Stablecoins and the real economy*

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PRELIMINARY, COMMENTS WELCOME

Abstract

The market capitalization of stablecoins – crypto-assets aiming at maintaining their value stable, and generally pegged to a fiat currency – has skyrocketed over the past year. This paper documents one implication for the real economy. Issuers of the main stablecoins back the value of their tokens on short-term debt denominated in US dollar, such as commercial papers that are key for the funding of banks and firms. We show that changes in the stablecoin market capitalization are correlated with the issuance of commercial papers and their interest rates, and run placebo tests to confirm these findings.

JEL: G14, G23, G29

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1 Introduction

Until recently, the effects of crypto-assets on the real economy were envisioned as a remote conceptual possibility. One reason is that crypto-assets are a highly volatile asset class, and, as such, are seen as too volatile to fulfill the functions performed by fiat currencies. Since January 2020, the annualized volatility of Bitcoin, for instance, stands around 70%, 6 times the volatility of commodities like Gold or Oil, more than twice the volatility of S&P 500, and 10 times the volatility of EURUSD exchange rate.[1] Another reason is that crypto- and real-assets markets were seen as completely distinct, without spillover risks. However, the development of new financial instruments (eg. listed funds and ETFs on crypto-assets) and new types of crypto-assets such as stablecoins may have already blurred the frontier between crypto-assets, traditional financial markets and the real economy.

Stablecoins are a specific category of crypto-assets aiming at maintaining their value stable against a benchmark asset, generally a fiat currency like the US dollar, and more marginally to commodities like Gold, or other crypto-assets. Beyond fintechs, large companies among the financial industry (JPM Coin by JP Morgan) and the bigtech (Facebook's Libra – now Diem – proposal) have shown interest in issuing such tokens. By overcoming the extreme volatility of other crypto-assets, stablecoins serve more and more as liquidity vehicles — a kind of "safe asset" – for the digital world. The development of stablecoins draws particular attention from regulators, from a number of reasons ranging from anti-money-laundering concerns, tax-evasion, to financial stability risk.

Main stablecoins are asset-backed or "collateralized" by reserve assets denominated in the fiat benchmark currency (mainly, the US dollar). This is how they maintain a relatively stable value but this may also pave the way for financial stability issues. The main stablecoin issuers generally promise redeemability at par with the US dollar and would accordingly sell the USD-denominated reserve assets if the demand for the stablecoin decreases. This mechanism may in return destabilize the markets in which reserves are held – an extreme version being a run on the stablecoin causing a sell-off in USD-denominated assets. In this sense, the stablecoin industry bears similiarities with money market funds – while still unregulated and far less transparent – that have been in the past at the core of such kind of mechanisms (Schmidt et al., 2016; Gorton and Zhang, 2021).

Stablecoins' reserve assets are held in part in commercial papers, that is, short-term debt issued by financial and non-financial corporates. In this paper, we test whether the evolution of stablecoins' market capitalization have influenced this market. We show that

[1] Computed from daily log return between January 2020 and September 2021, using Bloomberg data.

the extra demand from stablecoins issuers may already affect the supply and the rates of commercial papers. Therefore, stablecoins may already have a destabilizing impact on the short-term debt market denominated in US dollar. Even absent run mechanisms, conversion of stablecoins tokens into US dollar would induce selling pressures on the relatively illiquid commercial paper market. In addition, the apparition of persistent liquidity premium on commercial papers, stemming from stablecoins' demand, would also provide an incentive to corporates to issue more of this type of debt, exposing themselves to a higher roll-over risk that could materialize for reasons more related to developments on the crypto-assets markets (Bitcoin crash, regulatory shocks, tweets, etc...) rather than the real economy.

