L38: Stablecoin Mechanisms

Module E: DeFi Ecosystem

Blockchain & Cryptocurrency

December 2025

Learning Objectives

- Understand different stablecoin mechanism types
- Analyze fiat-backed stablecoins (USDC, USDT)
- Explore crypto-backed stablecoins (DAI, MakerDAO)
- Evaluate algorithmic stablecoins and their failure modes
- Compare stablecoin trade-offs (decentralization, stability, efficiency)

What is a Stablecoin?

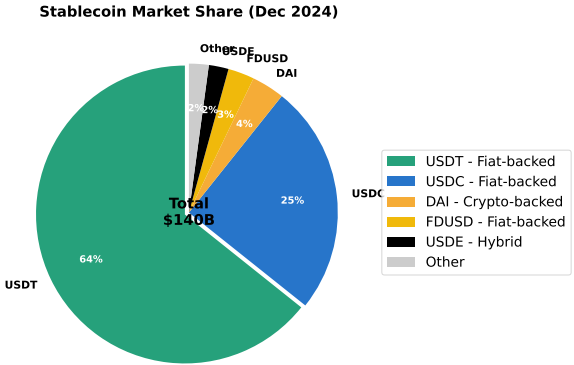
Definition: A cryptocurrency designed to maintain a stable value relative to $1 USD.

Why Stablecoins?

- Price stability (avoid crypto volatility)
- Medium of exchange, store of value
- DeFi building block (lending, trading, yield)
- Fast, cheap cross-border payments

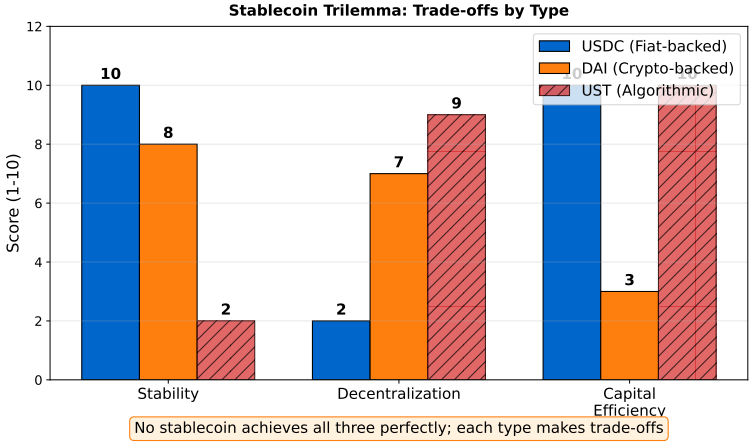
Total Market Cap: $140B (Dec 2024)

Stablecoin Market Share



USDT dominates (64%); fiat-backed stablecoins represent 90%+ of market

Stablecoin Trilemma



Each type sacrifices one property; no perfect stablecoin exists

Type 1: Fiat-Backed Stablecoins

Mechanism: 1 stablecoin backed by $1 in bank account.

How It Works:

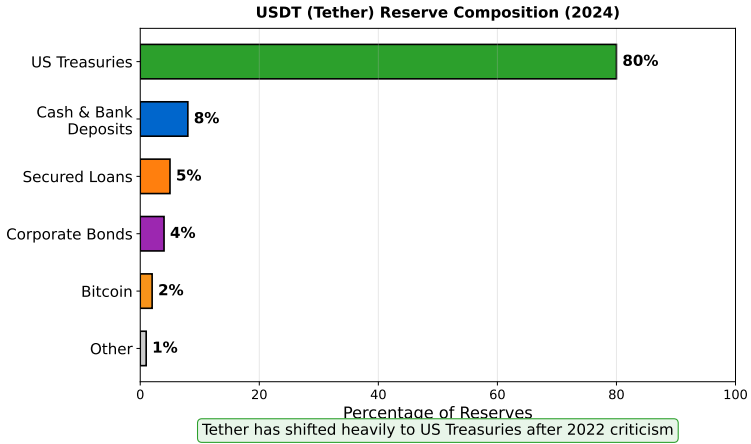
1. User deposits $100 fiat to issuer
2. Issuer mints 100 tokens, holds reserves
3. User can redeem 100 tokens for $100 anytime

Examples:

- **USDC:** Fully backed by cash + T-bills, monthly attestations
- **USDT:** Mixed reserves, largest but less transparent

Advantages: Strong peg, capital efficient, easy to understand
Disadvantages: Centralized, censorship risk, counterparty risk

USDT Reserve Composition



Tether has shifted to 80%+ US Treasuries after 2022 criticism

Fiat-Backed: Key Risks

Centralization: Issuer can freeze addresses (OFAC compliance)
Counterparty Risk: Trust issuer to maintain reserves

Black Swan Example: SVB Collapse (March 2023)

- Circle had $3.3B deposited at Silicon Valley Bank
- Bank failure caused USDC to depeg to $0.87
- Recovered after Fed guarantee on deposits

Lesson: Even "safe" fiat-backed stablecoins have counterparty risk.

Type 2: Crypto-Backed Stablecoins

Mechanism: Backed by crypto collateral (overcollateralized).

