

Stablecoins and Digital Money

Theme III: Decentralized Finance

Research Question: What stabilization mechanisms work for digital currencies, and what role should central banks play?

PhD Seminar in Digital Finance

Fiat-Backed

USDT, USDC: 1:1 reserve claims.

- Centralized custody
- Counterparty risk
- Regulatory target

Market cap (2024): \$150B+

Crypto-Collateralized

DAI: Overcollateralized ETH.

- Decentralized
- Capital-inefficient (150%+ collateral)
- Liquidation risk

Algorithmic

Stability via supply adjustment.

Terra/UST: Failed catastrophically.

Hybrid

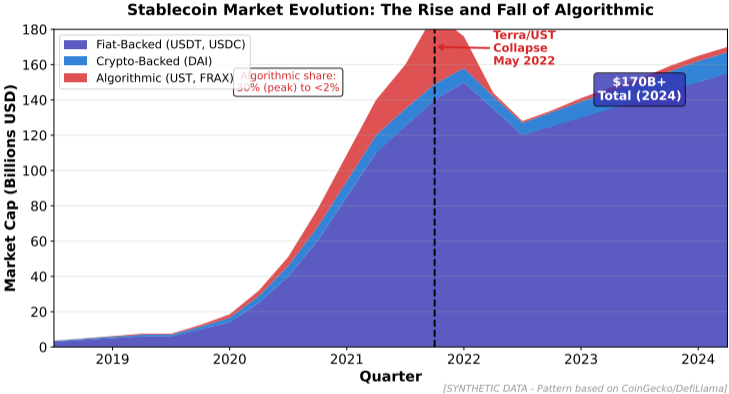
FRAX: Partial collateral + algorithmic.

Market Share (Dec 2024)

Type	Share
Fiat-backed	92%
Crypto-backed	6%
Algorithmic	2%

Fiat-backed dominates post-Terra; algorithmic largely discredited

Stablecoin Market Evolution



Fiat-backed stablecoins grew from \$5B to \$150B+ since 2020; algorithmic collapsed in 2022.

Klages-Mundt & Minca (2020)

Stochastic model of crypto-backed stablecoins.

Key Result

Proposition

Stability requires:

$$\mathbb{E}[\text{Collateral}] > \text{Outstanding debt}$$

with sufficient buffer for volatility.

Failure Mode

Death spiral:

- 1 Collateral price falls
- 2 Liquidations trigger selling
- 3 Price falls further
- 4 Protocol undercollateralized

Algorithmic Instability

Terra/UST collapse (May 2022):

- \$40B market cap wiped out
- Mint/burn mechanism failed under stress
- Reflexive dynamics accelerated collapse

BIS Analysis (2024)

“Algorithmic stablecoins are inherently fragile. Without exogenous collateral, stability depends on confidence – which is self-fulfilling.”

No pure algorithmic stablecoin has survived stress.

Diamond-Dybvig Parallel

Stablecoins face run risk similar to banks:

$$V_{\text{first mover}} > V_{\text{last mover}}$$

BIS Working Paper 1164 (2024)

“Public Information and Stablecoin Runs”

Key Findings

- Public signals coordinate runs
- Social media amplifies contagion
- Reserve transparency: double-edged

Empirical Evidence

March 2023 USDC de-peg:

- Silicon Valley Bank exposure
- USDC dropped to \$0.87
- \$10B redemptions in 48 hours
- Re-pegged after Fed backstop

Contagion Channels

- ① Direct exposure (reserves)
- ② Confidence spillover
- ③ DeFi composability
- ④ Arbitrageur withdrawal

BIS Working Paper 1164 (2024), “Public Information and Stablecoin Runs”

Stablecoin Runs: Game-Theoretic Analysis

Stablecoin as Diamond-Dybvig Bank

	Player 2: HOLD	Player 2: REDEEM
Player 1: HOLD	Both Hold (1, 1) <small>Nash Eq.</small> <i>Full Value</i>	P1 Hold, P2 Redeem (R, 1) <i>P1 loses if run</i>
Player 1: REDEEM	P1 Redeem, P2 Hold (1, R) <i>P2 loses if run</i>	Both Redeem (R, R) <small>Nash Eq.</small> <i>RUN: $R < 1$</i>

Key Insight:
Two Nash equilibria exist.
Public signals can coordinate
run (BIS WP 1164, 2024).

R = Recovery rate
if run occurs
(R < 1 always)

[GAME THEORY MODEL]

Diamond-Dybvig framework explains multiple equilibria in stablecoin runs.

