

Stablecoins

Ganesh Viswanath-Natraj

HEC Paris

February 6, 2023

Roadmap of Talk

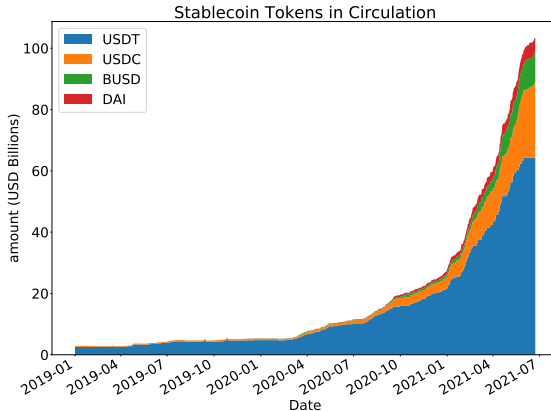
1. Stablecoin arbitrage design
 - Centralized (Tether)
 - Decentralized (DAI)
 - Algorithmic (TerraUSD)
2. Risk and Regulations of Stablecoins
 - Custodial risk, run-risk and systemic Risk
 - Proof of Reserves and audits
 - Macroprudential policies
3. Future of Stablecoins
 - Remittances and cross-border payments
 - On-chain FX
 - Global stablecoins

Stablecoin Arbitrage Design

Stablecoin systems and properties

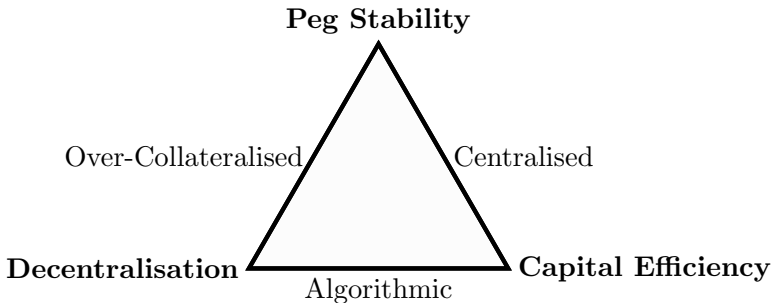
- Stablecoins operate on the blockchain and are pegged at parity to the US dollar.
- Two systems of collateral: **National-Currency backed** or **Cryptocurrency backed**, with the former predominating.
- **Vehicle currency**: They serve as vehicle currencies for trading crypto assets generally due to a reduction in intermediation costs by operating on the blockchain
- **Use in DeFi applications**: Stablecoins used as vehicle on Uniswap (DEX) and DeFi lending protocols to earn high savings rates (eg. Compound)
- **Alternative payments**: Remittance and cross-border payments. Residents in developing countries may use stablecoins to evade capital controls/high inflation.

Stablecoin Ecosystem



Stablecoin Trilemma

Stablecoin designs typically meet two of the following three objectives.



Stablecoin Designs

1. Centralised:

- Most common stablecoin type, lead by Tether. Typically backed by dollar reserves, although not all dollar reserves are cash or cash-equivalent.
- Tether's balance sheet includes commercial paper and less liquid assets.

2. Decentralised (over-collateralised):

- Lead by MakerDAO's DAI. Allows individuals to issue DAI tokens through over-collateralised positions in which they deposit cryptocurrency collateral (typically ETH).
- Drawback is that it is less capital efficient.

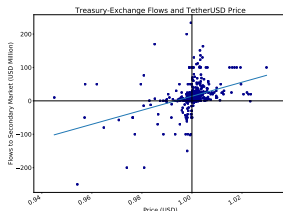
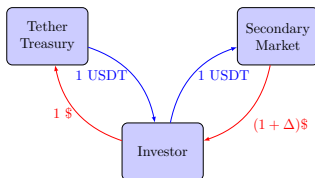
3. Algorithmic:

- Stablecoins that typically have zero collateral.
- While it is capital efficient, it has the drawback that it is prone to speculative attacks and can trade at large discounts.

Research Findings: Centralised Stablecoins

Reading: Lyons and Viswanath-Natraj 2023

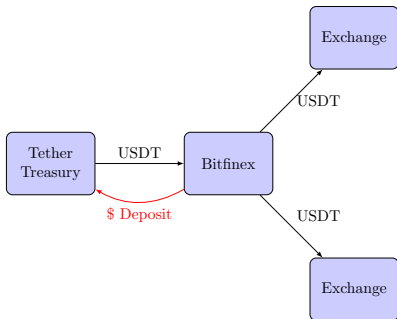
- **Arbitrage mechanism:** Stability of the Tether peg is maintained through arbitrageurs that exploit differences between the primary and secondary market price.
- If the secondary market price of Tether is above one dollar, an investor can buy Tether from the Treasury at a one-for-one rate, and sell Tether at the prevailing market rate to profit, resulting in a flow of Tether from the Treasury to the secondary market.



