DeFi-ying the Fed?

Monetary Policy Transmission to DeFi Rates

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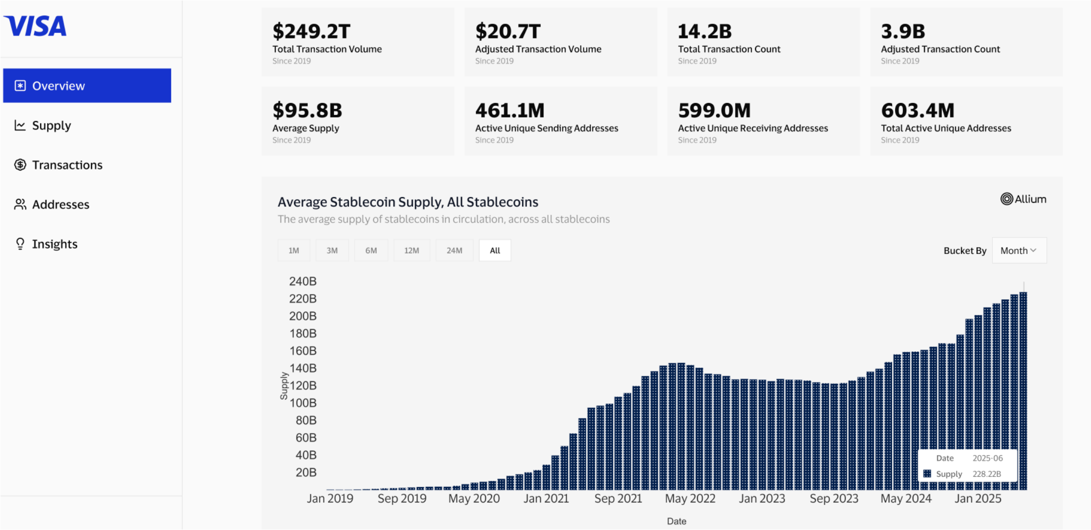
The Rise of Stablecoins



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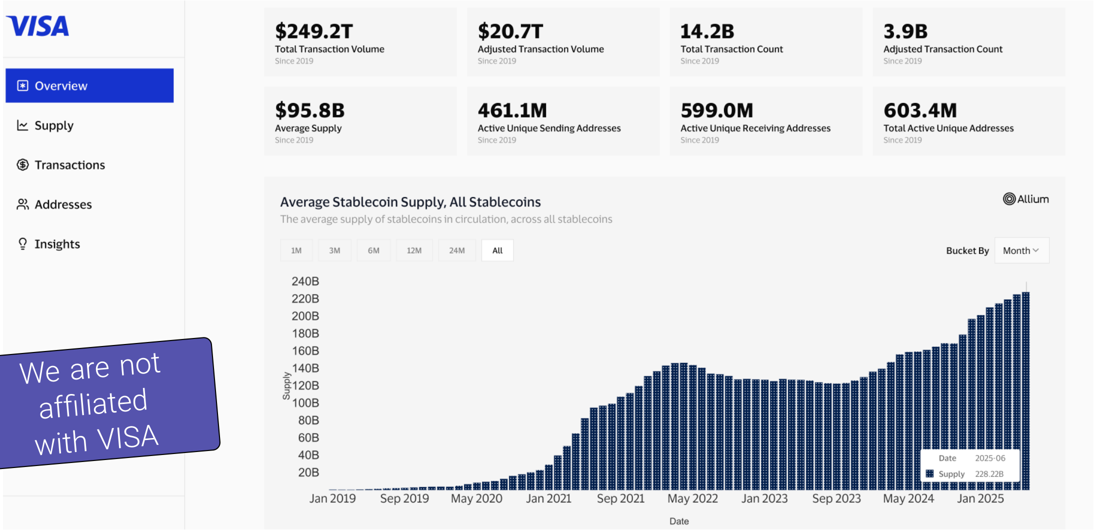

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Monetary Policy Transmission

DeFi Rates

- Most stablecoins do not pay interest natively
- But can be borrowed and lent in DeFi lending protocols (AAVE, Compound...)
- Interest rates earned on depositing USD-pegged stablecoins are widely different from US risk-free rates

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- Monetary policy effectiveness depends on its transmission to multiple rates
- But what about transmission to DeFi rates?