Our paper is connected to the nascent literature on stablecoins, their peg mechanisms and their potential risks (G7, 2019; ECB, 2020; Arner et al., 2020; IMF, 2021) especially in light of financial history (Schmidt et al., 2016; Frost et al., 2020; Gorton and Zhang, 2021), and in relation with their interactions with other crypto-assets (Lyons and Viswanath-Natraj, 2020; Griffin and Shams, 2020; Kozhan and Viswanath-Natraj, 2021). Our investigation on the link between stablecoins, their reserve assets and the real economy via the short-term debt market borrows to the liquidity premium literature, in which the demand for money-like asset explain a premium attached to commercial papers (Krishnamurthy and Vissing-Jorgensen, 2012; Sunderam, 2015; Nagel, 2016). As a consequence, commercial paper issuers may strategically issue more of this type of short-term debt, which bears consequences individually for their roll-over risk, and ultimately, in aggregate, for financial stability (Stein, 2012; Kacperczyk et al., 2021).

The remaining of the paper is organized as follow: Section 2 details the plumbing of stablecoins and explains how they are linked to the real economy, through their pegging mechanisms. Section 3 lays out our hypotheses on the possible links between the rise in the stablecoins demand and the commercial paper market, and our empirical strategy. Section 4 provides our results, both on the issuance of commercial paper and their rates. We find a positive correlation between issuance of certain types of commercial papers and stablecoins market cap, and a negative correlation with some of their rates. We confirm these results by running placebo tests using other money-like assets than commercial papers. Section 5 provides policy implications and concludes.

2 Stablecoins and the link with the real economy

In this section, we first describe how the main stablecoins work, their recent evolution and their peculiar role as safe asset of crypto-assets. We then show how stablecoins achieve stability and the parallel with currency board and central banks intervention under fixed exchange rate regime. Finally, we discuss the reserve compositions of Tether and USD Coin, the two most important stablecoins and their implications for the funding of the real economy.

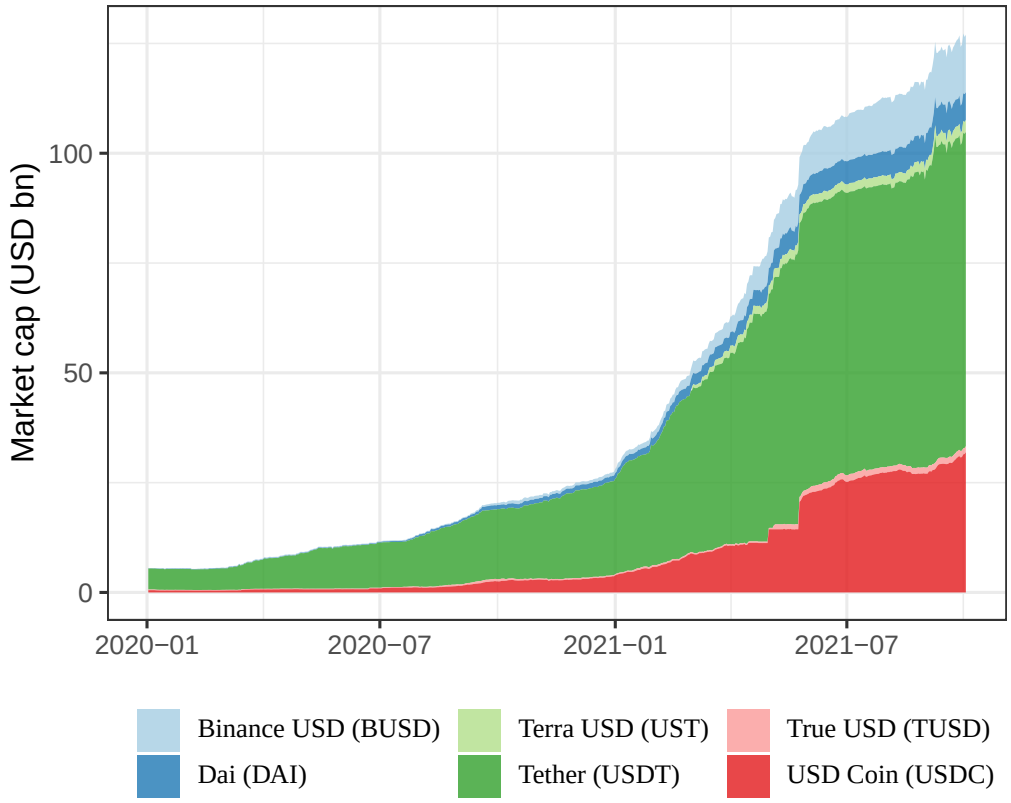
2.1 How to explain the growth of stablecoins ?