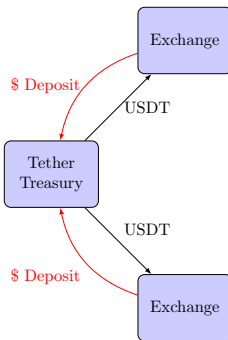
Research Findings: Centralised Stablecoins

- Decentralisation of issuance is critical to the arbitrage design.
- Initially, Bitfinex has monopoly creation of Tether: issuing 1 dollar deposit and receiving 1 Tether token in return.
- Migration to Ethereum Blockchain led to increased investor access

Omni



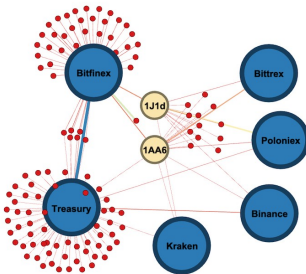
Ethereum



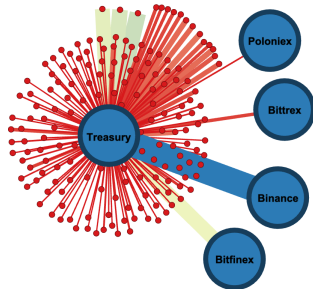
Research Findings: Centralised Stablecoins

Introduction of Tether to Ethereum Blockchain in April 2019 greatly increased access of investors to directly deposit dollars with the Treasury. Increased investor access \Rightarrow increase in peg efficiency.

Omni

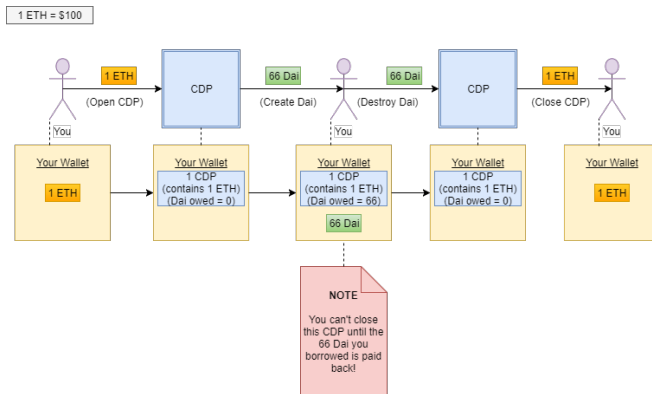


Ethereum



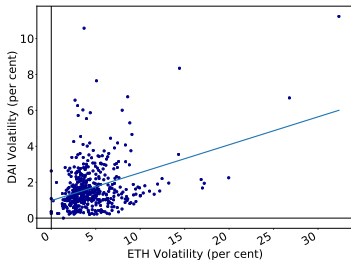
Research Findings: DAI (Decentralised Stablecoin)

- Users generate Dai by depositing collateral assets (eg. ETH) into Maker Vaults within the Maker Protocol.
- User positions are over-collateralised. All system parameters are enforced through smart contracts.



Research Findings: DAI (Decentralised Stablecoin)

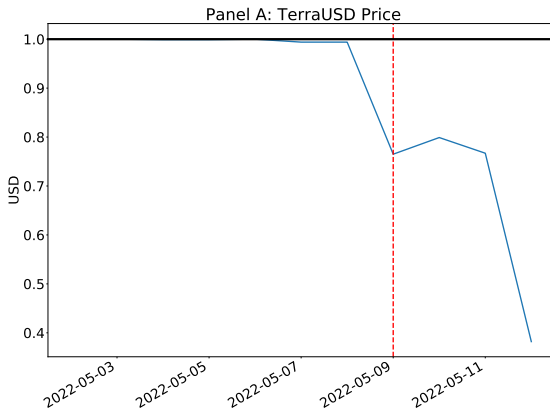
Reading: [Kozhan and Viswanath-Natraj 2021](#)



- risky collateral acts as a **limit to arbitrage**
- stable collateral increases ability of arbitrageurs to stabilize the peg.

Case Study: Algorithmic Stablecoin TerraUSD collapse

- Algorithmic stablecoins typically have little or no collateral.
- Vulnerable to speculative attacks and can trade at large discounts.

