Monetary Economics of Digital Currencies

L02: Money Theory Meets Cryptocurrency

Economics of Digital Finance

BSc Course

Lesson Overview

Today's Topics

1. Functions of money revisited
2. Quantity theory in digital age
3. Cryptocurrencies as money
4. Stablecoin economics
5. Currency substitution

Learning Objectives

- Apply monetary theory to digital currencies
- Assess crypto against money functions
- Analyze stablecoin stability mechanisms
- Understand Gresham's Law implications

Monetary economics provides rigorous framework for evaluating digital currencies

Functions of Money: Economic Analysis

Medium of Exchange
Economic rationale:

- Eliminates barter inefficiency
- Reduces search and matching costs
- Transaction cost $= c_b - c_m$ where $c_m \ll c_b$

Requirements:

- Acceptability (network effect)
- Divisibility
- Portability

Unit of Account
Economic rationale:

- Reduces cognitive costs
- With n goods: $\frac{n(n-1)}{2} \to n-1$ prices
- Enables economic calculation

Store of Value
Requirements:

- Stable purchasing power
- Low volatility: $\sigma_{\text{money}} < \sigma_{\text{goods}}$
- Inflation protection

Trade-offs exist: a good medium of exchange may not be ideal store of value

Quantity Theory of Money in Digital Age

Classical Equation of Exchange

$$MV = PY$$

- M = Money supply
- V = Velocity of circulation
- P = Price level
- Y = Real output

Implications

- If V stable: $\Delta M \rightarrow \Delta P$
- Seigniorage = $\frac{\dot{M}}{P}$
- Inflation tax on money holders

Digital Currency Complications

Bitcoin example:

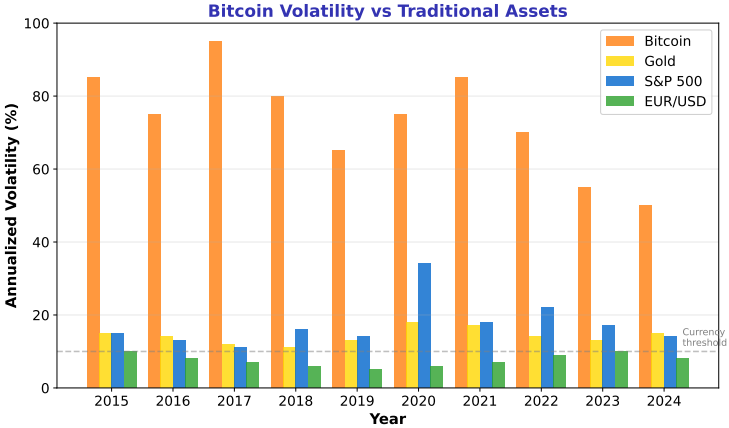
- M fixed at 21 million (deflationary)
- V highly volatile and hard to measure
- Which P? (Crypto priced in fiat)

Velocity Puzzle

- Traditional money: $V \approx 5 - 7$
- Bitcoin: V varies 2-20+
- Stablecoins: Very high turnover

Fixed supply creates deflationary pressure; incompatible with MoE function

Bitcoin as Money: The Volatility Problem



Bitcoin's 50-85% volatility vs EUR/USD's 5-10% makes it unsuitable as unit of account

Cryptocurrencies as Money: Economic Assessment

Medium of Exchange: Grade C-

- Limited merchant acceptance
- High transaction costs (at times)
- 10-60 min confirmation times
- Scalability trilemma

Unit of Account: Grade F

- Extreme volatility
- "Menu cost" of repricing
- No contracts denominated in BTC

Store of Value: Grade C

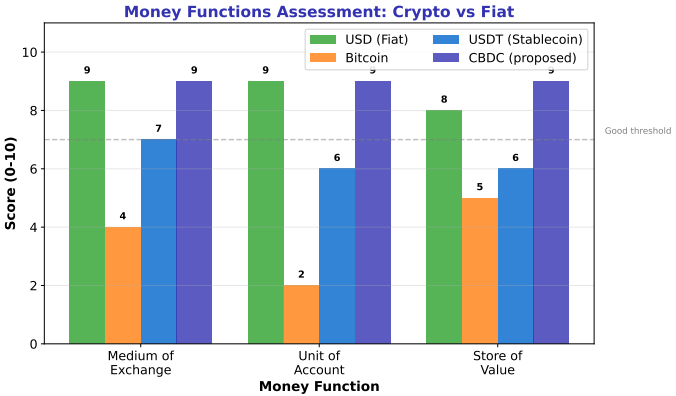
- Long-term appreciation (but volatile)
- Digital gold narrative
- Correlation with risk assets

Yermack (2015) Conclusion
"Bitcoin behaves more like a speculative investment than a currency"

- Low correlation with major currencies
- High correlation with tech stocks
- Driven by speculation, not trade

Bitcoin fails key money functions; better characterized as speculative asset

Money Functions: Comparative Assessment



CBDCs designed to achieve high scores across all functions; stablecoins compromise

Stablecoin Economics: Design and Mechanisms

Types by Collateral

1. Fiat-backed (USDT, USDC)

- 1:1 reserve in bank accounts
- Trust in issuer and audits
- Redemption guarantee

2. Crypto-backed (DAI)

- Over-collateralized (150%+)
- Smart contract enforcement
- Liquidation mechanisms

