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Abstract

We propose a theory of stablecoin disintermediation, whereby stablecoins not only erode banks' deposit franchises but also transmit liquidity stress to the banking system. Using transaction-level data linking on-chain transactions to wholesale interbank payments, we document the first evidence of liquidity-driven bank disintermediation. Stablecoins directly transmit liquidity shocks to the banking system: banks with stablecoin deposits experience substantial increases in payment demand and heightened liquidity exposure to daily stablecoin primary market activity. Consistent with theory, banks operate “narrowly” to support liquidity-hungry stablecoin deposits – requiring substantially larger bank reserve balances to mitigate potential shortfalls. Even as beneficiaries of stablecoin growth within the banking system, partner banks' loan share of assets contracts relative to peers. Our results substantially broaden the scope for stablecoins to disintermediate banks, impact bank lending, and complicate monetary policy implementation.

JEL classification: E41, E42, E58, G10, G21, D47

Key words: stablecoins, bank disintermediation, payments, bank reserves

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To view the authors' disclosure statements, visit https://www.newyorkfed.org/research/staff_reports/sr1185.html.

1 Introduction

The GENIUS Act marks a paradigm shift in the distribution of digital U.S. dollars. Payment stablecoins enable U.S. dollar settlement on blockchains, and are positioned to satiate global demand for U.S. dollars. Importantly, stablecoins are accessible to anyone with the internet. This stands in contrast to the bank hegemony. How will stablecoins impact the banking system?

In this paper, we study stablecoins through the lens of liquidity. Stablecoin issuers bridge liquidity from the traditional financial system by receiving and managing liquid claims at financial institutions. Payment stablecoins maintain stable value by offering fast, at-par redemption to stablecoin holders. The Act establishes a regulatory framework that enables stablecoin issuers to integrate into the broader financial system, and importantly, includes a key provision requiring payment stablecoin issuers to provide “timely redemption,” a function that requires liquidity and payment services from banks.

We provide comprehensive evidence of *stablecoin disintermediation* through liquidity linkages between stablecoin issuers and the banking system. Motivated by a liquidity-based theory of bank disintermediation, we construct a dataset linking on-chain primary market activity to wholesale interbank payments from the Fedwire Funds Service (“Fedwire”). We find that stablecoins directly transmit liquidity shocks to the banking system, resulting in heightened payment activity, volatility in reserve balances, and consequently, excess demand for reserves and diminished lending. This *liquidity* channel of disintermediation broadens the scope and mechanisms through which stablecoin adoption disintermediates banks, curtails lending activity, and complicates monetary policy implementation.

We use a theory of stablecoins and the banking system to distill the channels of disintermediation. In the model, banks actively manage reserves to provide liquidity to customers, including stablecoin issuers. Stablecoins disintermediate banks through a traditional *recomposition* channel: banks that lose deposits to stablecoins replace sticky deposits with wholesale deposits, raising bank funding costs and eroding bank deposit franchises. We identify a novel second *liquidity* channel: even as select banks see an influx of stablecoin deposits, banks must hold excess reserves to absorb stablecoin-related payment shocks. These partner banks operate a “narrow” operation for their stablecoin segment due to the liquidity-hungry nature of stablecoin deposits, in anticipation of large future outflows to

service stablecoin redemption requests. In this way, stablecoins disintermediate banks, not only by diluting bank deposit franchise, but also by transmitting liquidity stress to banks managing stablecoin deposits.

A deep analysis of the link between stablecoins and the traditional banking system requires studying the banks providing services for payment stablecoin issuers. Issuers sometimes publicly announce partnerships with banks, but issuers are not expected or required to disclose all banks servicing their deposits and payments. Leveraging the fact that dollar payments from stablecoin issuers are processed through interbank settlement systems, we match publicly observed issuance and redemption blockchain transactions to payments on Fedwire. Using a dataset of matched transactions, we identify a set of custodian banks that provide payment services (“partner banks”) for a stablecoin issuer that offers redemption rights to stablecoin holders (the “Issuer”). This provides an ideal laboratory to study liquidity linkages to the banking system.

We document stylized facts regarding stablecoins and liquidity management:

1. *The banking crisis of 2023 led to a re-evaluation of the money hierarchy and a fundamental shift in reserve management.* The failure of key banks that provided access to the crypto industry led to a recognition of commercial bank risk, catalyzing a shift in reserve composition away from deposits to collateralized alternatives, such as repo.
2. *Stablecoin issuers manage intraday liquidity.* Stablecoin issuers use the portion of their reserves held in bank deposits to process payments. From an issuer’s perspective, a shrinking share of reserves held in deposits requires tighter intraday liquidity management.

During the 2023 banking crisis, key banks providing access to crypto-native companies, including stablecoin issuers, failed. The 2023 banking crisis offers a plausibly exogenous shock to the set of partner banks processing payments for issuers with indirect access to the interbank payment system. We confirm that the Issuer forged significant partnerships with new banks in March 2023. Using a difference-in-difference approach, we directly test how stablecoins impact banks offering deposit services vis-à-vis the liquidity channel by examining changes in key dimensions of bank liquidity, including payment activity and reserve volatility, and the corresponding impact on banks’ balance sheets.

The liquidity channel operates through increased liquidity demand banks face arising from stablecoin-related activity. To start, we find strong evidence of liquidity spillovers from stablecoins to partner banks' day-to-day payment activity: in the nine months following new partnerships, banks' interbank payment activity increases by 67%. These stablecoin-related payments represent a series of shocks to banks' liquid balances throughout the day, and transmit liquidity stress to banks by increasing the variation in banks' reserve balances. Banks servicing stablecoin deposits may face greater gross variation in banks' reserve balances within a given day.

In order to test for the sensitivity of bank liquidity to stablecoin activity, we augment our difference-in-differences specification with a continuous measure of treatment intensity, the daily value of total primary stablecoin market activity, to further test how stablecoin payment needs pressure banks' liquidity conditions. In addition to daily payment activity, we examine three different measures of intraday reserve volatility – standard deviation in reserve balances, realized variance in reserve balances, and the intraday range.

The analysis lends support to the liquidity shock transmission: following partnerships, all measures of bank liquidity are impacted by stablecoin primary market activity. Partner banks' daily payment activity co-moves significantly with stablecoin activity. A one-standard deviation increase in primary market activity translates to about \$280 mln in additional Fedwire payments by the average treated bank relative to control banks. This corresponds to over 40% of the median daily payment value of the average treated bank in the pre-period. Measures of intraday liquidity stress exhibit economically-significant sensitivities to primary market activity following partnerships as well. A one-standard deviation increase in primary market activity increases intraday reserve volatility by an amount equaling roughly 55% of pre-period average volatility, and widens the range of intraday reserve balances by 36% relative to the pre-period average range for treated banks.

Our theory indicates that stablecoin liquidity needs should materially impact banks' balance sheets. In order to mitigate liquidity shortfalls, banks with stablecoin deposits may hold excess reserves to service payment outflows. Consequently, banks shift the composition of their balance sheet from less liquid assets, such as loans, to bank reserves. In line with our theory, stablecoin deposits appear to permanently affect banks' balance sheet composition. In the immediate period

following partnerships, banks' reserve holdings increase significantly, likely reflecting a large influx of stablecoin deposits. Importantly, however, partner banks retain larger bank reserve balances, by about \$1.5 bln in the subsequent period – an indication of precautionary holdings to manage liquidity risks associated with stablecoin deposits. In other words, banks do appear to support their stablecoin deposits using a “narrow” operation.

Banks' needs to retain large reserves balances to manage liquidity exposures directly impede their ability to use stablecoin deposits for credit intermediation. Although partner banks outpace peer banks in asset growth, we find that lending, as a share of bank assets, drops relative to peers. The share of loans decreases by 14 pp relative to the control group. This drop in loans relative to size represents a symptom of narrow operations necessary to effectively manage stablecoin liquidity demands. Our analysis suggests that even partner banks, who are *beneficiaries* of stablecoin markets within the banking system, materially adjust their operation, including lending activity.

Our paper demonstrates a novel payment-driven channel through which stablecoin disintermediation occurs. Existing studies have focused on the recomposition channel, as growth in the stablecoin market corresponds to shifts in liquidity from banks to stablecoin reserves. These dynamics primarily view disintermediation from the lens of funding markets, which could diminish aggregate lending (Keister and Sanches 2023), or improve market functioning (Chiu, Davoodalhosseini, Jiang and Zhu 2023), depending on the true underlying frictions that limit efficient allocations. In contrast, disintermediation through the liquidity channel unambiguously strains bank functioning through liquidity shocks that stablecoin issuers transmit to the broader banking system through their partners.

The impact that stablecoin growth has on bank liquidity exposures directly translates into material concerns regarding monetary policy implementation. We show that stablecoins distort the distribution of reserves in two ways: first, it shifts reserves to a concentrated few banks providing banking services for stablecoin issuers; second, these few banks require excess reserves to manage stablecoin-related payments. Both contribute to increasing demand for reserves that complicates the determination of aggregate reserve demand (Afonso, Giannone, La Spada and Williams 2022), and put greater emphasis on the channels through which the central bank can provide liquidity to banks free of stigma.

Several existing studies examine bank disintermediation resulting from new

forms of tokenized money. An earlier literature studies disintermediation in the context of central bank digital currencies, focusing on their financial stability implications (Bidder, Jackson and Rottner 2024), or through deposit substitution (Bacchetta and Perazzi 2021, Whited, Wu and Xiao 2022). These studies primarily consider disintermediation through the lens of deposit substitution – redistribution of liquidity through the introduction of alternative forms of money. Our paper uncovers a new dimension of disintermediation that arises through operational linkages between stablecoins and banks.

Evidence on liquidity shock transmissions lends greater credibility to concerns that sudden runs on stablecoins, whether due to a collapse in cryptocurrency markets or solvency concerns regarding a stablecoin, could be directly transmitted to partner banks. Redemptions could result in sudden large liquidity dry-ups unrelated to the performance of banks that could trigger self-fulfilling runs on banks themselves. Moreover, these payment-driven shocks could become sizable and threaten even large banks if the payment stablecoin market grows, and are more likely to result in a material event if stablecoin-related activity is concentrated in select banks. Lee (2026) documents the emergence of “composed asset transformation,” whereby tokenized securities, funds, and stablecoins are combined to create new tokenized US dollar assets with liquidity interdependencies. The cash-like use of stablecoins in the broader tokenized asset market could further amplify shocks and pose financial stability risks.

A growing literature examines the dynamics of stablecoins. Stability in the value of stablecoins hinges on both stability mechanisms in secondary markets (Lyons and Viswanath-Natraj 2023), reserve composition (Li and Mayer 2025), redemption practices in primary markets (Watsky, Allen, Daud, Demuth, Little, Rodden and Seira 2024), and importantly, require stablecoins to strategically design redemption policies (Ma, Zeng and Zhang 2025). We offer the first comprehensive analysis of linkages between on-chain and interbank payment activity and show that stablecoin issuers’ operations may have direct implications on banks’ liquidity and balance sheets.