The number of new stablecoins soared in the past couple of years (67 stablecoins are registered by Coinmarketcap, as of September 2021), but the largest stablecoins in terms of market capitalization are all asset-backed. As shown on Fig. 1, as of 16 September 2021, the market capitalization of stablecoins stands at more than 126 bn USD, while that of all crypto-assets stands at 2,185 bn USD according to CoinMarketCap. Five stablecoins exceed 1 bn USD. The three most important stablecoins are Tether (USDT), USD Coin (USDC) and Binance USD (BUSD) with a market capitalisation of 68 bn USD, 29 bn USD and 13 bn USD respectively. The three stablecoins are pegged to the US dollar, and build on stabilization mechanisms detailed below.

Fig. 2 below shows the average daily volumes exchanged between the 3 largest stablecoins (USDT, UDSC, BUSD), the 3 largest crypto-assets (BTC, ETH, ADA) – in terms of market capitalization – and the US dollar. Noticeably, the largest volumes are by far concentrated between stablecoins and the other crypto-assets. As highlighted by Gensler (2021), *"nearly three-quarters of trading on all crypto trading platforms occurred between a stablecoin and some other token"*. Fig. 7 shows the evolution of the same bilateral volumes, in 2018 and in 2021 to illustrate the changing landscape between fiat, stablecoins and crypto-assets. Fig. 9 also suggests that in the past year, volumes traded in the two main stablecoins have been correlated with th evolution of Bitcoin prices.

This suggests that the growth of stablecoins has to do with the growth of other crypto-assets, to serve as a stable store of value, as the nearest "safe-asset" available in the crypto-asset space. The intrication between stablecoins and crypto-assets could even go deeper. Griffin and Shams (2020) demonstrate the strong links between the supply of Tether and Bitcoin price developments. More specifically, flows of Tether are correlated with predictable trading patterns in Bitcoin and participated to inflating its price in 2017. Conversely, negative

Figure 1: Stablecoins' market capitalization

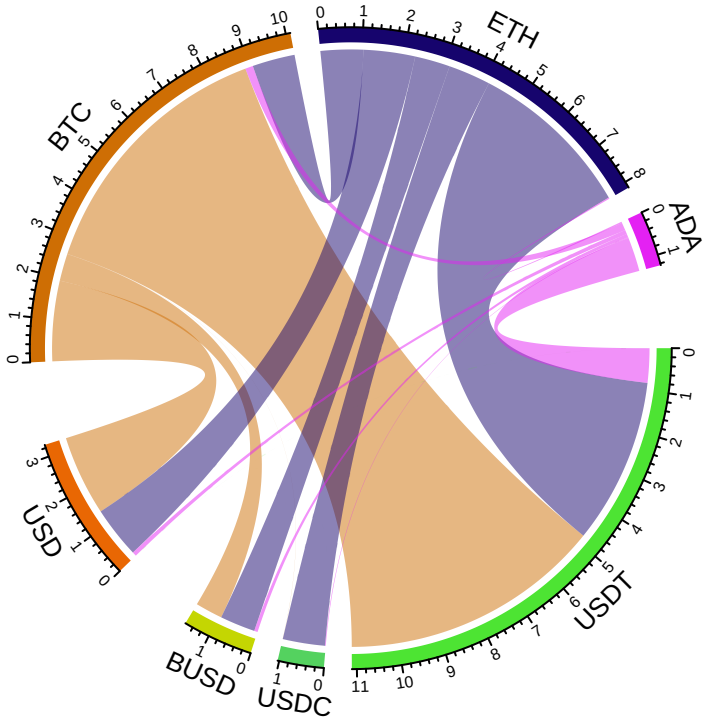


Note: This figure reports the evolution of the 6 largest stablecoins by market capitalization, as of October 2021. Latest observation: 2021-10-02. Market capitalization is the circulating supply times the market price. Source: CoinMarketCap, Messari.

returns on Bitcoin predict flows in Tether, suggesting they serve as temporary store of value to invest, exit or support more volatile crypto-assets.

