What Keeps Stablecoins Stable?

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NY Federal Reserve Conference, September 23, 2022
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.
This paper: Centralized (dollar-backed) stablecoins, led by Tether.
Considerable debate on what best describes the design and function of stablecoins:

1. Fixed exchange rates?
2. ETFs?
3. Money market funds?
4. Private bank notes?
5. Narrow or fractional reserve bank?

**Research Questions:**

1. How is the peg maintained given the absence of a central bank?
2. What design elements can increase the stability of the peg?

**Contribution:** Posit arbitrage mechanism in which issuance is decentralized through private investors.

**Arbitrage Design:** Efficiency reforms of (i) Migration to Ethereum blockchain and (ii) Independence of Tether treasury from Bitfinex increase peg stability by increasing access to arbitrage trades.
Data Sources

**Blockchain explorers**
- Blockchains on which Tether is issued are Omni, Ethereum and Tron during our sample period (04/2017-03/2020).
- Stock of Tether in circulation is held by exchanges or the Treasury.

\[ Q_{\text{Agg},t} = Q_{\text{EX},t} + Q_{\text{Treasury},t} \]

- We use this to construct net flows from the Tether treasury to the secondary market.

\[ \Delta Q_{\text{agg},t} = \text{Flow}_{T\rightarrow EX} + \Delta Q_{T,t} \]

**Cryptocurrency exchange prices**
- Use coinapi to obtain secondary market prices for USDT/USD trading on exchanges Kraken, Bittrex and Bitfinex.
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 II

- Introduction of Tether to Ethereum Blockchain in April 2019
- Motivation: increased speed, efficiency of deposit process, network of ERC20 tokens and investors.
- Greatly increased access of investors to directly deposit dollars with the Treasury.

What Keeps Stablecoins Stable?
Empirically, we observe a two-sided distribution, premiums due to safety during crypto crashes, and discounts due to collateral concerns. Increase in peg efficiency since Tether’s 2019 migration to the Ethereum blockchain.
Empirical Tests

We provide the following tests of the arbitrage mechanism:

1. **Decentralization of Issuance**: Variance decomposition to show that supply-based distribution declines following migration to the Ethereum blockchain.

2. **Decentralization and peg efficiency**: Did increased investor access to arbitrage trading lead to increased efficiency of the peg?

3. **Arbitrage Flow**: Does $Flow_{T \rightarrow EX}$ have a stabilizing effect on peg, with positive flows associated with a narrowing of peg price deviations?

4. **Arbitrage Profits**: Matching high-frequency timestamp of deposits and redemptions with secondary market prices, are systematic profits earned by arbitrageurs on the Omni and Ethereum Blockchains?
1. Decentralization of Issuance

- To quantify the independence of Tether from Bitfinex, we conduct a simple variance decomposition of Tether flows

\[
\text{var}(\Delta Q_t^i) = \text{cov}(\Delta Q_T^i, \Delta Q_t^i) + \text{cov}(\Delta Q_{Bitfinex}^i, \Delta Q_t^i) + \\
\text{cov}(\Delta Q_{Other}^i, \Delta Q_t^i)
\]

- The decomposition gives us a useful proxy for demand versus supply changes in issuance.

- On the Omni blockchain, supply changes dominate: the Treasury and Bitfinex account for 86.3 per cent of flows.

- On the Ethereum blockchain, demand changes dominate: the variance of flows explained by other investors rises to 67.2 per cent.
2. Decentralization and Peg Efficiency

- We divide periods into pre (04/17-03/19) and post (04/19-04/20):
- We find increased efficiency of the peg (deviations in BP).

<table>
<thead>
<tr>
<th>Period</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Half-Life (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Ethereum Blockchain</td>
<td>-28.2</td>
<td>97.2</td>
<td>-505</td>
<td>298</td>
<td>6.5</td>
</tr>
<tr>
<td>Post Ethereum Blockchain</td>
<td>-0.9</td>
<td>47.2</td>
<td>-298</td>
<td>119</td>
<td>3.3</td>
</tr>
</tbody>
</table>

- We conduct a series of robustness tests on the structural break in peg stability.
- We exploit the migration to the Ethereum blockchain as a plausibly exogenous variation in increased access to Treasury.
- We use a Difference-in-Difference framework comparing peg efficiency of Tether to other stablecoins that did not undergo a migration.
3. Arbitrage Flow

\[ P_{t+h} - P_{t-1} = \alpha + \beta_h \text{Flow}_{T \rightarrow EX} + \text{controls}_t \quad h = 1, 2, \ldots \]

- Trace effect of \( \text{Flow}_{T \rightarrow EX} \) on Tether/USD price across horizon \( h \) (controls include feedback effects from prices and flows).
- **Post Ethereum blockchain**: A 1 std deviation change (7.5 million USD) flows leads to a 5 basis point change in Tether price (supply up, price down).
4. Arbitrage Profits

- We compute arbitrage spreads as the difference between the primary and secondary market price net of transaction costs.
- **Democratization of arbitrage access**: Smaller arbitrage profits and deposit size on Ethereum blockchain relative to Omni.
- Arbitraged spreads – matching trades with deviations – shrink from an average of 69 basis points on Omni to 27 basis points on Ethereum.

![Arbitrage Spread: Deposits](chart.png)
Other applications: DAI

- DAI is a decentralized stablecoin backed by cryptocurrency collateral (typically ETH).
- **Problem**: Risky collateral leads to an unstable peg, lack of a primary-secondary market arbitrage mechanism!
- **Solution**: Peg stability module in December 2020, allows investors to swap the USDC stablecoin for DAI at a 1:1 rate.
Other applications: TerraUSD

- **TerraUSD** is an algorithmic stablecoin backed by Luna, a native token of the Terra blockchain.
- **Problem**: A downward spiral of Luna and TerraUSD prices in May 2022 meant there was insufficient Luna to redeem TerraUSD at par.
- **Solution**: Legislation to ban stablecoins that are unbacked or backed by collateral native to its blockchain.

![TerraUSD Price](image1)

![Luna/TerraUSD Market Cap](image2)

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Policy Implications

Full collateralization and liquid reserves

- Increased regulations for stablecoin to be fully backed by sufficiently liquid reserves, or have a backstop such as insurance provided by a central bank.
- Proof of reserve systems and real-time audits can increase transparency and reduce risk of stablecoin runs, when redemptions exceed liquid reserves.

Increasing access to primary market

- Regulatory frameworks should increase access to arbitrage trades, by extending the set of participants that can deposit/withdraw with the issuer when the capital of existing participants is low.
Concluding Remarks

How is the peg maintained given the absence of a central bank?

- In contrast to central bank reserve management, peg retention works through the actions of arbitrageurs.

What design elements can increase the stability of the peg?

- Migration of Tether from the Omni to Ethereum blockchain in 2019 and decentralization of issuance led to an increase in peg efficiency.
- Find additional support for other applications like the DAI peg stability module.
- Arbitrage mechanism works conditional on full collateralization with liquid reserves and efficient access to the primary market.
Thank You