3. Algorithmic (failed: UST)

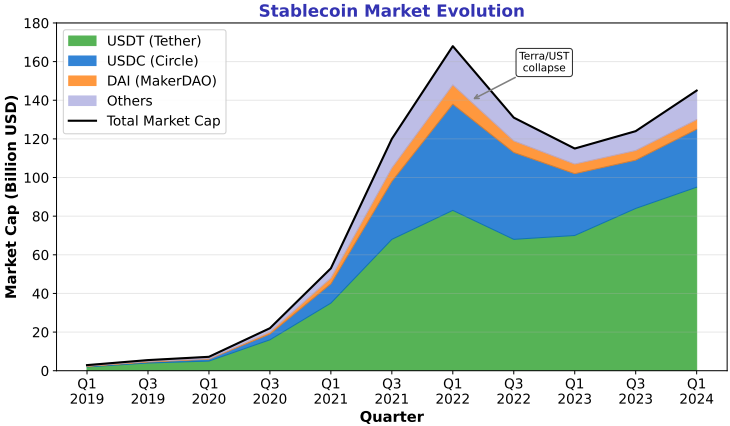
- No collateral backing
- Arbitrage-based stability
- Prone to death spirals

Economic Trade-offs

- Capital efficiency vs. safety
- Centralization vs. transparency
- Scalability vs. collateral needs

Terra/UST collapse (2022) showed algorithmic designs are inherently fragile

Stablecoin Market Evolution



Market concentrated in USDT; Terra collapse caused $40B+ losses in May 2022

Gresham's Law and Currency Substitution

Gresham's Law

"Bad money drives out good"

- When two currencies circulate at fixed rate
- Undervalued currency hoarded
- Overvalued currency spent

Digital Application

- Bitcoin hoarded ("HODL")
- Stablecoins used for transactions
- Self-fulfilling: reduces velocity

Currency Substitution

Dollarization analogy:

- Weak local currency replaced
- "Crypto-ization" in high-inflation countries
- Argentina, Venezuela, Turkey cases

Economic Consequences

- Loss of monetary policy autonomy
- Seigniorage transfer abroad
- Financial stability risks

Currency competition creates both opportunities and risks for monetary systems

Money Demand for Digital Currencies

Traditional Money Demand

$$M^d/P = L(Y, i)$$

- $L_Y > 0$: Transaction motive
- $L_i < 0$: Opportunity cost
- Baumol-Tobin inventory model

Portfolio Approach

$$M^d = f(W, r_m, r_b, \pi^e, \sigma)$$

- Wealth effect
- Relative returns
- Inflation expectations

Crypto Money Demand

Additional factors:

- Speculative motive dominates
- Network effects matter
- Regulatory risk premium

Empirical Challenges

- What is "crypto money supply"?
- How to measure crypto velocity?
- Multiple exchanges, prices

Traditional money demand models require significant adaptation for crypto analysis

Seigniorage in Digital Currency Systems

Traditional Seigniorage

$$S = \frac{\dot{M}}{P} = \frac{\Delta M}{M} \cdot \frac{M}{P}$$

- Revenue from money creation
- Accrues to central bank/government
- Inflation tax on money holders

Bitcoin "Seigniorage"

- Block rewards to miners
- Declining over time (halvings)
- Dissipated in mining costs

Stablecoin Seigniorage

- Interest on reserves kept by issuer
- Tether earns billions annually
- Users bear opportunity cost

Policy Implications

- Who captures monetary rents?
- Private vs. public money trade-offs
- CBDC: Returns seigniorage to public

Stablecoin issuers capture seigniorage that would otherwise accrue to governments

Monetary Policy Implications

Transmission Mechanism Risks

- Crypto reduces money multiplier
- Interest rate channel weakened
- Bank reserves less relevant

Financial Stability

- Pro-cyclical crypto prices
- Contagion from crypto crashes
- Interconnection with TradFi

Central Bank Responses

- CBDC development (defensive)
- Stablecoin regulation
- Reserve requirements for crypto banks

Long-term Questions

- Can crypto coexist with fiat?
- Optimal regulatory perimeter?
- International coordination needs?

Central banks view crypto growth as potential challenge to monetary sovereignty

Key Takeaways

Main Conclusions

1. Bitcoin fails core money functions due to volatility
2. Stablecoins are "money-like" but carry risks
3. Quantity theory applies but needs adaptation
4. Seigniorage distribution is policy issue

Economic Framework

- Money functions: MoE, UoA, SoV
- Quantity theory: $MV = PY$
- Gresham's Law and hoarding
- Currency substitution dynamics

Core Insight

Monetary economics reveals why cryptocurrencies struggle as money: they optimize for speculation, not monetary functions. Stablecoins address some issues but create new ones.

Next lesson: Central Bank Digital Currencies (CBDCs)

Further Reading

Academic Papers

- Yermack (2015): "Is Bitcoin a Real Currency?"
- Gorton & Zhang (2023): "Taming Wildcat Stablecoins"
- Brunnermeier et al. (2019): "The Digitalization of Money"

Policy Analysis

- BIS (2022): "The Future Monetary System"
- IMF (2023): "Elements of Effective Crypto Policies"
- ECB (2022): "Stablecoin Assessment"

All readings available on course platform