As a "safe-asset" digital analogue, stablecoins are the natural asset in which stop-loss and take-profits orders should be denominated. In addition, Makarov and Schoar (2020) explain that certain platforms only authorize trading between crypto-assets and stablecoins, but not fiat currencies. This includes major exchanges Poloniex, Binance, and Bittrex. Thus, stablecoins are used to settle crypto transactions and can easily be exchanged for other crypto tokens, making them the most convenient instrument for arbitraging the potential mispricing between crypto-assets across exchanges (Lipton et al., 2020). Stablecoins can also be swapped or repo-ed against other crypto-assets and this offers ways to build leveraged and short positions. Note also that holders of Tether or Circle tokens may be remunerated for lending their crypto tokens, for instance to back decentralised financial applications (Bundesbank,

Figure 2: Average traded volumes between the 3 largest crypto and 3 largest stablecoins in terms of market capitalization and the US dollar, in USD bn



Note: Average daily volumes between pairs, over one year (Sept 2020-Sept 2021) based on Cryptocompare API data, which states they aggregate transaction data for each pair traded on about 70 exchanges. All volumes amounts converted in US dollar. The chords' width reflect the volume traded in each pair, in billion USD.

2021), either to centralized exchanges, such as Binance[2], or onto decentralized exchanges, such as Curve.fi or Uniswap.

The use of stablecoins may also be related to circumventing capital controls (Makarov and Schoar, 2020), or exempting exchanges from the legal consequences of operating in fiat currencies: Griffin and Shams (2020) explain that *"operating based on digital stable coins rather than fiat currency further relaxes the need for these entities to establish a legitimate fiat banking relationship"*, imposing in return KYC and anti money-laundering procedures.

Finally, taxation may indirectly support the use of stablecoins, in particular for investors engaged in active trading. The reason is capital gains on Bitcoin, for instance, are taxed if and only if they are converted in USD, but not if they are converted in stablecoins. In the

[2]On Binance, the annualized interest rates that investors can obtain from lending their USDC/USDT tokens are between 0.6 and 4.24% in annualized interest rates, see Jensen et al. (2021)

US, IRS treats virtual currencies as property[3], and thus capital gains in Bitcoin are taxed in a similar manner to stocks.

2.2 How do stablecoins achieve stability ?

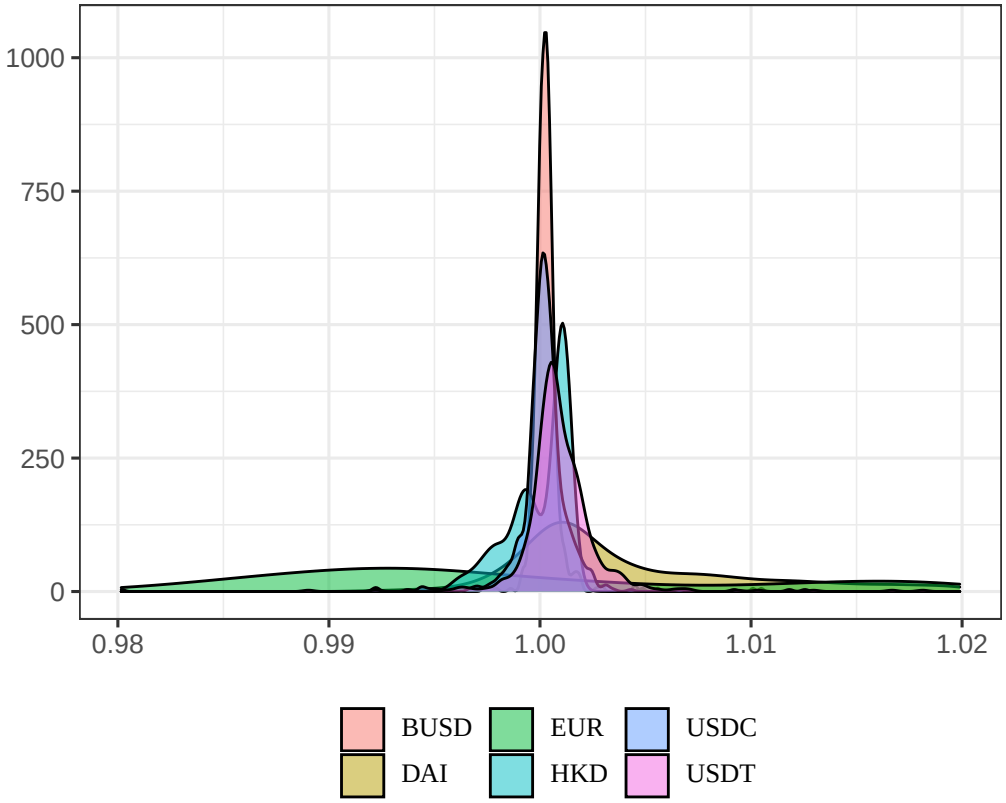
The major stablecoins have been so far quite successful to maintain their peg, and thus exhibit a volatility comparable to fiat currencies. Over the recent period, they are even less volatile than a floating exchange rate like EURUSD, and as stable as pegged fiat-currencies. Fig. 3 shows the dispersion of exchange rates against the US dollar since July 2020 of: a floating currency (EUR), a pegged currency (HKD), the three main stablecoins (USDT, USDC, BUSD) and an example of a non-fiat backed stablecoin (DAI).