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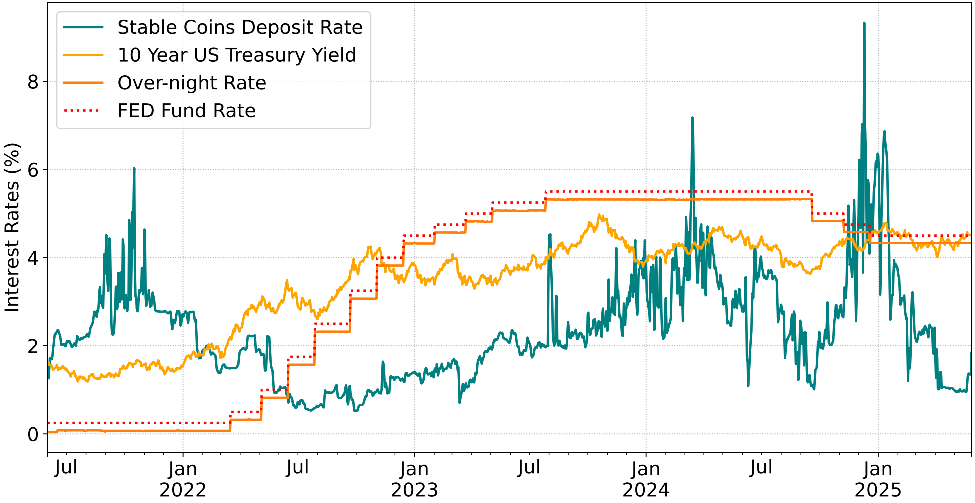
This paper: Analyze the pass-through of FED's monetary policy to DeFi rates

The Recent Fed's Hiking Cycle



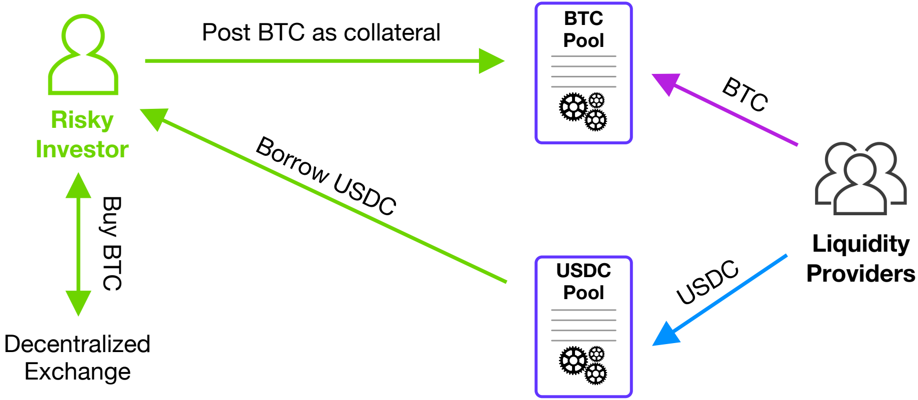
- **Liquidity Providers** (**LPs**) deposit stablecoins in liquidity pools (smart contracts)
- Other users can borrow those, posting a crypto collateral (ETH, BTC, ...)
- Loans are **overcollateralized**, with haircuts around 20% (depending on the volatility of the collateral asset)
- Each borrower has a health ratio, defined as

$$HF = \frac{\text{Collateral Value} \times \text{Liquidation Threshold}}{\text{Borrowed Value}}$$

- If $HF < 1$, the collateral assets are eligible for liquidation

Decentralized Leverage

- These overcollateralized loans are mainly used to take leveraged position on crypto assets (BTC, ETH, ...)