The remainder of the paper is organized as follows. In Section 2, we develop a theory of banks and stablecoins, and show the rise of the liquidity channel of disintermediation. Section 3 provides institutional background, a description of our data, and outlines stylized facts regarding stablecoin liquidity management. The main empirical analysis and results are provided in Section 4, followed by

robustness in Section 5. Concluding remarks are provided in Section 6.

2 A Model of Reserves, Deposits, and Stablecoins

We consider a model where banks lend and manage liquidity, in the form of reserves, to facilitate interbank payments. Stablecoin issuers receive payments and reallocate across a portfolio, with sufficient bank deposits to process redemption requests from stablecoin holders. Hence, banks and stablecoin issuers form a tiered-liquidity system (Liao and Caramichael 2022). The novel tension in the model is payment-driven liquidity demand – banks must hold sufficient reserves to meet withdrawal requests from depositors, including traditional depositors and deposits held in stablecoin reserves.

2.1 Model Environment

Agents. There are three periods $t = 0, 1, 2$. There are 2 banks $b \in \{1, 2\}$, a representative stablecoin issuer, and a mass of investors.

Assets. There are three types of assets: bank reserves R ; (long-term) risky assets \tilde{r}^L ; and (long-term) safe assets r^T . Bank reserves are assumed to have return normalized to $R = 1$. Risky assets pay \tilde{r}^L in two periods, which pays r^L with probability $1 - p$. At $t = 1$, with probability p , one of the two banks' assets are hit with a public shock with equal probability. The shocked bank's risky assets face a small possibility of failure q , in which case it pays 0. Risky assets have liquidation value of 0 at $t = 1$. Safe assets pay r^T in period $t = 2$ and $\ell^T < 1$ in period $t = 1$. Risky assets are assumed to be more profitable $E[\tilde{r}^L] > r^T > 1$. Banks can hold bank reserves and risky assets, and issue deposits. The stablecoin issuer can hold safe assets and deposits.

Investors. There are two types of investors: "slow" and "fast" $\theta \in \{s, f\}$. Slow investors are insensitive to perceived bank risk. Initially at $t = 0$, each bank starts with a unit mass of depositors consisting of "slow" investors. The initial composition of depositors is not crucial.

At $t = 1$, one bank is randomly matched to the stablecoin issuer. Stablecoin opportunities emerge for a fraction σ of all depositors, who transfer funds to the

bank matched to the stablecoin issuer. Stablecoins generate u^s utility per unit to depositors if held until $t = 2$.¹ After all the stablecoin-related transfers, banks are able to raise funds from fast investors, who are sensitive to bank risk and withdraw whenever default risks materialize (with probability pq).²

Let the mass of deposits by θ -type investors at bank b be denoted D_b^θ , and denote total wholesale funding as $D^f = D_1^f + D_2^f$. Banks incur an additional cost kD_b^f , reflecting costs associated with acquisition and wholesale funding costs. We assume throughout that k is sufficiently large, $k > E[r^L] - c$ so that switching to a full wholesale funding model is not sustainable. This reflects our focus on the segment of the banking system with deposit franchises. At $t = 2$, liquidity shocks hit individual investors with probability $\gamma \in (0, 1/2)$, who must withdraw.

Contracts. Banks offer deposits that offer par redemption at $t = 2$ and positive return at $t = 3$. Stablecoins are redeemable at par at any period. Contracts stipulate payoffs at $t = 2, 3$:

- Deposit contracts are assumed to pay $(1, r^\theta)$.
- Stablecoins are redeemable at par in any period $(1, 1)$.

Stablecoin Issuer. At $t = 1$, after receiving payments from stablecoin depositors, the stablecoin issuer chooses the μ_s share to hold its capital in the safe asset and the rest in bank deposits to maximize profits subject to liquidity constraints for each period. Let $t = 1$ redemptions be denoted γ_s . The liquidity constraint for periods $t = 2, 3$ are given by:

$$\gamma_s \leq \mu_s \ell^T + (1 - \mu_s) \text{ at } t = 2 \quad (1)$$

$$1 - \gamma_s \leq \mu_s r^T \text{ at } t = 3 \quad (2)$$

Banks. At $t = 0$, banks make portfolio choice μ , where μ is the investment of initial unit mass of deposits into risky assets. Let $t = 2$ total withdrawals at bank b be $A_b W_b$, where A_b is the total mass of depositors of bank b and W_b is the fraction of deposits being withdrawn. Payments are made. Within bank transfers are settled internally, but interbank transfers are settled with reserves. The fraction

¹Stablecoins are assumed to generate sufficiently large gains to end-users.

²This captures the liquidity risks posed by wholesale funding.

of interbank transfers is assumed to be proportional to size, i.e. bank b 's external transfers are $\rho_b = \frac{A_{-b}}{A_{-b} + A_b}$. Within-period transfers are assumed to be net settled.³ We assume that the penalty rate for central bank liquidity is sufficiently high such that it is always optimal to have sufficient liquidity to service deposit outflows at $t = 1$ and $t = 2$, where the $t = 2$ condition is:

$$M_b \geq \rho_b A_b W_b - \rho_{-b} A_{-b} W_{-b} \text{ at } t = 2 \quad (3)$$

where M_b is the quantity of reserves held by bank b at $t = 1$. We denote total reserves held by banks as $M = M_1 + M_2$. Banks are assumed to face an operating cost $C_b = \bar{c} + cA_b$.

Timeline.

$t = 0$ Banks make portfolio choice.

$t = 1$ Stablecoin shock. Depositors move to stablecoins. Stablecoin issuer makes portfolio choice. Banks access wholesale funding market.

$t = 2$ Liquidity shocks. Withdrawals occur, and interbank payments are made.

$t = 3$ Payoffs are realized.

Equilibrium Concept. A symmetric subgame-perfect Nash equilibrium is banks' optimal portfolio choice $\{\mu^*\}$, banks' wholesale funding choice $\{D_i^{f*}\}$, stablecoin portfolio choice μ_s^* , and users' optimal investment and withdrawal strategies.

2.2 Equilibrium Analysis

To start, we characterize the stablecoin issuer's portfolio problem. A stablecoin issuer maximizes their payoffs by investing in assets, subject to the liquidity constraint. Because banks have a possibility of failure, the stablecoin issuer must hold enough safe assets to satisfy the $t = 2$ liquidity constraint, and enough deposits to satisfy the $t = 1$ liquidity constraint. This reflects the uninsured nature of deposits held by stablecoin issuers, as stipulated in the GENIUS Act, and also the real risks

³In practice, payment transfers are gross settled and lead to strategic payment games (Bech and Garratt 2003, Afonso and Shin 2011). However, net settlement attenuates liquidity stress, and precluding such will amplify our results.

that materialized as a consequence of failures at key partner banks in 2023. The optimal stablecoin reserves consist of the minimum amount in deposits, subject to the liquidity constraint and avoiding costly liquidation of assets:

Lemma 1. *The optimal stablecoin reserve is comprised of $1 - \gamma$ safe assets and the remaining in deposits.*

The optimal stablecoin reserve ensures that the stablecoin issuer holds enough deposits to service $t = 2$ redemptions without liquidating its safe assets, and enough safe assets to ensure that it can service all remaining redemptions in full. Lemma 1 foretells the liquidity implications of stablecoin deposits. The stablecoin issuer holds just enough liquidity, in the form of deposits, to service all expected redemptions from its token holders. Consequently, although the liquidity needs of its token holders are identical in distribution to the general population, the duration of stablecoin deposits is much shorter than that of the average depositor.

Banks face withdrawal requests at $t = 1$ and $t = 2$. At $t = 2$, investors are hit by liquidity shocks that result in withdrawals. Withdrawals represent a reshuffling of liquidity across banks. Without loss of generality, let bank 1 be the partner bank. Given A_1, A_2 , bank b 's net transfer to bank $-b$ is:

$$\rho_b A_b W_b - \rho_{-b} A_{-b} W_{-b} = \frac{A_b A_{-b}}{A_b + A_{-b}} (W_b - W_{-b}). \quad (4)$$

The withdrawal rate W_b is given by

$$W_b = \gamma + (1 - \gamma) \frac{D_b^f}{A_b} \mathbb{1}_b + \frac{2\sigma\gamma}{A_b} (1 - \gamma) \mathbb{1}_{b=s}, \quad (5)$$

where $\mathbb{1}_b = 1$ if bank b 's assets are subject to default risk, and $\mathbb{1}_{b=s} = 1$ if bank b is holds stablecoin deposits. Noting that $\mathbb{1}_b = 1$ with probability $\frac{p}{2}$, we attain:

$$W_1 - W_2 = \begin{cases} (1 - \gamma) \frac{D_1^f}{A_1} + \frac{2\sigma\gamma}{A_1} (1 - \gamma) & \text{if } \mathbb{1}_1 = 1, \text{ w.p. } \frac{p}{2} \\ -(1 - \gamma) \frac{D_2^f}{A_2} + \frac{2\sigma\gamma}{A_1} (1 - \gamma) & \text{if } \mathbb{1}_2 = 1, \text{ w.p. } \frac{p}{2} \\ \frac{2\sigma\gamma}{A_1} (1 - \gamma) & \text{w.p. } 1 - p \end{cases} \quad (6)$$

With size-weighted interbank transfers, normal liquidity-based withdrawals result in net zero transfers between banks. Material changes in the reserve balance between banks arise from stablecoin-related transfers and fast investors wary of

bank risk. Large inflows of liquidity into the partner banks at $t = 1$ are redistributed to non-partner banks at $t = 2$ withdrawals, resulting in clear anticipated outflows of deposits from partner banks. In addition, whenever banks are funded by wholesale deposits, they face potential withdrawals when risks emerge to their underlying assets. These withdrawals materialize in the form of payment outflows at $t = 2$ to the unaffected bank.

The net liquidity position of bank b is given by:

$$M_b - \frac{A_1 A_2}{A_1 + A_2} (W_b - W_{-b}). \quad (7)$$

Banks must hold sufficient reserves to facilitate transfers. The $t = 2$ bank liquidity condition requires the minimum net liquidity position of bank b to be nonnegative with certainty. For bank 1, this requires:

$$\mu_1 \leq (1 - \sigma) + (D_1^f + 2\gamma\sigma) \left(1 - (1 - \gamma) \frac{A_2}{A_1 + A_2} \right). \quad (8)$$

In comparison, bank 1's liquidity condition at $t = 1$ requires bank 1 to hold sufficient liquidity net of its stablecoin deposits: $\mu_1 \leq (1 - \sigma) + (D_1^f + 2\gamma\sigma)$. Hence, the $t = 2$ liquidity condition is more binding.