Keeping stablecoins stable echoes the objectives of other financial institutions in other contexts: a currency board to ensure fixed exchange rates, money funds that guarantee a stable value of their shares, or narrow banks that receive deposits backed by only safe and liquid assets. In the context of stablecoins, several mechanisms have been outlined in whitepapers, and some of them implemented by the various stablecoins in the market: backing the value of stablecoin by reserves held in the benchmark fiat currency, "interventions" similar to foreign exchange interventions to defend the peg, or backing by other assets than the benchmark fiat currency and relying on over-collateralization. Technically, several solutions are envisioned, either by centralizing the issuance by an institution that holds the reserve assets – on-chain or off-chain meaning the property of these reserves assets can be hardcoded in the blockchain or not – or via decentralized contracts and issuance, relying on a "proof of reserves"(Arner et al., 2020; ECB, 2020).

The main stablecoins are collateralized by assets denominated in the national currency to which the stablecoin is pegged (USDT, USDC, BUSD...), held by an institution. But there are few noticeable exceptions. For instance, DAI — whose market capitalization is around 6 bn USD as of end September 2021– is a decentralized collateral-backed stablecoin soft-pegged to the US Dollar (Kozhan and Viswanath-Natraj, 2021). The collateralization is done through a smart contract programmed on Ethereum implementing a repo-like contract based on multiple crypto-assets, applying conservative haircuts to guarantee the convertibility at par in the benchmark asset. Finally, some stablecoins are not collateralized and stability is supposed to be warranted by an algorithmic approach, either automatized market interventions or providing incentives to market participants to keep the token's value stable. They are still marginal so far: none of them have succeeded in becoming a large player. Table 1 describes

[3] https://www.irs.gov/pub/irs-drop/n-14-21.pdf

Figure 3: Dispersion of exchange rates against the US dollar: floating fiat currency (EUR), pegged fiat currency (HKD), and stablecoins (USDT, USDC, BUSD, DAI)



Note: Density plot of the daily end-of-day exchange rates data from Stablecoinindex, Yahoo finance, between July, 1st 2020 and Sept, 17th 2021. EUR and HKD are expressed in deviation from their mean over this period. Distribution shown for EUR is trimmed to the [0.98-1.02] interval.

8 stablecoins to show the different mechanisms used to stabilize their value.