DeFi Rates

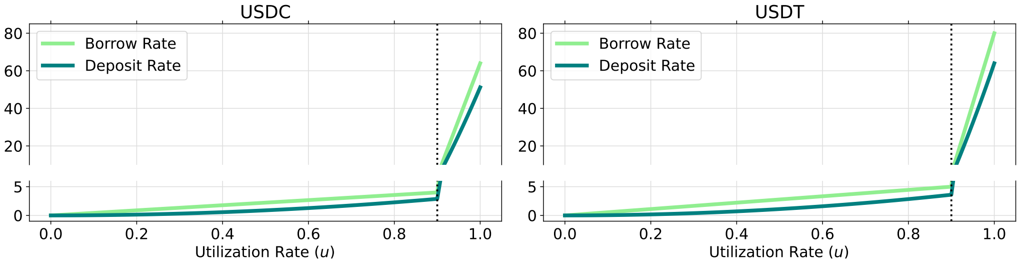
DeFi lending rates are set automatically, based on the **utilization rate**

$$u = B/S = \text{Borrowed amount}/\text{Supplied amount}$$

Borrow Rate:

$$f(u) = \begin{cases} \alpha + \beta u & \text{if } u < \bar{u} \\ \alpha + \beta \bar{u} + \beta' (u - \bar{u}) & \text{if } u \geq \bar{u} \end{cases}$$

Deposit Rate: $u \cdot f(u)$



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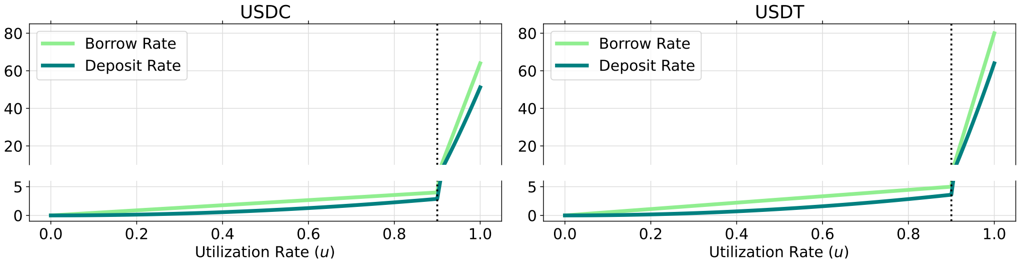
Deposit Rate: $u \cdot f(u)$

Usually, $\alpha = 0$ and
$\beta = 0.05$
$\beta' = 75$



Methodology

Equilibrium Model

- We build a simple model to understand monetary policy transmission
    - **Liquidity providers:** Invest in the risk-free asset and lend stablecoins
    - **Risky investors:** take leverage position on crypto-assets by borrowing stablecoins

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Empirics

- Use a rich dataset of DeFi lending transactions (using our Ethereum node)
  - Estimate the relationship between risk-free rates and DeFi rates, controlling for relevant confounding factors
  - Test additional empirical implications of our model on the data

Data

- Blockchain data for 3 stablecoins (USDT, USDC, and DAI) on Ethereum
- Transactions are gathered from the AAVE v2 Lending Pool and the AAVE v3 Pool smart contracts
  (i) **Deposit** and **Withdraw** transactions, which we use to reconstruct the historical levels of liquidity deposited in the protocol for each stablecoin
  (ii) **Borrow** and **Repay** transactions, to reproduce the historical outstanding borrowed amounts by stablecoin
- We have more than 2.5M transactions, from May 2021 to May 2025
- Prices of ETH and BTC call and put options from *tardis.dev*

Liquidation Risk

- When the Health Factor $HF < 1$, the collateral assets are eligible for liquidation
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- Third party agents (liquidators) can repay the loan
- In exchange for that, they get the collateral at a 5% discount
- However, if the collateral price drops rapidly, lenders may suffer losses
- We follow Prat et al. (2023) and construct a measure of liquidation risk:

$$\mathscr{L} = \mathbb{E}[\text{Loss}] = \mathbb{P}(R < -10\%) \times (\text{Bad Loans} \mid R < -10\%)$$