The binding nature of $t = 2$ liquidity condition encapsulates the *liquidity channel* through which disintermediation occurs. Although both banks experience stablecoin-related deposit outflows, bank 1 sees inflows in stablecoin deposits, which counteracts liquidity needs at $t = 1$. However, even with stablecoin deposits, the bank must reserve sufficient liquidity to address stablecoin-related outflows at $t = 2$. Because stablecoin issuers service redemption requests exclusively through deposits, stablecoin deposits represent concentrated liquidity claims of all stablecoin holders. This makes stablecoin deposits liquidity-hungry – more so than any other form of deposit, including wholesale.

Anticipating large outflows at $t = 2$, a bank with stablecoin deposits can only redirect a fraction of stablecoin deposits towards funding risky assets, and holds significant portion "narrowly" in the form of reserves.

For bank 2, the liquidity condition at $t = 2$ requires:

$$\mu_2 \leq (1 - \sigma) + D_2^f \left(1 - (1 - \gamma) \frac{A_1}{A_1 + A_2} \right) + 2\gamma(1 - \gamma) \frac{A_1}{A_1 + A_2} \sigma. \quad (9)$$

Note that bank 2, which experiences pure outflows to stablecoins at $t = 1$, faces a $t = 1$ liquidity condition of $\mu_2 \leq 1 - \sigma + D_2^f$. For bank 2, the $t = 1$ condition strictly binds if and only if its wholesale funding is sufficiently large, i.e. $D_2^f > 2\gamma\sigma$.

We have fully characterized banks' liquidity conditions at $t = 1$ and $t = 2$. Banks raise costly wholesale funding at $t = 1$ to resolve current and expected liquidity shortfalls. Given symmetric strategies on portfolio choice ($\mu_1 = \mu_2 = \mu$), the bank 1's wholesale funding choice D_1^f is:

$$D_1^f \geq \begin{cases} \frac{1}{1-(1-\gamma)\frac{A_2}{A_1+A_2}} (\mu - (1 - \sigma)) - 2\gamma\sigma & \text{if } \mu > (1 - \sigma) + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1+A_2}\right) \\ 0 & \text{if } \mu \leq (1 - \sigma) + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1+A_2}\right) \end{cases} \quad (10)$$

and for bank 2:

$$D_2^f \geq \begin{cases} \frac{1}{1-(1-\gamma)\frac{A_1}{A_1+A_2}} (\mu - (1 - \sigma) - 2\gamma(1 - \gamma)\frac{A_1}{A_1+A_2}) & \text{if } \mu > (1 - \sigma) + 2\gamma\sigma \\ \mu - (1 - \sigma) & \text{if } \mu \in (1 - \sigma, (1 - \sigma) + 2\gamma\sigma] \\ 0 & \text{if } \mu \leq 1 - \sigma \end{cases} \quad (11)$$

Banks optimize on the choice of μ , taking into account the possibility of stablecoin deposits.

$$\begin{cases} \mu E[\tilde{r}^L] - \frac{c(A_1)+c(A_2)}{2} & \text{if } \mu \leq 1 - \sigma \\ \mu E[\tilde{r}^L] - \frac{c(A_1)+c(A_2)}{2} - \frac{k(D_2^f)}{2} & \text{if } \mu \in \left(1 - \sigma, 1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1+A_2}\right)\right] \\ \mu E[\tilde{r}^L] - \frac{c(A_1)+c(A_2)}{2} - \frac{k(D_1^f)+k(D_2^f)}{2} & \text{if } \mu > 1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1+A_2}\right) \end{cases} \quad (12)$$

A bank chooses its portfolio, taking into account the expected shortfall from withdrawals, and the need to raise costly funding as a result. By choosing $\mu < 1 - \sigma$, a bank can ensure that it holds sufficient reserves with certainty. For intermediate allocations into the risky asset, the bank holds adequate liquidity if it receives stablecoin deposits, but must seek additional deposits if it experiences deposit outflows. For sufficiently large allocations, a bank must always raise whole-

sale deposits to supplement expected liquidity shortfalls.

We summarize the equilibrium below:

Proposition 1. *Suppose that wholesale funding costs are not too high, i.e. $k < \bar{k}$ for some cutoff \bar{k} . In equilibrium, aggregate lending, reserves, and wholesale funding is given by:*

$$2\mu^* = 2 \left(\sqrt{(\gamma\sigma(1-\gamma))^2 + (1-\sigma+2\gamma\sigma)^2} - \gamma\sigma(1-\gamma) \right) \quad (13)$$

$$M^* = 2\gamma\sigma(1-\gamma) \frac{\mu^*}{\mu^* + (1-\sigma) + 2\gamma\sigma} \quad (14)$$

$$D^{f*} = \mu^* - (1-\sigma). \quad (15)$$

Two concrete channels of disintermediation realize in equilibrium. First, deposit outflows from affected banks push banks to replenish liquidity through wholesale funding D^{f*} . Larger outflows result in greater wholesale funding needs, resulting in a recomposition of their deposit base. Flows into stablecoins are partially captured by stablecoin deposits, but require excess reserves M^* to be held in anticipation of large interim outflows. The liquidity-hungry nature of stablecoin deposits necessitates higher reserve holdings, attenuating the potential for liquidity transformation and bank intermediation.

Proposition 2 (Stablecoin Impact). *As stablecoin adoption grows (larger σ):*

- *Bank lending declines (lower μ^*);*
- *Wholesale funding needs increase (larger D^{f*});*

Furthermore, aggregate demand for reserves increases (larger M^) if either stablecoin adoption passes a threshold ($\sigma > \bar{\sigma}$) or if liquidity value is sufficiently high ($\gamma > \bar{\gamma}$), for some thresholds $\bar{\sigma}, \bar{\gamma}$.*

In general, stablecoin adoption unambiguously contracts aggregate lending by lowering the deposit franchise value of banks and straining banks' liquidity through high payment needs. Although the impact on aggregate lending is challenging to observe given the nascent stage of stablecoin adoption, our theory offers sharp empirical implications that are immediately recognized for select banks that become partner banks for stablecoin issuers.

We summarize three testable implications:

Implication 1. *Bank liquidity redistribution. We should observe large liquidity flows from non-partner banks to partner banks.*

Implication 2. *Stablecoin transmission to banks. We should observe increased payment activity driven by stablecoin transactions following an inflow of stablecoin deposits.*

Implication 3. *Liquidity channel. We should see stablecoin partner banks retain significant levels of stablecoin-related liquidity in the form of bank reserves, resulting in an increase in bank reserve balances and a drop in the loan share of assets.*

With the growth of the stablecoin market, Implication 1 follows directly. Implication 2 is a key indicator for stablecoin payment demand transmitting to banks, which motivates the liquidity-based bank disintermediation outlined by Implication 3. In the next section, we provide empirical tests for Implications 2 and 3.

3 Stablecoins and Liquidity Management

3.1 Institutional Background

Before going into our empirical analysis, we provide background on the stablecoin operations of issuance, redemption, and payment through which stablecoins link blockchain systems to the traditional banking system.

Operationally, a stablecoin issuer creates (“issues”) and transfers payment stablecoins to its customer’s blockchain address after receiving US dollars from a customer, and sends US dollars after a customer requests a redemption and upon taking payment stablecoins out of circulation (“redeem”). Stablecoins are redeemable at par, either directly through the issuer, or indirectly through partners and third-party services. The ease and certainty with which users can issue and redeem impacts the key value proposition of payment stablecoins to maintain par value to the pegged currency. Recognizing this, the GENIUS Act requires issuers to provide “timely” at par-dollar redemption to payment stablecoin holders. In practice, current redemption policies vary significantly across issuers on the speed, eligibility, and fees associated with issuance and redemption. However, in order for a stablecoin issuer to service fast issuance and redemption, it must have access to traditional payment rails to send and receive US dollars.

A useful comparison is between stablecoin issuers and government money market funds. Stablecoin issuers and government money market funds are restricted to invest in a similar set of assets and offer redemption at par. In general,

flows in and out of stablecoins are in line with those observed for US government funds (for example, see Lee (2025)). However, in contrast to money market funds, payment stablecoins are intrinsically designed and expected to be used as settlement instruments. This places a premium on rapid conversion between fiat and stablecoins.

Faster redemption offerings increase liquidity risks faced by payment stablecoin issuers, relative to money market funds. In contrast to money market funds, which adjust their liquidity positions after netting inflows and outflows end-of-day, stablecoin issuers may process intraday redemptions on a gross basis. This can substantially increase intraday liquidity volatility, and requires issuers to actively monitor and, in stress periods, adjust their reserves to fulfill redemption obligations. Consequently, relative to money funds, payment stablecoin issuance and redemption requests could transmit payment-related liquidity shocks to partner banks fulfilling issuers' intraday payment needs.

3.2 Data and Empirical Approach

Our paper uses three main data sources: (i) on-chain stablecoin primary market activity from a stablecoin issuer (the "Issuer"), (ii) wholesale interbank payments, and (iii) daily reserve balances for banks with accounts at the Federal Reserve. This analysis follows Federal Reserve statistical disclosure practices: all results aggregate at least three institutions, no institution names are linked to payment data, and reported temporal analysis uses daily or lower frequency to protect confidentiality.

On-chain primary market activity. Stablecoin primary market activity is publicly observable at the transaction level. Primary market activity consists of transfers between the treasury address of the Issuer and external addresses corresponding to redemptions and issuances of the stablecoin. We obtain transaction-level data, including the amount and time associated with each transaction, between September 2021 and January 2025 from Dune Analytics.

Wholesale interbank payments and reserves. We use transaction-level data on wholesale payment activity on the Fedwire Funds Service, a real-time gross settlement system owned and operated by Federal Reserve Banks. Payments on

Fedwire represent real-time transfers in central bank reserves between participating banks. Each Fedwire transaction contains information, including a timestamp, transfer amount, and the sending and receiving institutions. To track bank liquidity, we use daily reserve balances held by depository institutions in their accounts with the Federal Reserve. We construct daily measures of payment flows for banks by aggregating Fedwire transactions at the bank-date level. Table 1 compares bank characteristics for the treated and control groups, which are similar in the pre-period across bank characteristics.

Transaction Matching. Primary market activity is a transaction between a user and the stablecoin issuer. On the blockchain side, the majority of identities of address holders are unknown, and in custodial arrangements, addresses often do not represent the beneficiary of the assets. On the traditional side, transactions specify banks but not the end-sender and receiver of funds. We build a matched dataset using transaction specificity and temporal proximity, choosing conservative rules that prioritize precision over volume. Of the targeted transactions representing roughly 60% of total transactions by volume (40% by value), we match about 30% by volume (7% by value). As Figure 1 shows, match rates by volume are consistent throughout the sample period, and by value, rise towards the latter half of the sample.

3.3 Stablecoin Reserves and Bank Deposits

In the context of our model, we show that the advantageous liquidity profile of bank deposits, combined with issuers' sensitivities toward even small commercial bank risk, can result in bank deposits being used primarily for facilitating liquidity needs associated with its operations. In this case, stablecoin issuers minimize the share of their reserves held in bank deposits.