Retail vs. Wholesale

Retail CBDC

- Direct CB liability to public
- Payment efficiency
- Financial inclusion
- Privacy concerns

Wholesale CBDC

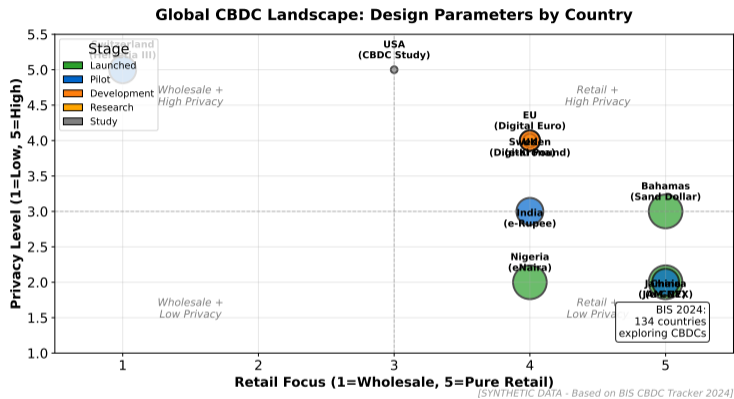
- Bank-to-bank settlement
- Securities tokenization
- Less disruptive

Key Design Parameters

Choice	Trade-off
Interest-bearing?	Policy vs. deposits
Holding limits?	Disintermediation
Privacy level?	Surveillance vs. AML
Offline capability?	Inclusion vs. security

Global Status (BIS 2024)

- 134 countries exploring
- 68 in advanced stages
- 3 fully launched (Bahamas, Jamaica, Nigeria)



134 countries exploring CBDCs; design choices vary on retail/wholesale and privacy dimensions.

ECB Timeline

Phase	Status
Investigation	2021-2023
Preparation	2023-2025
Legislation	2024+
Launch	2028? (TBD)

Key Features (Proposed)

- Offline capability
- Privacy (tiered)
- Holding limits (3,000 EUR?)
- Free basic use

ECB Progress Reports (2024)

June 2024: Technical prototypes tested.

December 2024: Rulebook consultation.

Open Questions

- 1 Bank disintermediation risk
- 2 Privacy vs. AML balance
- 3 Cross-border interoperability
- 4 Merchant acceptance mandate

Swiss Context

SNB: No retail CBDC planned.

Wholesale: Project Helvetia III (2024).

Pilot Overview (2024)

- Real wholesale CBDC on SIX Digital Exchange
- Tokenized bond settlement
- CHF 750M+ in transactions
- 6 tokenized bonds issued

Participants

- SNB (central bank)
- SIX (exchange)
- Commercial banks
- Cantonal issuers

Key Findings

Benefits Demonstrated

- Atomic DvP settlement
- Reduced settlement risk
- Operational efficiency

Challenges Identified

- Legal framework gaps
- Interoperability standards
- Liquidity fragmentation

Next Steps

Extended pilot through 2025. Policy decision pending.

Publishable Research Directions

1 Stablecoin Run Dynamics

- RQ: What triggers stablecoin runs, and can they be predicted?
- Method: Event study of de-pegging episodes, social media analysis
- Gap: Limited systematic analysis of run determinants

2 CBDC and Bank Deposits

- RQ: How much deposit outflow would a CBDC cause?
- Method: Calibrated model or survey experiments
- Gap: Holding limit design needs empirical grounding

3 Singleness of Money

- RQ: Does stablecoin fragmentation violate monetary policy transmission?
- Method: Compare stablecoin vs. bank deposit substitution
- Gap: Novel monetary economics question

Digital money is frontier research area with policy urgency

Mathematical

Model stablecoin as Diamond-Dybvig bank.

- Early redemption: \$1
- Late redemption: \$1 if solvent, \$R if run

Derive conditions for:

- Good equilibrium (no run)
- Bad equilibrium (run)

Due: Week 10 – Diamond-Dybvig intuition applies directly to stablecoins

Empirical

Using on-chain data:

- 1 Track USDC/USDT peg deviations
- 2 Correlate with market events
- 3 Analyze redemption patterns

Data: Dune, CoinGecko API

Research Proposal

Draft 1-page proposal:

- “CBDC Adoption Determinants”
- Cross-country variation
- Institutional factors
- Data sources

Bank run theory provides excellent framework for stablecoin analysis

Core Papers (Read Before Class)

- 1 **BIS Working Paper 1164** (2024). “Public Information and Stablecoin Runs.”
 - Focus: Model setup, empirical analysis
- 2 **Klages-Mundt & Minca** (2020). “While Stability Lasts: A Stochastic Model of Stablecoins.” *FC 2020*.
 - Focus: Stability conditions, failure modes

Supplementary

- ECB Digital Euro Reports (2024): Policy perspective
- SNB Project Helvetia III (2024): Wholesale CBDC
- BIS Working Paper 1270 (2024): “Stablecoins and Safe Asset Prices”

BIS provides excellent policy-relevant stablecoin research