- We use data from the crypto-options market to estimate the probability of a 10% crash in BTC or ETH, and the pool characteristics to estimate the resulting percentage of bad loans

A Simple Model of DeFi Lending

Environment

- Two dates: $t \in \{0, 1\}$
- Two types of (price-taker) investors: liquidity providers (LPs) and risky investors
- Two digital assets: a risky crypto-asset and a stablecoin
- A DeFi protocol: lending and borrowing digital assets

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- Two digital assets: a risky crypto-asset and a stablecoin
- A DeFi protocol: lending and borrowing digital assets

DeFi Protocol

- LPs deposit/lend a quantity S of stablecoin at a gross rate $\rho = uf(u)$
- LPs face liquidation risk, in case of a sudden drop in collateral's value
- Risky investors borrow a share of these tokens B at a rate $f(u)$

A Simple Model of DeFi Lending

LPs maximize Mean-Variance Utility

$$U(W,S) = \mathbb{E}W - \frac{\gamma}{2}\mathbb{V}W$$

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Assuming the demand for borrowing B is exogenous and LPs are risk-neutral,

$$\text{DeFi Rate} \;=\; \text{Risk-free} \;+\; \gamma\mathscr{L}$$

where ρ^* is the FED's risk-free rate and $\mathscr{L}$ is the expected loss due to liquidation risk

Panel Regression

$$
\begin{aligned}
\text{DeFi Rate}_{it} \;=\; \alpha_i \;&+\; \beta\,\text{Risk-free}_{it} \\
&+\; \gamma_1\,\text{LiqRisk}_{it} \;+\; \gamma_{\mathbf{2}}\,\mathbf{X}_{it}^{\text{crypto}} \;+\; \gamma_{\mathbf{3}}\,\mathbf{X}_{it}^{\text{equity}} \\
&+\; \delta\,\text{DeFi Rate}_{i,t-1} \;+\; \epsilon_{it}
\end{aligned}
$$

- $\mathbf{X}_{it}^{\text{crypto}}$: BTC Price, BTC Volatility, BTC Momentum, Gas Price
- $\mathbf{X}_{it}^{\text{equity}}$: S&P Return, S&P Volatility, S&P Momentum, Inflation Swap, VIX
- For the risk-free rate, we use the over-night rate
  - Results are robust to using longer maturities (1M or 1Y T-bills, 10Y treasuries)

Main Results

	(1)
Dep. Variable	DeFi Rate
Risk-free	0.09
	(1.19)
Liquidation Risk	
Crypto Controls	
Market Controls	
Deposit Rate (t-1)	
Intercept	4.09***
	(13.91)
Observations	4,812
R-squared	0.00
SEs clustering	Coin and Day

Main Results

	(1)	(2)
Dep. Variable	DeFi Rate	DeFi Rate
Risk-free	0.09	0.61***
	(1.19)	(12.33)
Liquidation Risk		0.08***
		(7.68)
Crypto Controls		
Market Controls		
Deposit Rate (t-1)		
Intercept	4.09***	-3.50***
	(13.91)	(-7.86)
Observations	4,812	4,812
R-squared	0.00	0.05
SEs clustering	Coin and Day	Coin and Day

Main Results

	(1)	(2)	(3)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.09	0.61***	0.79***
	(1.19)	(12.33)	(21.49)
Liquidation Risk		0.08***	0.04***
		(7.68)	(4.50)
Crypto Controls			Yes
Market Controls			
Deposit Rate (t-1)			
Intercept	4.09***	-3.50***	-4.14***
	(13.91)	(-7.86)	(-11.70)
Observations	4,812	4,812	4,812
R-squared	0.00	0.05	0.31
SEs clustering	Coin and Day	Coin and Day	Coin and Day