The underlying concerns regarding commercial bank risk are founded directly in stablecoin issuers' recent experiences. In the fallout of the 2023 banking crisis, the stablecoin sector experienced significant turbulence due to failure of key banks that provided access to banking services for the cryptocurrency industry (Anadu, Azar, Cipriani, Eisenbach, Huang, Landoni, La Spada, Macchiavelli, Malfroy-Camine and Wang 2025, Du, Sonawane and Watsky 2025).

The experience of the 2023 banking crisis had a profound impact on how sta-

blecoin issuers manage their reserves and bank deposits today (Lee 2025). The stablecoin industry as a whole shifted away from holding bank deposits as reserves, as shown in Figure 2. In the post-bank collapse period, aggregate stablecoin reserves see a downward shift in the share of deposits in their reserves substituted with greater activity in alternative short-term money markets, effectively balancing the liquidity profile of their asset portfolio and shifting their dependence from bank deposits.

Observation 1. *In the post-bank collapse period, stablecoin reserves are re-calibrated away from bank deposits.*

3.4 Stablecoin Liquidity Management

Intuitively, stablecoin issuers face higher liquidity pressure relative to other financial arrangements that benefit from netted settlement. This makes the design of payment stablecoins particularly liquidity-intensive when offering fast redemption, which can require gross settlement. Intraday liquidity pressure motivates strategic liquidity management, most commonly observed in the context of the interbank settlement. When liquidity is valuable, institutions may time transfers to dynamically manage their balances (Bech and Garratt 2003, Afonso and Shin 2011).

A common approach to strategic liquidity management in gross-settled payments systems is effective netting. Outgoing payments are strategically timed after receiving payments, which minimizes the likelihood of breaching liquidity drawdowns below targeted levels. When outgoing payments exceed incoming payments, outgoing payments are delayed to lower balance volatility. In the case of stablecoins, issuance requests translate into flows that add to a stablecoin issuer's liquidity buffer. Fulfilling redemption-related payments after receiving payments from customers allows an issuer to minimize fluctuations in balances arising from expected flows throughout the course of the day.

The processing patterns of the Issuer align with our theory of the role of bank deposits for stablecoin reserves. In particular, we observe patterns indicative of strategic processing for liquidity purposes. First, within our matched transactions for the Issuer, the average processing times of redemption transactions are greater than issuance transactions. Second, even as a smaller share of its reserves are held in bank deposits, the Issuer maintains a relatively stable redemption policy.

Facilitating the same velocity of primary market activity with a smaller deposit base magnifies liquidity management needs. Tracking the processing delays of issuance and redemption requests over time confirms this: Figure 3 shows that in the post-March 2023 period, average delays in redemption diverge from delays in issuances – an indication of greater liquidity needs.

Observation 2. *Processing times for redemptions grow on average than those for issuances in the post-March 2023 period.*

3.5 Stablecoins and Partner Banks

As summarized in Implication 1, stablecoins have distributional consequences on banks based on where they allocate stablecoin deposits. Issuers sometimes publicly announce partnerships with banks, but are generally not expected or required to disclose all banks servicing their deposits and payments. We use our matched transactions to examine the banks providing banking services over time, which we refer to as partner banks.

We make a few observations regarding partner banks. In general, the processing of stablecoin transactions are highly concentrated in a few banks. Figure 4 shows the share of payments value processed by the top three banks over our sample period. We observe that they are responsible for almost 58% of transactions in our matched sample by value. In terms of the composition of banks, partner banks engaged vary, and significant partners are generally those with asset size less than \$250 bln (based on 2021q4 values). This is consistent with the important role of banks outside of the systemically important banks in providing access to banking services for fintech and crypto-native companies.

Observation 3. *Transactions are highly concentrated, with the top three banks processing the majority of payments value.*

4 Liquidity Channel of Bank Disintermediation

The 2023 banking crisis led to the closures of crypto-friendly banks that provided bank services and impacted stablecoin issuers, including the Issuer. Furthermore, the clustered failures were unanticipated. This meant that in the period immediately following the bankruptcy of these banks, the Issuer may have

needed to form new partnerships in order to facilitate regular stablecoin operations. These circumstances offer a useful quasi-experimental setting, which we exploit to empirically test the impact of stablecoins on *new* partner banks holding and managing stablecoin deposits.

Using the matched transactions, we first examine whether a new set of partner banks provide payment services to the Issuer following March 2023. Although the stablecoin market has grown significantly over the years, the deposit base of the Issuer is not significant enough to materially impact the balance sheets of large financial institutions. We explicitly focus on non-systemically important banks for which stablecoin partnerships are more likely to be significant. This allows us to better identify the impact of stablecoins on the banking system as the stablecoin market grows.⁴ We use the “adjustment period”, the four-month period following March 2023, to identify top processors of matched payments by value.

Processing activity is highly concentrated throughout our sample. We focus our attention on the top three banks by processing value. Our matched dataset shows that these partner banks become significant providers in the post-period, collectively accounting for over three quarters of all matched transaction value in the latter half of the sample (Figure 5).

Our sample period coincides with changing financial conditions that could impact bank liquidity. In addition to other controls, we construct a control group of similarly-sized banks using publicly available Consolidated Reports of Conditions and Income report (Call Report). Specifically, we identify Call Report-filing domestic banks with Federal Reserve accounts and total assets that matches a narrow bound around the size of the treated banks at the end of 2021q4, excluding any banks classified as treated. In order to better match banks that have meaningful Fedwire payment activity, we further restrict to banks with sustained Fedwire participation, defined as having at least 300 business dates of activity in each of the two 18-month windows surrounding the interim period used to identify treated banks. The control group contains 49 banks and is held fixed across all analyses.

For banks newly providing stablecoin deposits in large quantities, we should observe a shift in size corresponding to inflows. Unsurprisingly, we find significant increases in size, measured by bank assets, in the post-period. Bank assets jump in March 2023 and increase over our post-period, representing an aver-

⁴Incidentally, this ex-ante choice does not bear significant impact on the selection process, as key partnerships inferred from our data are concentrated amongst this segment of the banking sector.

age increase of over \$2 bln. This suggests that stablecoin deposit flows represent meaningful changes in bank size on average, especially for the treated banks. We account for bank assets, either as a control or as a ratio, whenever appropriate.

4.1 Stablecoin Integration and Liquidity Spillovers to Banks

We examine whether treated banks experience differential changes in bank liquidity outcomes in the period following their stablecoin partnership, relative to the control group. As a baseline, we use a difference-in-difference (DiD) approach to study the window around March 2023. As noted earlier, the 4-month period starting in March 2023 serves as the adjustment period, during which new partnerships are formed. This adjustment period serves as a “grace period” during which large flows are expected, including for operational reasons. In order to identify the immediate changes at banks managing stablecoin deposits, we compare the 9-months prior to and following the adjustment period.⁵ The specification is given by:

$$y_{it} = treated_i * adjustment_t + treated_i * post_t + \alpha_i + \gamma_t + \epsilon_{it} \quad (16)$$

Here, y_{it} is the bank liquidity outcome of bank i on Fedwire business date t , and $treated_i$ is a dummy equaling 1 (0) for banks in our treatment (comparison) set. We use $adjustment_t = 1$ for dates corresponding to the interim adjustment period occurring on and after March 1st, 2023 and before July 1st, 2023. We use $post_t = 1$ for dates occurring on and after July 1st, 2023, which constitutes the primary post-treatment period of interest. Note that the $adjustment_t$ and $post_t$ dummies do not overlap; thus, their corresponding coefficients can be interpreted independently. All specifications include bank fixed effects α_i and a set of time fixed effects, with the most granular specification incorporating date fixed effects γ_t .

The liquidity channel operates through the increased liquidity demand that banks face from supporting stablecoin-related activity. To start, we directly test whether stablecoin partnerships coincide with greater liquidity demand on partner banks, which serves as the basis for liquidity shocks to be transmitted to the banking system vis-à-vis payment and deposit services. Increased payment de-

⁵Another reason we exclude the months following March 2023 is because it is as a selection criteria for treated banks.

mand associated with processing stablecoin primary market activity should translate into greater interbank payment activity. Consequently, we should observe that treated banks see significant increases in interbank payments in the post-period relative to control banks.

We observe statistically and economically significant increases in total interbank payment value for the treated banks relative to control banks. Results are summarized in Table 2. Specifically, in the post-period, treated banks experience an average increase in daily payment value of approximately \$658 mln relative to the control group. This constitutes a daily gross value increase of almost \$600 mln, and represents roughly a 67% increase in payment value relative to the pre-period levels.

The significant shift in payment activity faced by banks following partnerships supports the idea that stablecoin partnerships require banks to meet significant intraday liquidity obligations. In theory, stablecoin-related payments represent a series of shocks to banks' liquid balances. These payment obligations can transmit liquidity stress to banks by increasing the variation in banks' reserve balances.

Hence, stablecoin-driven payment shocks should directly impact the dynamics of bank liquidity. Namely, if stablecoin partnerships materially impact bank liquidity, then we should expect stablecoin primary market activity to rise as a key determinant for high-frequency bank liquidity conditions. This would strengthen the evidence on the liquidity channel, and also alleviate concerns regarding other macroeconomic factors operating during the sample period, such as shifts in monetary policy and bank market structure.

We extend our baseline specification by examining how partnerships resulted in changes in the dynamics between bank liquidity and stablecoin primary market activity. Specifically, we examine changes in the sensitivity of bank liquidity to stablecoin activity. To test this, we augment our baseline specification with a continuous daily measure of stablecoin flows, resulting in the triple-difference:

$$y_{it} = treated_i * post_t * activity_t + \alpha_{im(t)} + \varepsilon_{it}. \quad (17)$$

where we interact the $treated_i * post_t$ variable with $activity_t$, which is the total dollar value of stablecoin primary market activity on business date t . Given the focus in the post-period, we omit the adjustment period from our sample. With the triple-difference specification, we are now able to control for time-varying unobservable

factors at the bank level using bank-month fixed effects $\alpha_{im(t)}$. As before, we focus on a relatively narrow window of 9 months prior to and following the adjustment period. All results are summarized in Table 3.

First, we revisit the impact of partnerships on daily payment activity. Consistent with the notion that primary market activity should impact day-to-day payment activity, we find that daily payment activity increases in co-movement with primary market activity for treated banks following partnerships across all specifications. Primary market activity significantly impacts daily payment activity: following partnership, every \$1 in stablecoin activity coincides with \$0.323 in payment activity for the average treated bank. To offer perspective, a one-standard deviation increase in daily primary market activity translates into a 30.9% jump in daily payment activity relative to pre-period means.

Given the linkages between stablecoin primary markets and bank payment activity, primary market activity should rise as a nontrivial determinant of treated banks' intraday liquidity balance volatility. We examine three measures of high frequency liquidity volatility, using hourly bank reserve balances: daily standard deviation in reserve balances, realized variance in reserve balances, and the intraday range in reserve balances. These measures offer related but distinct proxies for characterizing intraday variation in bank liquidity.