In the "reserve assets" approach, one solution is for an institution issuing a stablecoin to commit to buy and sell the stablecoin token at par with the dollar at any time: tokens are then redeemable on demand against the benchmark asset denominated in fiat currency. To be credible, reserves must be held in the most liquid asset like cash equivalent. The two key ingredients for the success of the peg are: firstly, the adequacy of reserves and its public availability in real time for redemption. The adequacy means that the outstanding reserves are large enough and liquid enough to allow the issuer to buyback the tokens at the pegged price sufficiently fast. Secondly, the issuing firms should be ready (or commit) to intervene to limit exchange rate fluctuations. However, if the issuing firm succeeds in convincing market participants that the value will be almost stable, then arbitrageurs that buy when the price

Table 1: Some stablecoins and their policy to ensure stability

Stablecoin project	Governance	Asset-backed	Algorithmic backing
Tether (USDT)	centralized	real assets	no
Circle (USDC)	centralized	real assets	no
Binance (BUSD)	centralized	real assets	no
DAI (DAI)	decentralized	crypto assets(1)	no
Reserve (RSV)	decentralized	crypto assets(1)	no
Terra (LUNA)	decentralized	no	incentivized intervention
Ampleforth (AMPL)	decentralized	no	automatic intervention

Note: (1) crypto-assets (including stablecoins) held in backing are not accepted at face value but with a haircut, a feature often nicknamed "over-collateralization".

is low and sell when high may suffice to stabilize the stablecoin price absent any intervention by the issuing firm.

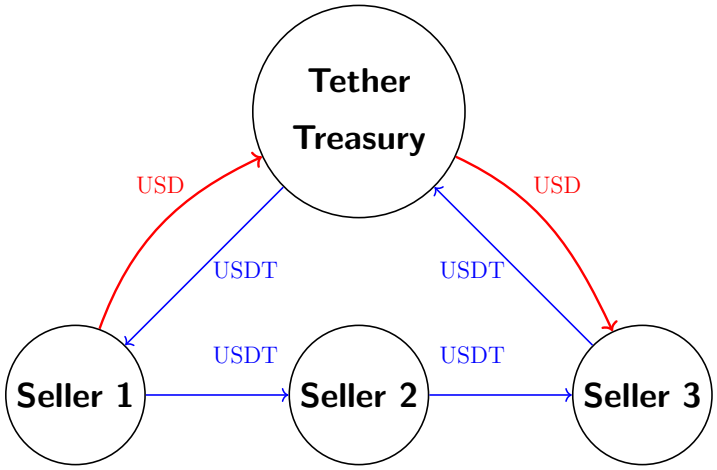
In the case of Tether, all Tether tokens are purportedly backed one-to-one with the US dollar by Tether Limited holdings in reserves assets.[4] The holder of a token can either trade for another crypto-asset or USD on a platform (Kraken, Binance, Bitfinex...) or directly trade with Tether Treasury, responsible for the creation and destruction of tokens and where Tether tokens holder can redeem their tokens against USD at par.

Tether tokens are available on multiple blockchains: Ethereum, Tron, EOS, Liquid, Algorand, SLP, Solana, and Omni layer (Bitcoin) blockchains. Tether Treasury issues and absorb tokens on each blockchain. The vast majority of tokens circulate on Omni, Ethereum, and Tron. Interestingly, it can be verified from the adresses owned by Tether Treasury on various blockchains that it actually holds very large positions in USDT.[5] According to Lyons and Viswanath-Natraj (2020), Tether Limited has formally stated that it does not intervene in secondary markets to stabilise the market price. The authors show that the maintaining of the peg is mainly achieved by market forces: Some arbitrageurs buy tokens when the price is below the parity and sell them immediately to Tether treasury or wait for higher prices and

[4]Tether claims so, as stated in their frontpage: *"Every Tether token is always 100% backed by our reserves"*, but New York Attorney General suggests this has not been the case all the time, see https://ag.ny.gov/press-release/2021/attorney-general-james-ends-virtual-currency-trading-platform-bitfinexs-illegal

[5]See https://wallet.tether.to/richlist

Figure 4: Creation, circulation, and destruction of Tether



sell them later.

Figure 4 shows the life cycle of a Tether. Seller 1 deposits USD deposits at Tether Treasury who issues a new token and transfers it to Seller 1. Then, this token circulates among investors (Seller 1, 2 and 3). In the meantime, Tether Limited manages its reserves and can buy and sell USD denominated assets. Finally, seller 3 claims to redeem the token in USD deposits. Tether Treasury transfers funds to Seller 3's bank account while it destroys the USDT token.