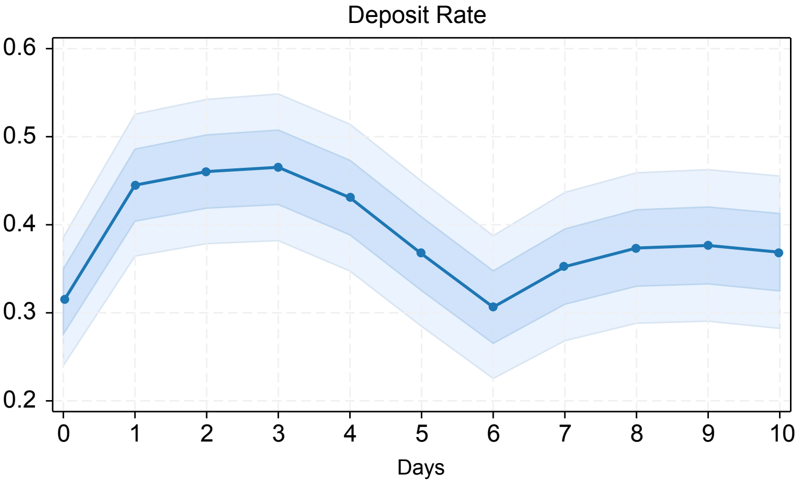
Main Results

	(1)	(2)	(3)	(4)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.09	0.61***	0.79***	0.67***
	(1.19)	(12.33)	(21.49)	(19.53)
Liquidation Risk		0.08***	0.04***	0.07***
		(7.68)	(4.50)	(11.08)
Crypto Controls			Yes	Yes
Market Controls				Yes
Deposit Rate (t-1)				
Intercept	4.09***	-3.50***	-4.14***	-7.79***
	(13.91)	(-7.86)	(-11.70)	(-7.50)
Observations	4,812	4,812	4,812	4,812
R-squared	0.00	0.05	0.31	0.37
SEs clustering	Coin and Day	Coin and Day	Coin and Day	Coin and Day

Main Results

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.09	0.61***	0.79***	0.67***	0.31***
	(1.19)	(12.33)	(21.49)	(19.53)	(6.43)
Liquidation Risk		0.08***	0.04***	0.07***	0.03***
		(7.68)	(4.50)	(11.08)	(3.50)
Crypto Controls			Yes	Yes	Yes
Market Controls				Yes	Yes
Deposit Rate (t-1)					0.55***
					(7.42)
Intercept	4.09***	-3.50***	-4.14***	-7.79***	-3.47***
	(13.91)	(-7.86)	(-11.70)	(-7.50)	(-5.11)
Observations	4,812	4,812	4,812	4,812	4,812
R-squared	0.00	0.05	0.31	0.37	0.56
SEs clustering	Coin and Day	Coin and Day	Coin and Day	Coin and Day	Coin and Day

Local Projections



- We estimate the IRF using local projections

Imperfect Competition

- If liquidity provision is concentrated among a few LPs, the equilibrium DeFi rates may be distorted by a lack of competition
- We extend our model assuming a finite number of symmetric LPs $n > 2$
- The model predicts that a higher level of liquidity concentration could inflate the response to changes in the risk-free rate

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- We interact the risk-free rate with a dummy indicating coin-days with high concentration of liquidity

Gas Price and Limits to Arbitrage

- Our model predicts that limits to arbitrage should reduce the sensitivity of DeFi rates to changes in the risk-free rate

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Gas Price and Limits to Arbitrage

- Our model predicts that limits to arbitrage should reduce the sensitivity of DeFi rates to changes in the risk-free rate
- We focus on entry and exit costs, arising from the cost of blockchain transactions (gas fees) to deposit and withdraw liquidity from the lending platform
- We gather daily gas prices on Ethereum from Dune Analytics
- We use gas prices as a proxy for the severity of limits-to-arbitrage induced by entry and exit costs
- We interact the risk-free with a dummy indicating coin-days with high gas prices