By all three measures, we find a statistically significant increase in the sensitivity of treated banks' reserve balances to stablecoin primary market activity in the post-period. As shown in columns (3) and (4) of Table 3, the triple-difference estimates imply an increase in co-movement of approximately \$0.03 in the daily standard deviation of hourly reserve balances per \$1 in primary market activity, relative to control banks. These represent economically meaningful transmissions: a one-standard deviation increase in primary market activity translates into nearly a half-a-standard deviation increase in intraday reserve balance variation, and a 38% increase relative to the pre-period average. Results based on realized variance yield a similar pattern: a one-standard-deviation increase in daily primary market activity is associated with an increase corresponding to 25% of the pre-period average levels.

The intraday range estimates in columns (7) and (8) further support that treated banks experience larger within-day swings in reserve balances in response to short-run movements in stablecoin primary market activity. An increase in primary market activity of \$1 bln is estimated to result in \$90 mln increase in the

within-day range of reserve balances. A one-standard-deviation rise in stablecoin activity widens the range by 36% of the pre-period levels for treated banks.

Overall, increased sensitivity of bank liquidity conditions offer direct evidence of transmission and indicate that stablecoin activities markedly change the liquidity obligations faced by banks. Our theory predicts that banks servicing stablecoin deposits adjust their balance sheet to absorb stablecoin-related liquidity exposures. We explore this in the next section.

4.2 Impact on Bank Reserves and Lending

The significant increase in bank liquidity sensitivity to stablecoin primary market activity supports the view that stablecoin deposits transmit high-frequency liquidity shocks to banks. Importantly, banks' reserve balances, particularly at lower frequencies, are endogenously determined by the expected liquidity demand from their depositors. Banks, anticipating liquidity stress, should shift the composition of their assets to safe and liquid assets and claims, including bank reserves, as a precautionary measure. These ensure that banks can adequately service deposit outflows and other payment obligations. We test whether banks engage in precautionary reserve holdings by examining whether there is a shift in partner banks' reserve balances in the post-period.

To capture the broader impact of stablecoin liquidity exposure on banks' asset choices, we examine their impact on bank reserves over a longer horizon. We use the baseline DiD specification with monthly average bank reserve balances. We use quarterly total assets as a control or as a ratio to account for bank growth during this period.

Table 4 provides regression estimates with mean daily reserve balances for bank i over calendar month t as the outcome. In the adjustment period, we observe a significant increase in reserves for treated banks. These increases mechanically arise in the formation of partnerships, which require the Issuer to transfer money from other banks to new partners to be held in the form of deposits. If servicing stablecoin deposits did not materially impact liquidity risk exposures of the banks, then we should see subsequent drops in reserves that reflect reallocation of reserves to less-liquid but higher-yielding assets.

Instead, we find strong evidence of persistent upward shifts in reserve holdings for treated banks. In the post-period, treated banks increased their reserves

by about \$1.54 bln relative to control banks, and translates to a 147% increase relative to the treated banks' pre-period levels. Our findings on reserves are robust to normalizing by bank assets. The monthly reserve share of treated bank assets increases by about 8 pp relative to the control group in the post-period. Overall, treated banks' reserve-to-asset ratios more than double on average relative to their pre-period levels.

Banks' precautionary reserves represent a direct channel through which stablecoins impact the asset composition of banks. As stated in Implication 3, the need for liquidity directly impacts the ability of banks to use their stablecoin deposit base to support lending activity. Results are summarized in Table 5. Consistent with this, while partner banks grew significantly relative to control banks in the post-period, loan balances drop, after controlling for assets relative to peer banks. The drop in the loan-to-asset ratio is pronounced. In the post period, the quarterly share of loans dropped by 14 pp relative to the control group. This represents a 11.4% decrease for treated banks, relative to their pre-period levels.

Our results on the relative contraction in bank loans for treated banks are symptoms of narrow operations necessary to effectively manage stablecoin liquidity demands. The size of the stablecoin market during our sample period is not sufficiently large to effectively identify and estimate the impact on aggregate lending. However, treated banks in our analysis are a small subset of banks that are, relatively speaking, *beneficiaries* of stablecoin market growth. We demonstrate that even banks who experience large deposit inflows as bank partners of stablecoin issuers appear to materially change their lending activity to support stablecoins.

5 Robustness

5.1 Placebo Tests for Main Specifications

We show that our results are robust using randomization inference. We run placebo tests on results using the main difference-in-difference and triple-difference specifications, assigning treatment to all permutations of three banks within our 49-bank control group (18,424 in total), excluding the three treated banks. For each permutation, we hold the regression specification fixed and re-estimate the coefficient of interest, thereby constructing the full empirical distribution of placebo estimates. Within the distribution of placebo estimates, treated estimates across

all regression specifications (DiD and triple-differences) are outside of the one-sided 99th percentile. These results address concerns on the statistical inference problem with a small number of treated units.

5.2 Synthetic Control Method

We complement the difference-in-differences estimates with an augmented synthetic control method (SCM), using the control banks as the donor pool. The synthetic control approach addresses concerns that the control banks may not serve as adequate matches for the treated banks by constructing a data-driven counterfactual that closely tracks the treated unit’s pre-treatment trajectory and captures latent factors that might potentially drive the dynamics of bank liquidity and balance sheet outcomes.

We implement the ridge-augmented SCM estimation with unit fixed effects (Ben-Michael, Feller and Rothstein 2021). We adopt a concatenated specification, which stacks the three outcome series to simultaneously match the pre-treatment outcome-period moments, and yields a tighter pre-period fit than matching on any single outcome. This allows the synthetic control to capture common latent factors across the outcomes. We make several departures relative to the baseline approach. First, we aggregate outcomes to the quarterly frequency. This substantially reduces the periods in our sample, but allows us to implement the SCM across multiple outcomes and include balance sheet outcomes. Second, we take the average of the treated banks over the entire sample as a single treated unit. This focuses the analysis on the collective impact and abstract from potential dynamics of utilization between treated banks in the post-period. Third, we focus on three of the key normalized outcomes from the main analysis: average daily payments-to-assets, average daily reserves-to-assets, and loans-to-assets ratios at the quarterly frequency. The estimation window spans 6 quarters prior to and following the adjustment period, and the adjustment period is excluded. The control group serves as the donor pool; one bank is excluded due to incomplete quarterly coverage, resulting in a donor pool of 48 banks.

Figure 7 presents the estimated treatment effect for each outcome. The synthetic control closely fits the trends of the treated unit in the pre-period. In the post-period, the average treatment effect (ATT) estimates are large and sustained, consistent with results obtained from the DiD specifications. The average ATT es-

estimates are 0.050, 0.095, and -0.138 for payments-to-assets, reserves-to-assets, and loan-to-assets respectively, and are statistically significant at the 0.1% level, using a jackknife variance estimator over the donor pool (reported in Table 6).

These results are not driven by any individual donor.⁶ We conduct a “leave-one-out” (LOO) test, re-estimating the synthetic control weights by dropping one donor unit from the pool. For each LOO iteration, we report both the average post-treatment ATT and the dynamic ATT trajectories. The LOO estimates, overlaid in Figure 7, closely track the baseline synthetic control path for each outcome. The average ATT estimates from the LOO tests form tight bounds around main estimates, with [0.046, 0.056] for payments, [0.065, 0.127] for reserves, and [-0.168, -0.098] for loans-to-assets.

Finally, we complement the jackknife inference with a nonparametric placebo test following Abadie, Diamond and Hainmueller (2010). For each of the 48 donor units, we reassign treatment status and re-estimate the augmented SCM using the identical specification. We compute the average post-treatment ATT for each placebo re-assignment to construct an empirical distribution of placebo effects. As shown in Figure 8, treated estimates are outside of the 5th or 95th percentiles of the distribution of average ATT estimates.

6 Concluding Remarks

Fiat-backed stablecoins, by function and design, possess liquidity linkages to the banking system. Providing fast redemptions enhances the usability and value of stablecoins; they also give rise to a novel channel of bank disintermediation. The liquidity channel unambiguously strains bank functioning through liquidity shocks that transmit from stablecoin issuers to partner banks. Our results show that even the select banks that are able to attract stablecoin deposits face substantial increases in liquidity risk exposure. Individually, these banks manage these risks, in part by holding substantially larger quantities of bank reserves. Consequently, the relatively small share of bank deposits held by stablecoin issuers provides diminished support for bank lending activity.

Our analysis intentionally focuses on banks for which stablecoin issuers are likely to have a meaningful impact on. This provides a window into the broader liquidity implications of stablecoins on the banking system in a world with widespread

⁶The weight distribution is shown in Figure 6.

stablecoin adoption. One reasonable question is the extent to which the liquidity channel generalizes to large financial institutions. A rough back-of-the-envelope calculation: a proportional growth in the stablecoin market to \$3 tln translates into an increase in the stablecoin deposit base to more than \$450 bln in deposits – equaling roughly 15% of the average total reserves in the system in the last decade.

With greater stablecoin adoption, the liquidity channel can distort the distribution of bank reserves in two ways. First, it straightforwardly shifts reserves to a concentrated few banks providing core banking services for large stablecoin issuers. Second, these few banks require large quantities of reserves in order to manage stablecoin-related payments. Both contribute to increasing demand for reserves that complicates the determination of the optimal quantity of bank reserves (Afonso et al. 2022).

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7 Figures

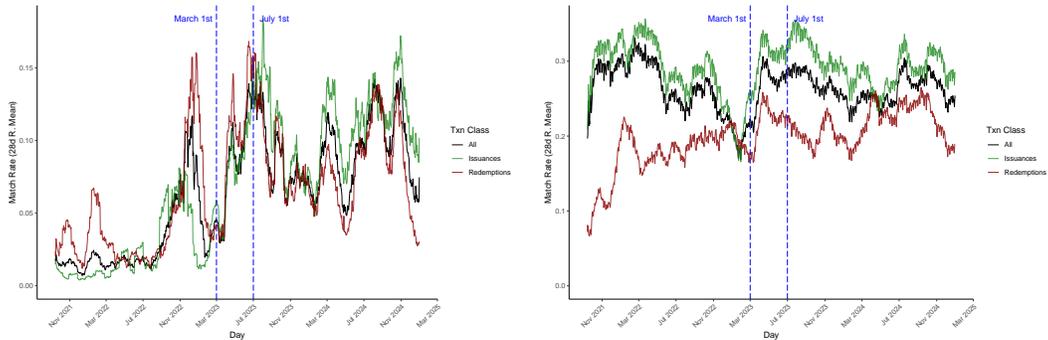


Figure 1: Daily match rates (smoothed) by value (left), volume (right) over the sample window. This figure plots daily match rates between on-chain primary market transactions and Fedwire payments over the sample window, using 28-day rolling means. Match rates are computed over a restricted set of target on-chain transactions. Matches are constructed at the transaction level based on exact amount equality (to the cent) and a 24-hour matching window. Vertical dashed lines mark March 1, 2023 and July 1, 2023, corresponding respectively to the onset of the March 2023 banking shock and the end of an interim adjustment period.