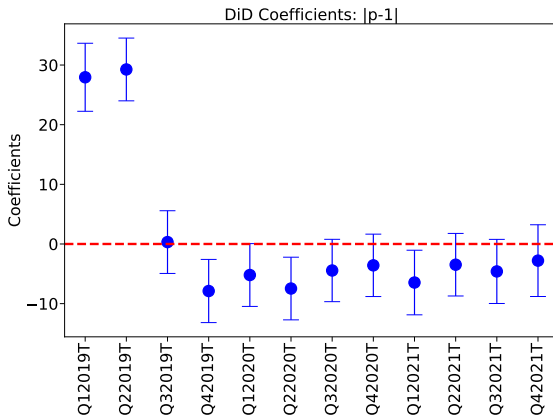


Arbitrage design: key lessons

- **Access to primary market/stablecoin issuer** ↑ **peg efficiency**: To take advantage of pricing discrepancies between primary and secondary markets, stablecoins require sufficient arbitrage capital among participants.
- **Stable collateral** ↑ **peg efficiency**: Introducing safe collateral types makes it easier for arbitrageurs to execute price-stabilising trades.
- **Exogenous and endogenous collateral**: It is important for a stablecoin to be backed by exogenous collateral for stability. Adverse feedback loops can occur if the stablecoin and collateral backing belong to the same blockchain.

Lesson #1: \uparrow access to primary market stabilizes the peg

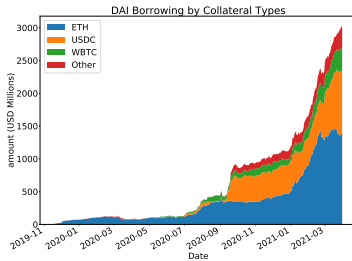
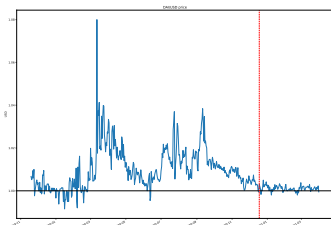
Relative to a control group, we find an increase in peg efficiency of Tether (lower absolute deviations and volatility) following increased access to the stablecoin issuer.



Lesson #2: Access to stable collateral \uparrow peg efficiency

With reference to the DAI stablecoin:

1. USDC Stable collateral type introduced in March 2020
2. Peg Stability Module (PSM) in December 2020 allows users to swap DAI with the USDC stablecoin at a 1:1 rate without needing to create a vault and deposit collateral.

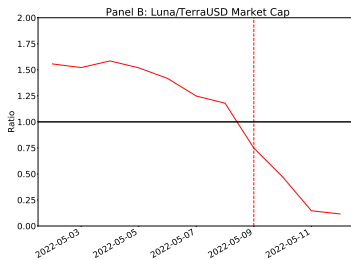
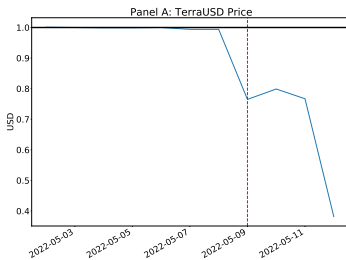


Lesson #3: Exogenous vs Endogenous collateral

- One crucial difference between algorithmic stablecoins like TerraUSD and decentralized stablecoins like DAI is the choice of collateral.
- DAI has **exogenous collateral** (eg. ETH), and in [Kozhan and Viswanath-Natraj 2021](#) we observe a negative co-movement between ETH prices and the peg and rationalise it through a story of leveraged speculators.
- Algorithmic stablecoins like TerraUSD has **endogenous collateral**: the TerraUSD token is backed by LUNA token which is native to its blockchain.
- Equilibria where TerraUSD and Luna tokens jointly collapse can occur, resulting in a breakdown of the arbitrage mechanism.

Lesson #3: Exogenous vs Endogenous collateral

TerraUSD price and ratio of value of TerraLuna to TerraUSD in May 2022



Risk and Regulations of Stablecoins

Stablecoin Risks

- **Custodial Risk:** Centralised issuer absconding with funds.
- **Run-risk:** Redemptions exceed liquid cash reserves.
- **Systemic risk** Stablecoins used in crypto derivatives increase risk exposures of financial intermediaries.
- **Payments risk:** Stablecoin devaluations can trigger insolvency of firms and consumers with savings/payments.