Passthrough Heterogeneity - Results

	(1)
Dep. Variable	DeFi Rate
Risk-free	0.31***
	(6.43)
Risk-free $\times$ High-Concentration	
High-Concentration	
Risk-free $\times$ High-Gas	
High-Gas	
Risk-free $\times$ High-Hacking	
High-Hacking	

Passthrough Heterogeneity - Results

	(1)	(2)
Dep. Variable	DeFi Rate	DeFi Rate
Risk-free	0.31***	0.31***
	(6.43)	(6.68)
Risk-free × High-Concentration		0.11*
		(1.67)
High-Concentration		0.04
		(0.74)
Risk-free × High-Gas		
High-Gas		
Risk-free × High-Hacking		
High-Hacking		

Passthrough Heterogeneity - Results

	(1)	(2)	(3)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.31*** (6.43)	0.31*** (6.68)	0.33*** (8.13)
Risk-free × High-Concentration		0.11* (1.67)	
High-Concentration		0.04 (0.74)	
Risk-free × High-Gas			-0.32*** (-3.07)
High-Gas			-0.36 (-1.28)
Risk-free × High-Hacking			
High-Hacking			

Passthrough Heterogeneity - Results

	(1)	(2)	(3)	(4)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.31***	0.31***	0.33***	0.31***
	(6.43)	(6.68)	(8.13)	(6.26)
Risk-free × High-Concentration		0.11*		
		(1.67)		
High-Concentration		0.04		
		(0.74)		
Risk-free × High-Gas			-0.32***	
			(-3.07)	
High-Gas			-0.36	
			(-1.28)	
Risk-free × High-Hacking				-0.09***
				(-2.85)
High-Hacking				-0.09
				-(0.56)

Stablecoin Convenience Yield

- Users value the ability to hold tokenized representations of fiat currencies
- Stablecoins allow for self-custody, rather than relying on a bank account
- In emerging markets, stablecoins are adopted for payments and currency substitution

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- In emerging markets, stablecoins are adopted for payments and currency substitution
- If stablecoins provide some sort of *convenience yield*, DeFi rates should be lower in equilibrium
- We use the total supply of stablecoins in circulation as a proxy for their convenience yield

Stablecoin Convenience Yield - Results

	(1)	(2)	(3)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.31***	0.20***	0.26***
	(6.43)	(4.59)	(5.89)
Stablecoin Supply (Ethereum)		-1.81***	
		(-6.43)	
Stablecoin Supply (other chains)			-4.34***
			(-5.89)
Deposit Rate (t-1)	0.55***	0.53***	0.54***
	(7.42)	(7.23)	(7.29)
Intercept	-3.47***	5.00***	2.84**
	(-5.11)	(3.17)	(2.40)
Observations	4,812	4,812	4,812
R-squared	0.56	0.56	0.56

The convenience yield impacts DeFi rates negatively, as expected

Leverage Demand

- As noted, DeFi lending is mainly used to take leverage
- If demand for leverage moves and supply does not react immediately, this could lead to high volatility in DeFi rates

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- If demand for leverage moves and supply does not react immediately, this could lead to high volatility in DeFi rates
- We construct a proxy for the intensity of leverage demand using perpetual futures
- In particular, we collect perpetual futures funding rate from Binance
- Those are determined by relative demand for long and short positions

Leverage Demand - Results

	(1)	(2)	(3)	(4)
Dep. Variable	DeFi Rate	DeFi Rate	DeFi Rate	DeFi Rate
Risk-free	0.24***	0.26***	0.22***	0.21***
	(5.32)	(6.52)	(6.08)	(5.48)
BTC Funding Rate	0.01***			
	(5.03)			
ETH Funding Rate		0.01***		
		(3.25)		
BTC Funding Rate (lagged)			0.02***	
			(5.81)	
ETH Funding Rate (lagged)				0.02***
				(7.15)
Deposit Rate (t-1)	0.54***	0.54***	0.53***	0.53***
	(7.26)	(7.17)	(7.10)	(7.26)
Intercept	-2.49***	-3.04***	-2.39***	-2.67***
	(-4.22)	(-4.93)	(-4.67)	(-4.89)