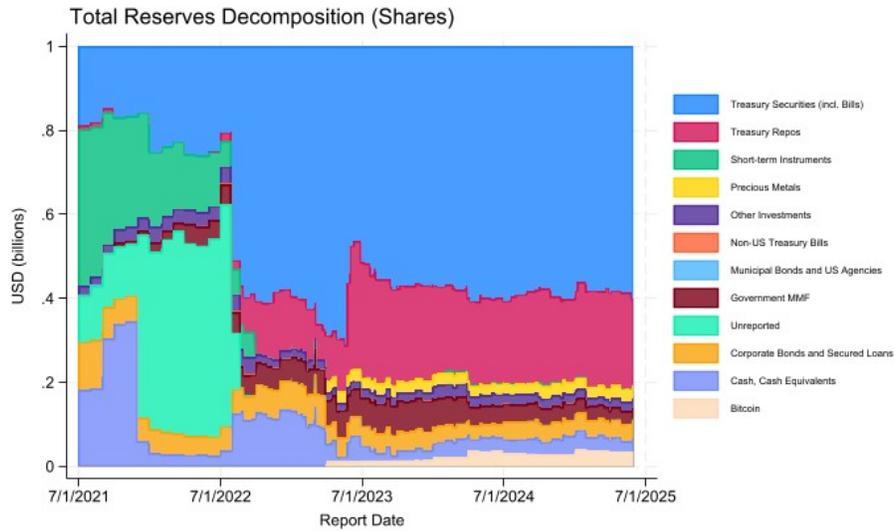


Figure 2: Decomposition of Stablecoin Reserves. This figure shows the composition of assets held as stablecoin reserves for multiple stablecoins, including USDT (Tether), USDC (Circle), FDUSD (First Digital), PYUSD (Paypal), RLUSD (Ripple), USDG (Paxos), BUSD (Binance), USD1 (World Liberty Financial), GUSD (Gemini), and USDP (Paxos), based on public disclosures.

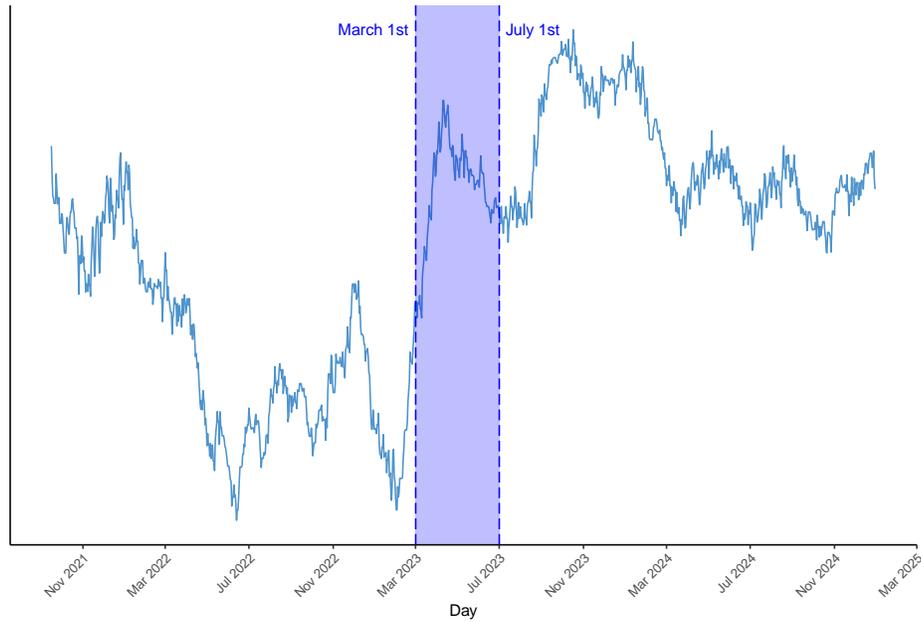


Figure 3: Daily difference (smoothed) in mean transaction delays between redemptions, issuances over the sample window. This figure plots the daily signed difference between mean transaction processing delays for redemptions versus issuances ($Delay_{Red.} - Delay_{Iss.}$) for matched stablecoin primary market transactions. On each day, matched transactions are partitioned into issuances and redemptions, and the daily mean delay is computed as the absolute time difference (in hours) between the on-chain transaction request and the corresponding off-chain Fedwire settlement. The daily series is smoothed using 60-day centered rolling averages. Vertical dashed lines mark March 1, 2023 and July 1, 2023, corresponding respectively to the onset of the March 2023 banking shock and the end of an interim adjustment period.

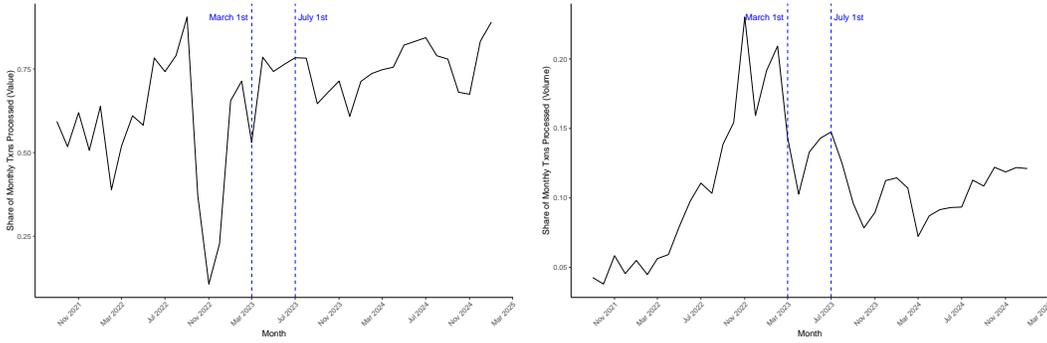


Figure 4: Monthly processing of matched transactions by top three processing banks by value (left), volume (right) over the sample window. This figure plots the monthly share of matched primary market transactions routed through the top three processing banks over the sample window. Vertical dashed lines mark March 1, 2023 and July 1, 2023, corresponding respectively to the onset of the March 2023 banking shock and the end of the interim adjustment period.

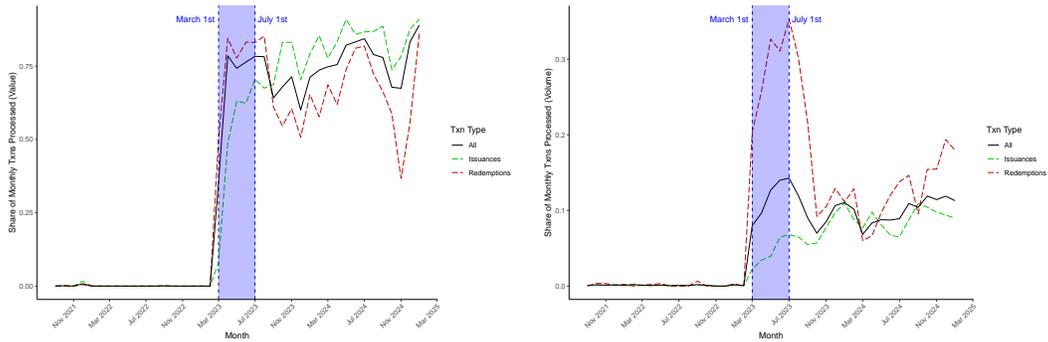


Figure 5: Monthly processing of matched transactions by three-bank treated set by value (left), volume (right) over the sample window (bank identities not disclosed; selected based on processing volume). This figure plots the monthly share of matched stablecoin primary market transactions processed by the treated banks over the sample window (9/1/2021 to 1/1/2025). Vertical dashed lines mark March 1, 2023 and July 1, 2023, corresponding respectively to the onset of the March 2023 banking shock and the end of an interim adjustment period.

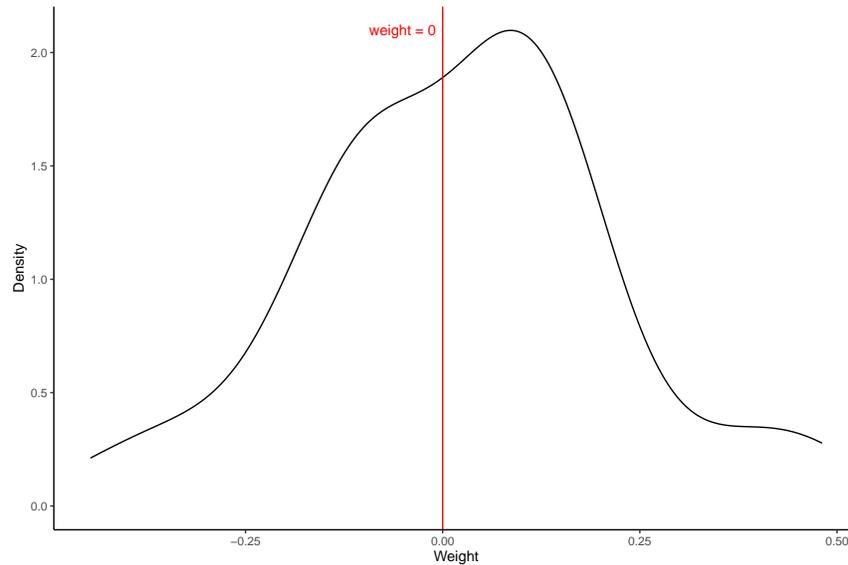


Figure 6: Distribution of synthetic weights across donors. This figure reports the distribution of donor weights from the baseline augmented synthetic control specification. The treated unit corresponds to the unweighted cross-sectional average of the treated banks at each quarter. Donor weights are constructed using the 48 control banks with complete quarterly coverage over the sample window, which spans 6 quarters prior to and following the adjustment period. Quarters overlapping with the adjustment period (2023q1 and 2023q2) are excluded from estimation. The matching procedure adopts a concatenated multi-outcome specification, jointly minimizing pre-treatment discrepancies in quarterly payments-to-assets, reserves-to-assets, and loans-to-assets ratios. Unit (bank) fixed effects are included, and the ridge-augmented SCM is implemented with the regularization parameter selected via cross-validation to minimize the mean squared error of the outcome model.