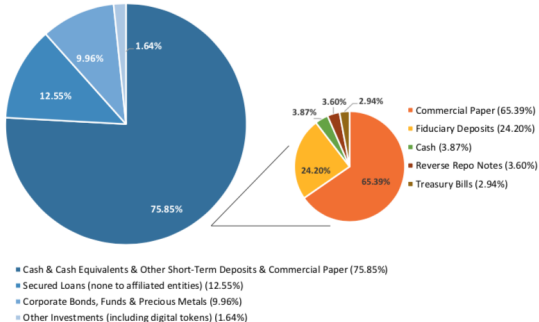
I will now focus on some empirical evidence on run-risk and systemic risk.

Run risk: Illiquid assets

2021 Q1 Quarterly statement released by Tether Ltd on breakdown of reserves. Only 75 % backed by cash or cash equivalents. Since then have scaled down their commercial paper to nearly 0!



Reserves Breakdown at March 31, 2021



Run-risk: Measures

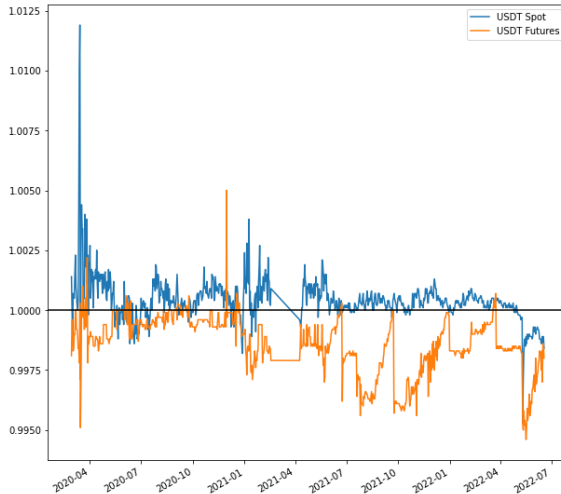
- In [M. Nguyen and Viswanath-Natraj 2022](#), we obtain an expression for the probability of run-risk.
- This can be estimated based on observable spot and futures rates s_t and f_t , and ρ measures the half-life of deviations.

$$\mathcal{P}_t = 1 - \frac{f_t - \rho^h s_t}{1 - \rho^h}$$

- The probability of a stablecoin run is decreasing in the futures rate and increasing in the spot rate. It is inversely related to the futures-spot basis $f_t - s_t$.
- As the horizon of the futures contract $h \rightarrow \infty$, the equation simplifies to $\mathcal{P} = 1 - f_t$.

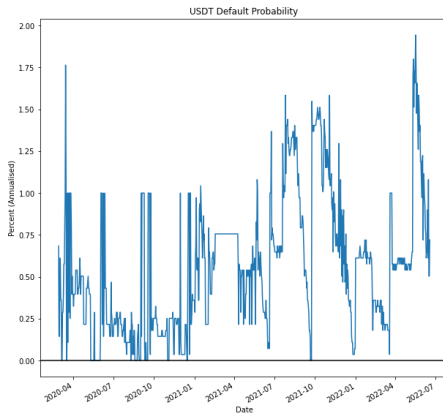
Run-risk: Measures

- Futures prices on USDT/USD systematically trade at a discount, evidence of devaluation risk!



Run-risk: Measures

- We estimate probability of default to average between 0 to 2 per cent (annualized).
- Factors that increase probability of default: increased concentration of Tether addresses, and an increase in systemic risk (bitcoin volatility).



Systemic risk

stablecoins → real economy

- [Barthelemy, Gardin, and B. Nguyen 2021](#) and [Kim 2022](#) find evidence that stablecoin issuance of Tether and USDC drive CP rates.
- Stablecoin issuer can become a large enough player in financial markets, increasing exposure of real economy to stablecoin shocks.

real economy → stablecoins

- There is less evidence of pass-through from the real economy to stablecoins.
- For example, do policy announcements affect feedback?
- In [M. Nguyen and Viswanath-Natraj 2022](#), we find no evidence of systematic effect of Fed monetary announcements on stablecoin prices.

Stablecoin Regulations

- Capital requirements and audits to ensure full collateralisation.
- Insurance through a deposit guarantee scheme.
- Liquidity support by the central bank to enable the bank to meet redemptions.
- Macroprudential regulation to limit risk exposures of banking sector, households and firms in crypto.

Chainlink Proof of Reserve

Reading: <https://chain.link/proof-of-reserve>

- A potential solution to minimising run-risk is real-time audits through a proof-of-reserve system. Examples include wrapped Bitcoin and TrueUSD.
- Third party verification of the stablecoin-issuer assets at a block-time frequency can mitigate run-risks and custodial risk of an issuer absconding with funds off-chain.
- By publishing real-time audit reports, Chainlink can prevent systemic failures in DeFi applications and protecting users from unexpected fractional reserve activity.