How It Works:

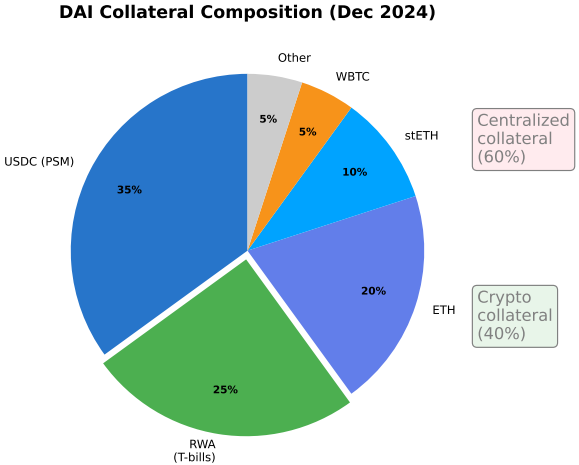
1. User deposits $150 ETH as collateral
2. Protocol mints $100 DAI (150% collateralization)
3. If ETH drops, position liquidated to protect peg

Example: DAI (MakerDAO)

- Largest decentralized stablecoin ($5B)
- Backed by ETH, WBTC, USDC, RWAs
- Governed by MKR token holders

Advantages: Decentralized, transparent, censorship-resistant

DAI Collateral Composition



DAI's decentralization reduced by USDC and RWA backing (centralized collateral)

MakerDAO: DAI Stability Mechanisms

1. **Arbitrage**
   - DAI ¿ $1: Mint DAI, sell for profit
   - DAI ¡ $1: Buy DAI, repay vault for profit
2. **Stability Fee (Interest Rate)**
   - High fee: Reduces supply (repayments)
   - Low fee: Increases supply (more minting)
3. **Peg Stability Module (PSM)**
   - Swap USDC for DAI 1:1 (backstop for large depegs)

Trade-off: PSM improves stability but increases centralization.

Type 3: Algorithmic Stablecoins

Mechanism: Maintain peg through supply adjustments (no/minimal collateral).

How It Works (Theoretically):

- Price ¿ $1: Increase supply (mint, sell)
- Price ¡ $1: Decrease supply (buy, burn)

Examples:

- **Terra UST:** Failed spectacularly (May 2022)
- **FRAX:** Hybrid (partially collateralized)

Theoretical Advantage: Capital efficient, decentralized, scalable
Reality: Most pure algorithmic stablecoins have failed (death spirals).

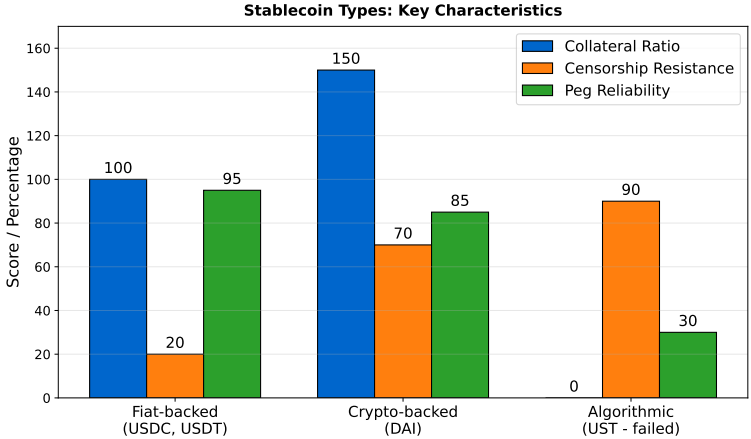
Why Algorithmic Stablecoins Fail

Death Spiral Scenario:

1. Stablecoin depegs below $1
2. Protocol mints sister token to incentivize buying
3. Sister token crashes from dilution
4. Loss of confidence accelerates selling
5. Spiral to zero, total collapse

Root Cause: No intrinsic backing or demand floor.
Lesson: Algorithmic stability relies entirely on confidence. Once lost, irrecoverable.

Stablecoin Types Comparison



Fiat-backed wins on reliability; crypto-backed best censorship resistance

Stablecoin Comparison Table

Type	Example	Backing	Decent.	Efficient
Fiat-backed	USDC	USD (1:1)	No	Yes
Fiat-backed	USDT	Mixed	No	Yes
Crypto-backed	DAI	ETH+USDC	Partial	No
Algorithmic	UST	None	Yes	Yes
Hybrid	FRAX	USDC+FXS	Partial	Partial

Key Insight: No stablecoin achieves all three properties (trilemma).

Regulatory Landscape

US:

- SEC scrutiny (some stablecoins may be securities)
- Bank-like regulation proposed (reserve requirements)

EU (MiCA):

- Stablecoin issuers need authorization
- Reserve and redemption requirements
- Significant stablecoins face additional rules

Impact:

- BUSD shut down (Feb 2023, regulatory pressure)
- Increasing compliance costs for issuers
- May favor large, regulated players (Circle)

Summary

Key Takeaways:

- Stablecoins maintain $1 peg; $140B market cap
- Fiat-backed (USDC, USDT): Stable but centralized
- Crypto-backed (DAI): Decentralized but capital inefficient
- Algorithmic: Capital efficient but unstable (most failed)
- Stablecoin trilemma: Can't have stability + decentralization + efficiency
- DAI's centralization debate: USDC backing vs. pure crypto
- Regulation increasing (MiCA, US proposals)

Next Lecture: Terra/Luna Case Study.

Questions for Reflection

1. Why do algorithmic stablecoins tend to fail during market stress?
2. How does the PSM help DAI maintain its peg? What's the trade-off?
3. Would you trust a stablecoin backed by 80% US Treasuries?
4. How might stablecoin regulation impact DeFi?
5. Is perfect decentralization compatible with price stability?