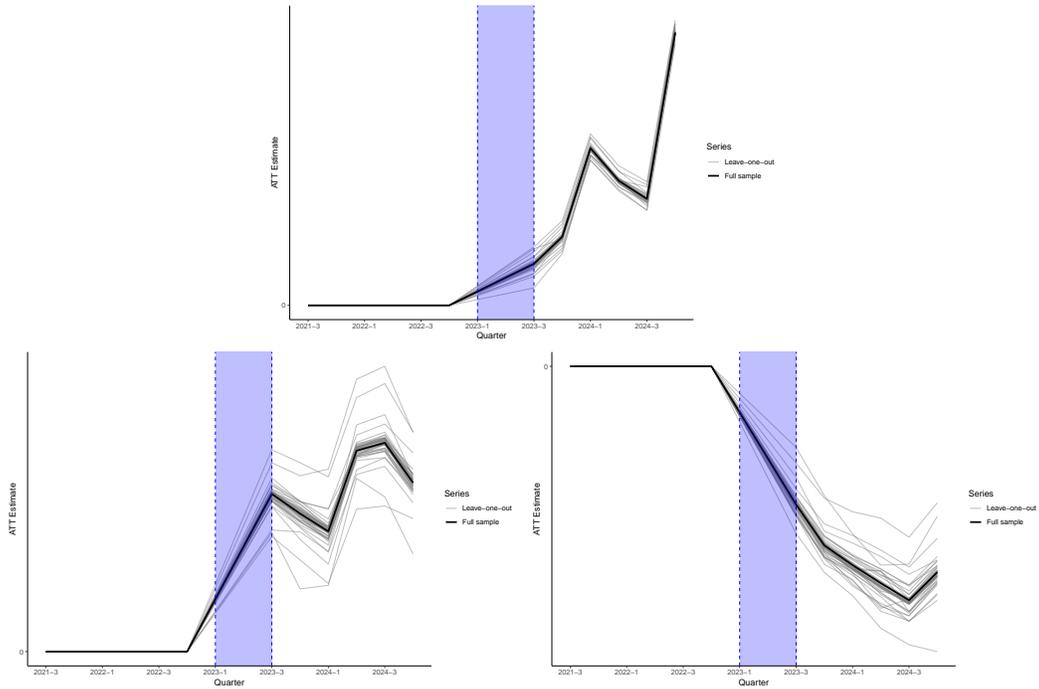


Figure 7: Distribution of synthetic ATT paths for payments-to-assets (top), reserves-to-assets (left), and loans-to-assets (right) across leave-one-out combinations. This figure presents the dynamic treatment effect estimates across the three asset-normalized quarterly outcomes under leave-one-out re-estimation of the baseline augmented synthetic control specification. In each iteration, one donor bank (of $n = 48$) is removed from the pool and the synthetic control weights are re-estimated using the remaining donors, while holding the specification fixed. The treated unit corresponds to the unweighted cross-sectional average of the three treated banks at each quarter. For each outcome, the full-sample ATT path is shown alongside the distribution of leave-one-out ATT paths. Vertical dashed lines mark 2023q1 and 2023q3, corresponding respectively to the onset of the March 2023 banking shock and the end of an interim adjustment period (omitted from the estimation).

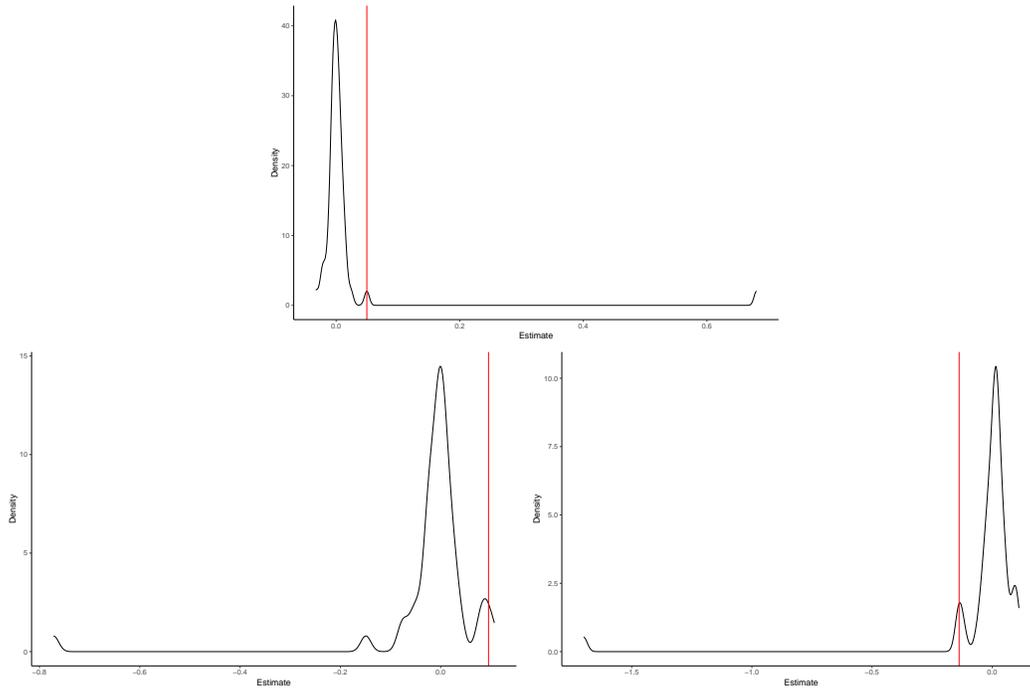


Figure 8: Distribution of synthetic DiD coefficients for payments-to-assets (top), reserves-to-assets (left), and loans-to-assets (right) for placebo test. This figure presents the empirical distribution of average post-treatment ATT estimates for the three asset-normalized quarterly outcomes under placebo re-assignment of treatment within the donor pool. For each of the 48 donor banks, treatment status is reassigned and the augmented synthetic control is re-estimated using the baseline specification. The “true” treated unit corresponds to the unweighted cross-sectional average of the three treated banks at each quarter. The vertical red line denotes the “true” post-treatment ATT estimate. Relative to the full signed distribution of placebo estimates (49 total combinations incl. the treated assignment), this estimate lies at the 97.92th percentile for payments-to-assets, the 97.92th percentile for reserves-to-assets, and the 4.17th percentile for loans-to-assets.

8 Tables

Table 1: Summary statistics by bank group. This table reports baseline balance sheet characteristics, payment activity outcomes, and sample composition for control and treated banks. Panel A reports group differences in balance sheet variables measured via Call Report at a fixed pre-treatment baseline (end of 2021q4). Panel B reports Fedwire outcomes as mean percent changes from the pre- to post-treatment period; percent changes are computed at the bank level and averaged within group. Panel C summarizes sample composition, including the number of banks and observed bank-dates in each period. All “dates” correspond to business dates of observed payment activity in the Fedwire system.

| Panel A: Baseline (2021q4) Bank Characteristics | | |
|---|---------|---------|
| <i>Difference in 2021q4 group means (Treated – Control)</i> | | |
| Total assets (bln) | | -2.4 |
| Total loans (bln) | | 1.7 |
| Loans / Assets | | 0.23 |
| Panel B: Daily Fedwire Outcomes (Pre to Post) | | |
| <i>Bank-level % change, averaged within group</i> | | |
| | Control | Treated |
| End-of-day reserves | 2.54% | 147.19% |
| End-of-day reserves / start-of-quarter assets | -7.23% | 118.80% |
| Daily Fedwire payments | -9.10% | 108.43% |
| Daily Fedwire payments / start-of-quarter assets | -16.72% | 103.48% |
| Panel C: Sample Composition | | |
| | Control | Treated |
| Number of banks | 49 | 3 |
| Bank-dates (pre) | 18,125 | 1,110 |
| Bank-dates (post) | 18,047 | 1,128 |
| Mean active dates per bank (pre) | 370 | 370 |
| Mean active dates per bank (post) | 376 | 376 |

Table 2: Partnership effect on daily Fedwire payment activity. This table reports difference-in-differences estimates of the effect of new partnership on banks' payment activity following the onset of partnership post-bank collapses. Each observation corresponds to a bank and a business day in the Fedwire system, and the dependent variable in columns (1)-(2) is the total daily value of Fedwire payments processed by the bank, measured in millions of dollars and aggregated across both incoming and outgoing payments. Columns (2) and (3) additionally normalize the raw measure by start-of-quarter total assets. The indicator "Post" equals one for business days on or after July 1, 2023. The indicator "Adjustment" equals one for business days between March 1, 2023 and June 30, 2023, capturing an interim partnership adjustment period following the March 2023 banking shock. The sample window is 6/1/2022 to 4/1/2024. Standard errors are two-way clustered by bank and business date and reported in parentheses.

| Dependent Variables: Model: | Daily payments (millions) | | Daily payments Start-of-quarter assets | |
|------------------------------------|---------------------------|---------------------|---|----------------------|
| | (1) | (2) | (3) | (4) |
| <i>Variables</i> | | | | |
| Adjustment | 14.67 (21.62) | | 7.59×10^{-5} (0.0012) | |
| Post | -37.35 (24.17) | | -0.0027** (0.0013) | |
| Treated \times Adjustment | 308.7** (120.3) | 308.4** (121.0) | 0.0262 (0.0181) | 0.0262 (0.0181) |
| Treated \times Post | 658.4** (323.0) | 658.0** (323.1) | 0.0423** (0.0209) | 0.0423** (0.0209) |
| Start-of-quarter assets (millions) | -0.0229 (0.0189) | -0.0225 (0.0193) | | |
| <i>Fixed-effects</i> | | | | |
| Bank | Yes | Yes | Yes | Yes |
| Year | Yes | | Yes | |
| Date | | Yes | | Yes |
| <i>Fit statistics</i> | | | | |
| Observations | 23,397 | 23,397 | 23,397 | 23,397 |
| R ² | 0.63464 | 0.65921 | 0.67451 | 0.69566 |
| Within R ² | 0.08264 | 0.08564 | 0.09442 | 0.09853 |

Clustered (Bank & Date) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 3: Shock transmission into payment activity and reserve volatility. This table reports triple-difference estimates of changes in daily co-movements between stablecoin primary market activity and various dollar measures of banks' liquidity volatility following the onset of partnership post-bank collapses. Each observation corresponds to a bank and a business day in the Fedwire system. The dependent variable in columns (1)-(2) is the total daily value of Fedwire payments processed by the banks. The dependent variables in columns (2)-(8) are volatility measures derived from end-of-hour reserve balances. "Total Activity" measures the aggregate dollar value of stablecoin flows on that business day, summed across issuances and redemptions. The indicator "Post" equals one for business days on or after July 1, 2023. Dates corresponding to the interim partnership adjustment period (3/1/2023 to 6/30/2023) are dropped from the sample. The sample window is 6/1/2022 to 4/1/2024. Standard errors are two-way clustered by bank and business date and reported in parentheses.

