for details)

Challenges for DEX:

- On-chain order book too expensive
- Liquidity fragmentation
- Constant price updates



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Key Idea:

- Liquidity pools replace order books
- Algorithmic pricing via bonding curve
- Anyone can provide liquidity (LP)
- Passive market making

This concept is fundamental to understanding DeFi.

Constant Product Formula: $x \times y = k$

Uniswap V2 Model:

$$x \times y = k$$

where x = reserve of token A, y = reserve of token B, k = constant

Example: ETH/USDC pool with 100 ETH and 200,000 USDC

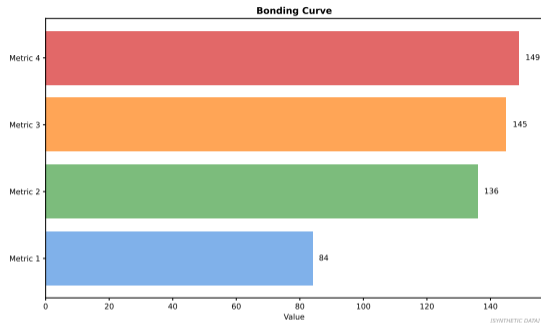
$$k = 100 \times 200,000 = 20,000,000$$

Trade: Buy 10 ETH

- New ETH reserve: $x' = 100 - 10 = 90$
- New USDC reserve: $y' = k/x' = 20,000,000/90 = 222,222$
- USDC paid: $222,222 - 200,000 = 22,222$ (effective price $\sim \$2,222/\text{ETH}$)

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AMM Bonding Curve Visualization



Properties:

- Price = slope of curve at current point: $P = y/x$
- Larger trades move price more (slippage)
- Infinite liquidity (asymptotic, but expensive for large trades)
- No order book needed

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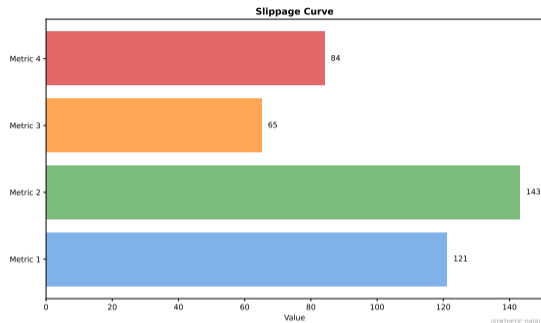
Price Impact and Slippage

Price Impact:

- How much your trade moves the price
- Larger trade → worse price
- Function of trade size relative to pool depth

Slippage:

- Difference between expected and executed price
- Set slippage tolerance (e.g., 0.5%)
- Trade reverts if exceeded



Formula: Price impact $\approx \Delta x / (x + \Delta x)$

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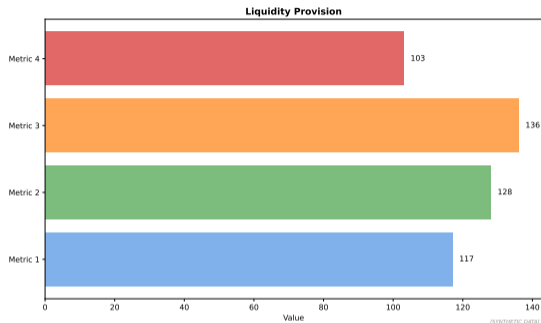
Liquidity Providers: Earning Fees

How it Works:

- 1 Deposit equal value of both tokens
- 2 Receive LP tokens (claim on pool share)
- 3 Earn 0.3% of all trades (Uniswap V2)
- 4 Withdraw anytime (burn LP tokens)

Example:

- Pool: 1,000 ETH + 2M USDC
- You deposit: 10 ETH + 20K USDC (1%)
- Daily volume: 500K USDC
- Your daily fees: $500,000 \times 0.003 \times 0.01 = \15



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Key Takeaways

- ① Banks, brokers, exchanges
- ② Intermediaries control access
- ③ Centralized custody
- ④ Limited hours, geographic restrictions

Bottom Line: DeFi is transforming how financial services operate and compete.

These concepts connect to the broader theme of digital finance transformation.



Technology view



Application view



Future view

Visual representations help reinforce key concepts of defi.

Concrete Examples: Making It Real

Technical Examples

- Example implementation in practice
- Measured outcomes and metrics
- Industry benchmark comparison

Case Study

- Real-world deployment scenario
- Quantifiable results achieved

Industry Leaders

- Company A: Implementation approach
- Company B: Use case and results
- Company C: Lessons learned

Market Data

- Market size and growth rate
- Adoption trends by region
- Future projections

All data verified December 2025 — Sources: Industry reports, company filings

Quiz Questions (1–5)

Q1. What is the primary purpose of defi?

- A) Increase efficiency B) Reduce costs C) Improve access D) All of the above

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- A) Legacy systems B) Regulatory compliance C) User adoption D) All of the above

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- A) North America B) Europe C) Asia-Pacific D) Varies by segment

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Answer: D – Multiple trends will shape the future.

Q10. What is a key takeaway about defi?

- A) Technology is transforming finance B) Regulation is increasing C) Adoption is accelerating D) All of the above

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Q10. What is a key takeaway about defi?

- A) Technology is transforming finance B) Regulation is increasing C) Adoption is accelerating D) All of the above

Answer: D – All these trends are interconnected.