Capital Requirements

- Capital requirements can theoretically increase peg stability [Li and Mayer 2022](#)
- [Liao 2022](#) suggests using a liquidity coverage ratio (LCR) similar to Basel 3 liquidity coverage ratio, which measures the ratio of high quality assets to total deposit outflows over the last 30 days.
- Basel 3 requires this ratio to be greater than 1, in practice stablecoins like USDC have LCR in the 2-8 range.
- Banking legislation can outlaw algorithmic stablecoins or coins backed by **endogenous collateral**, <https://decrypt.co/110208/stablecoin-law-ban-terra-luna>.

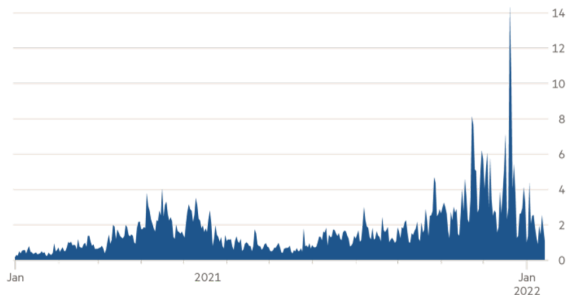
Future of Stablecoins

Cross-border payments

- Stablecoins can be increasingly used in cross-border payments, by reducing remittance costs and as a hedge against high inflation and macroeconomic uncertainty.
- Increased demand for USDT during Turkish Lira crisis as high inflation leads to a devaluation of the Lira (Source: FT)

Stablecoin tether attracts billions of lira each month

Volume of Turkish lira traded across major crypto exchanges in tether market (bn)

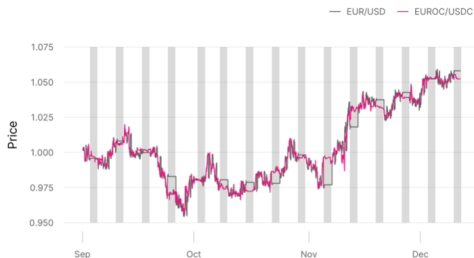


Source: Elliptic
© FT

On-chain FX

Reading: [Adams et al. 2023](#)

- On-chain Circle products EURC and USDC are stablecoins pegging the Euro and Dollar respectively.
- Find stablecoin EURC/USDC is within ± 5 basis points of EUR/USD.
- These pairs have additional advantage of 24 hour/7 days liquidity and have alternative market design with automated market makers (AMMs) and smart contract functionality to execute trades.



Libra-Diem project and global stablecoins

The potential emergence of global stablecoins like Facebook's now defunct Libra/Diem introduces a new set of exciting research questions:



- How does Libra/Diem affect financial stability through competing as an alternative to sovereign currency?
- Is Libra/Diem adopted by the unbanked population? What are welfare benefits of increased access to digital currency?

Conclusions

- **Arbitrage design:** Access to primary market for arbitrage traders, the importance of stable and exogenous collateral for peg efficiency.
- **Risk and regulation:** run-risk and systemic risk can be minimised through appropriate real-time audits and increased capital requirements.
- **Future of stablecoins:** Potential for widespread adoption by countries with weak economic fundamentals, low financial inclusion, and by FX markets that can tap into DeFi markets for improved functionality.

Thank You!

References I

- Adams, Austin et al. (2023). "On-Chain Foreign Exchange and Cross-Border Payments". In: *Available at SSRN 4328948*.
- Barthelemy, Jean, Paul Gardin, and Benoit Nguyen (2021). "Stablecoins and the Financing of the Real Economy". In: *Available at SSRN 3973538*.
- Kim, Sang Rae (2022). "How the cryptocurrency market is connected to the financial market". In: *Available at SSRN 4106815*.
- Kozhan, Roman and Ganesh Viswanath-Natraj (2021). "Decentralized stablecoins and collateral risk". In: *WBS Finance Group Research Paper*.
- Li, Ye and Simon Mayer (2022). "Money creation in decentralized finance: A dynamic model of stablecoin and crypto shadow banking". In: *Fisher College of Business Working Paper 2020-03*, p. 030.

References II

- Liao, Gordon (2022). “Macroprudential Considerations for Tokenized Cash”. In: *Available at SSRN*.
- Lyons, Richard K and Ganesh Viswanath-Natraj (2023). “What keeps stablecoins stable?” In: *Journal of International Money and Finance* 131, p. 102777.
- Nguyen, My and Ganesh Viswanath-Natraj (2022). “Stablecoin Devaluation Risk”. In: *Working paper*.