| Dependent variable: Model: | Daily payments | | EOH balance SD | | Realized EOH balance vol. | | High-low EOH balance range | |
|---|----------------------|--|---------------------|--|---------------------------|---|----------------------------|---|
| | Raw (1) | /Assets (2) | Raw (3) | /Assets (4) | Raw (5) | /Assets (6) | Raw (7) | /Assets (8) |
| <i>Variables</i> | | | | | | | | |
| Total Activity | -0.0011 (0.0037) | -4.1×10^{-14} (2.14×10^{-13}) | -0.0002 (0.0004) | -7.38×10^{-15} (2.51×10^{-14}) | 0.0001 (0.0014) | 2.26×10^{-14} (8.08×10^{-14}) | -0.0002 (0.0012) | 2.55×10^{-15} (7.38×10^{-14}) |
| Treated \times Total Activity | -0.0068 (0.0152) | 1.67×10^{-13} (1.27×10^{-12}) | 0.0004 (0.0020) | 1.24×10^{-13} (1.9×10^{-13}) | -0.0033 (0.0043) | -3.84×10^{-14} (3.56×10^{-13}) | -0.0015 (0.0048) | 1.06×10^{-13} (4.31×10^{-13}) |
| Post \times Total Activity | 0.0230 (0.0210) | 1.23×10^{-12} (1.15×10^{-12}) | 0.0021 (0.0020) | 1.34×10^{-13} (1.34×10^{-13}) | 0.0001 (0.0061) | -5.99×10^{-14} (3.68×10^{-13}) | 0.0043 (0.0062) | 2.14×10^{-13} (3.9×10^{-13}) |
| Treated \times Post \times Total Activity | 0.3083** (0.1525) | 1.79×10^{-11} *** (6.31×10^{-12}) | 0.0290* (0.0156) | 1.39×10^{-12} ** (6.5×10^{-13}) | 0.0593*** (0.0212) | 3.18×10^{-12} ** (7.59×10^{-13}) | 0.0937** (0.0461) | 4.66×10^{-12} ** (1.93×10^{-12}) |
| <i>Fixed-effects</i> | | | | | | | | |
| Bank-Month | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>Fit statistics</i> | | | | | | | | |
| Observations | 19,011 | 19,011 | 18,649 | 18,649 | 18,649 | 18,649 | 18,649 | 18,649 |
| R ² | 0.82424 | 0.83070 | 0.45519 | 0.42251 | 0.58378 | 0.52981 | 0.55980 | 0.51127 |
| Within R ² | 0.00406 | 0.00366 | 0.00125 | 0.00108 | 0.00057 | 0.00043 | 0.00150 | 0.00107 |

Clustered (Bank & Date) standard-errors in parentheses
Signif. Codes: ***, 0.01, **, 0.05, *, 0.1

Table 4: Partnership effect on monthly reserves. This table reports difference-in-differences estimates of the effect of new partnership on banks' reserve holdings following the onset of partnership post-bank collapses. Each observation corresponds to a bank and a calendar month, and the dependent variable in columns (1)-(2) is the monthly unweighted mean of the bank's end-of-day closing reserve balances, measured in millions of dollars. Columns (3) and (4) additionally normalize the raw measure by start-of-quarter total assets. The indicator "Post" equals one for business days on or after July 1, 2023. The indicator "Adjustment" equals one for business days between March 1, 2023 and June 30, 2023, capturing an interim partnership adjustment period following the March 2023 banking shock. The sample window is 9/1/2021 to 1/1/2025. Standard errors are two-way clustered by bank and calendar month and reported in parentheses.

| Dependent Variables: Model: | Monthly reserves (millions) | | Monthly reserves Start-of-quarter assets | |
|------------------------------------|-----------------------------|-----------------------|---|-----------------------|
| | (1) | (2) | (3) | (4) |
| <i>Variables</i> | | | | |
| Adjustment | 161.9*** (18.46) | | 0.0085*** (0.0006) | |
| Post | 189.5*** (48.66) | | 0.0104*** (0.0029) | |
| Treated × Adjustment | 1,219.4*** (209.7) | 1,217.4*** (197.6) | 0.0754*** (0.0062) | 0.0754*** (0.0059) |
| Treated × Post | 1,546.3** (613.2) | 1,539.1** (606.0) | 0.0779*** (0.0272) | 0.0779*** (0.0272) |
| Start-of-quarter assets (millions) | 0.0106 (0.0203) | 0.0219 (0.0188) | | |
| <i>Fixed-effects</i> | | | | |
| Bank | Yes | Yes | Yes | Yes |
| Year | Yes | | Yes | |
| Month | | Yes | | Yes |
| <i>Fit statistics</i> | | | | |
| Observations | 2,055 | 2,055 | 2,055 | 2,055 |
| R ² | 0.53211 | 0.59788 | 0.44423 | 0.48765 |
| Within R ² | 0.11432 | 0.12452 | 0.04997 | 0.04909 |

Clustered (Bank & Month) standard-errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 5: Partnership effect on quarterly lending. This table reports difference-in-differences estimates of the effect of new partnership on banks' quarterly lending outcome. The dependent variable in column (1) is end-of-quarter total loan value, measured in millions of dollars, with column (2) additionally normalizing by end-of-quarter total assets. The "Post" variable equals one for quarters on or after 2023q3, and the "Adjustment" variable equals one for quarters 2023q1 and 2023q2. The sample window covers all quarters from 2021q3 through 2025q1. Standard errors are two-way clustered by bank and quarter and reported in parentheses.

| Dependent Variables: | End-of-quarter loans (millions) | End-of-quarter loans End-of-quarter assets |
|----------------------------------|---------------------------------|---|
| Model: | (1) | (2) |
| <i>Variables</i> | | |
| Treated × Adjustment | -1,606.6*** (511.1) | -0.1097*** (0.0227) |
| Treated × Post | -2,000.0*** (629.5) | -0.1394*** (0.0228) |
| End-of-quarter assets (millions) | 0.6877*** (0.0271) | |
| <i>Fixed-effects</i> | | |
| Bank | Yes | Yes |
| Quarter | Yes | Yes |
| <i>Fit statistics</i> | | |
| Observations | 770 | 770 |
| R ² | 0.98996 | 0.91395 |
| Within R ² | 0.88327 | 0.23964 |

Clustered (Bank & Quarter) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6: Average ATT effects using synthetic controls. This table reports the average post-treatment ATT estimates from the baseline augmented synthetic control specification for quarterly payments-to-assets, reserves-to-assets, and loans-to-assets ratios. The treated unit corresponds to the unweighted cross-sectional average of the treated banks at each quarter. Donor weights are constructed using the 48 control banks with complete quarterly coverage over the sample window, which spans 6 quarters prior to and following the adjustment period. Quarters overlapping with the adjustment period (2023q1 and 2023q2) are excluded from estimation. The matching procedure adopts a concatenated multi-outcome specification, jointly minimizing pre-treatment discrepancies in quarterly payments-to-assets, reserves-to-assets, and loans-to-assets ratios. Unit (bank) fixed effects are included, and reported p-values are derived from the ridge outcome model-based variance estimator described in (Ben-Michael et al. 2021).

| Outcome | Estimate | p-value |
|--------------------|----------|---------|
| Payments-to-assets | 0.0497 | 0.001 |
| Reserves-to-assets | 0.0954 | 0.001 |
| Loans-to-assets | -0.138 | 0.001 |

9 Proofs

Proof of Proposition 1 and 2. We consider the three cases.

Case 1. $\mu \leq 1 - \sigma$

Maximize μ conditional on constraint yields:

$$(1 - \sigma)E[\tilde{r}^L] - \bar{c} - c(1 - (1 - \gamma)\sigma) \quad (18)$$

Organized with respect to σ :

$$E[\tilde{r}^L] - (\bar{c} + c) - \sigma \left(E[\tilde{r}^L](1 - \gamma)c \right) \quad (19)$$

Case 2. $\mu \in \left(1 - \sigma, 1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1 + A_2} \right) \right]$

Maximize μ conditional on constraint:

$$(1 - \sigma + 2\gamma\sigma)E[\tilde{r}^L] - \bar{c} - c(1 - (1 - \gamma)\sigma) - \frac{1}{2}2\gamma\sigma(k + c) \quad (20)$$

Organized with respect to σ :

$$E[\tilde{r}^L] - (\bar{c} + c) - \sigma \left(E[\tilde{r}^L](1 - \gamma)c \right) + 2\gamma\sigma \left(E[\tilde{r}^L] - \frac{1}{2}(k + c) \right) \quad (21)$$

which dominates Case 1 if $E[\tilde{r}^L] > \frac{1}{2}(k + c)$.

Case 3. $\mu > 1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1 + A_2} \right)$

Investment levels in this region results in a jump in wholesale funding cost:

$$\left[(1 - \sigma)E[\tilde{r}^L] - \bar{c} - c(1 - (1 - \gamma)\sigma) \right] + 2\gamma\sigma \left(E[\tilde{r}^L] - \frac{1}{2}(k + c) \right) + d \left(E[\tilde{r}^L] - (k + c) \right) \quad (22)$$

where d is $\mu - \left(1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma)\frac{A_2}{A_1 + A_2} \right) \right)$. Reorganizing:

$$E[\tilde{r}^L] - (\bar{c} + c) - \sigma \left(E[\tilde{r}^L] - (1 - \gamma)c \right) + 2\gamma\sigma \left(r^L - \frac{1}{2}(k + c) \right) + d \left(E[\tilde{r}^L] - (k + c) \right) \quad (23)$$

Since $E[\tilde{r}^L] - (k + c) < 0$ is assumed, never desirable to fund wholesale with certainty. Together, this implies that $\mu \in (1 - \sigma, 1 - \sigma + 2\gamma\sigma(1 - (1 - \gamma)\frac{A_2}{A_1 + A_2})]$ dominates.

Bank total deposits at the end of $t = 1$ are

$$A_1 = 1 - \sigma + 2\gamma\sigma + D_1^f = 1 - \sigma + 2\gamma\sigma \quad (24)$$

$$A_2 = 1 - \sigma + D_2^f = 1 - \sigma + (\mu - (1 - \sigma)) = \mu \quad (25)$$

Equilibrium μ is given by:

$$\mu = (1 - \sigma) + 2\gamma\sigma \left(1 - (1 - \gamma) \frac{A_2}{A_1 + A_2} \right) \quad (26)$$

$$= (1 - \sigma) + 2\gamma\sigma \left(1 - (1 - \gamma) \frac{\mu}{1 - \sigma + 2\gamma\sigma + \mu} \right) \quad (27)$$

Substituting in expressions, and solving for μ^* yields:

$$\mu^* = -\gamma\sigma(1 - \gamma) + \sqrt{(\gamma\sigma(1 - \gamma))^2 + (1 - \sigma + 2\gamma\sigma)^2} \quad (28)$$

which strictly decreases in σ .

For $\mu = 1 - \sigma + 2\gamma\sigma \left(1 - (1 - \gamma) \frac{A_2}{A_1 + A_2} \right)$, bank 2 lends the exact quantity such that the reserve balance at the end of $t = 1$ is 0. For bank 1, the reserve balance is given by $1 - \sigma + 2\gamma\sigma - \mu^*$. Taking the first derivative:

$$\frac{2(2\gamma - 1)(2\gamma\sigma - \sigma + 1) + \gamma(1 - \gamma)^2}{2\sqrt{\gamma(1 - \gamma)^2\sigma + (2\gamma\sigma - \sigma + 1)^2}} - (1 - \gamma)\gamma \quad (29)$$

which is positive for $\sigma > 1 - \frac{1}{\sqrt{2}}$. For $\sigma < 1 - \frac{1}{\sqrt{2}}$, (29) monotonically increases in γ . Since $1 - \sigma + 2\gamma\sigma - \mu^*$ is strictly increases in σ for $\gamma \rightarrow 1/2$, there exists some $\bar{\gamma} < \frac{1}{2}$ such that for $\gamma > \bar{\gamma}$, M_1 increases in σ .

□