DeFi Rates are increasing in leverage demand

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- In March 2021, the meltdown of SVB caused a temporary de-peg of USD**C**

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- In March 2021, the meltdown of SVB caused a temporary de-peg of USD**C**
- We use this event as an exogenous shock to leverage demand for USD**T**

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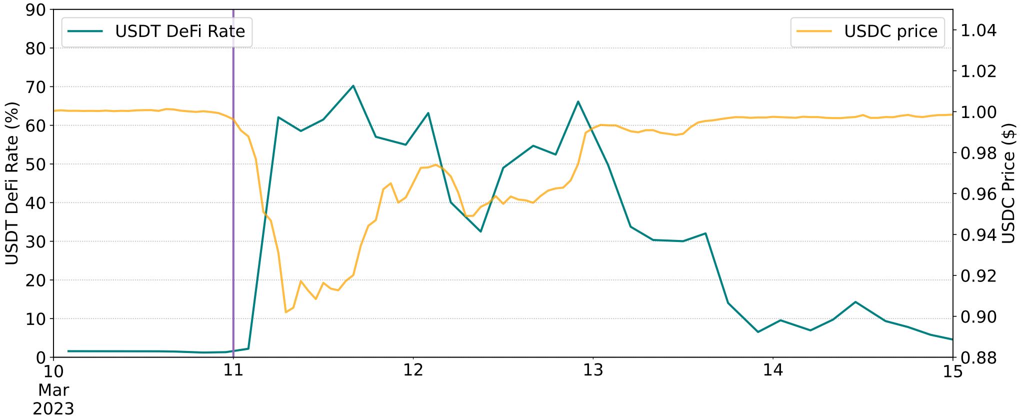

- DeFi rate for USDT jumped to 70% following a large demand shock

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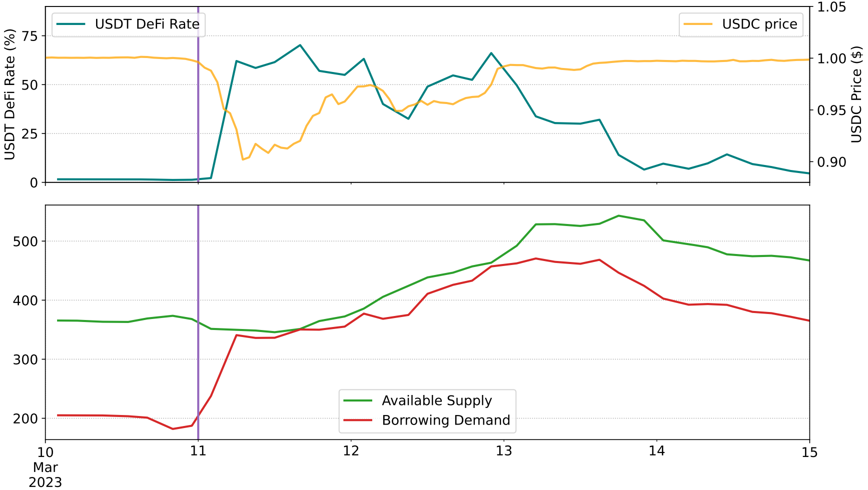

- The demand shock is absorbed over time as supply adjusts slowly

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    - Imperfect Competition
    - Gas and Limits to arbitrage
    - Leverage Demand Shocks

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    - Liquidation Risk
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    - Gas and Limits to arbitrage
    - Leverage Demand Shocks
- **Does it Matter for Monetary Policy?**
  - At the current size of the stablecoin market probably not
  - May become more important, especially now with the GENIUS Act

Thanks for your attention!