2.3 Reserve composition

Until recently, the composition of Tether reserve assets was not public. Thus, the claim that Tether tokens were backed 1-for-1 to fiat currency was unverifiable, and subject to a vivid controversy. Following a legal procedure and an agreement with the New York Attorney General reached in February 2021,[6] Tether started to disclose some information in July 2021, certified by an independent accountant.[7] Since then, Tether has been fined by the CFTC "over claims that Tether stablecoin was fully backed by US dollars".[8]

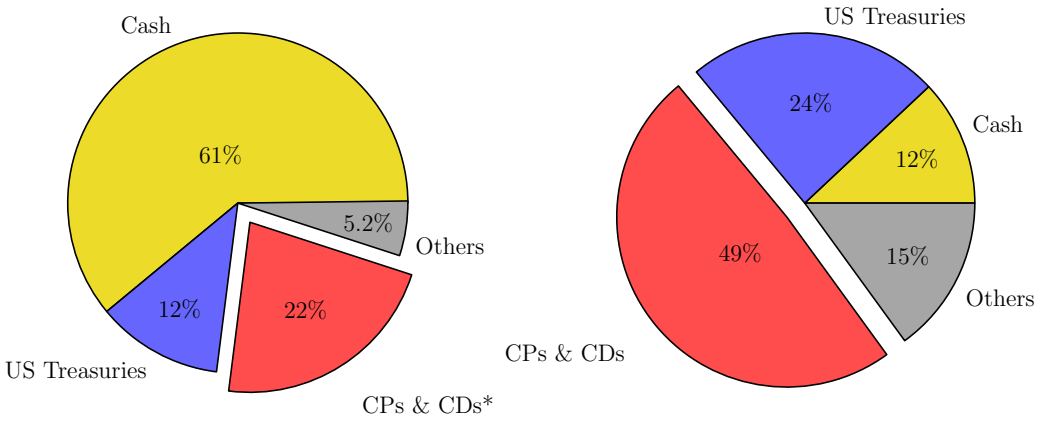
The report showed that Tether tokens were mainly backed by Commercial Paper (CP) and Certificates of Deposits (CD) (See Figure 5) denominated in US dollar. As of June 2021, Tether Holdings Limited held around 31 bn USD of CP/CDs. While the detailed composition

[6] https://ag.ny.gov/press-release/2021/attorney-general-james-ends-virtual-currency-trading-platform-bitfinexs-illegal

[7] https://tether.to/wp-content/uploads/2021/08/tether_assuranceconsolidated_reserves_report_2021-06-30.pdf

[8] https://www.cftc.gov/PressRoom/PressReleases/8450-21

Figure 5: Reserve composition of USDC (left) and Tether (right)



Source: Circle (composition as of May 28, 2021), Tether (composition as of June 30, 2021).
*13% of USDC reserves is composed of Yankee CDs; the split between CD and CP is unknown for Tether.

in terms of issuers of these commercial papers is unknown (they could be in principle foreign issuers), the average duration of CP/CDs is reported to be 150 days for an average rating of A2.

This *de facto* placed Tether on par with the largest Prime money funds in terms of CP holdings:

> *"If Tether was a prime money fund it would be among the largest. Indeed, there are only five prime funds that are bigger than Tether's $62bn in assets. This is also true with respect to its CP holdings—Tether's $31bn CP portfolio is larger than all but five prime funds (...) (the largest CP holding among prime funds is $45bn)"* (Abate, 2021)

By comparison, one of the largest money market fund, the "JPMorgan Prime Money Market Fund" has about 75 USD bn of assets under management, invested at 25% in CPs, 30% in CDs, and 15% in US Treasuries.[9]

In a similar move, the second biggest stablecoin in terms of market capitalization, USD Coin (USDC) issued an independent accountant report[10] that reveals USDC tokens were backed at 61 % by cash and securities with an original maturity less than or equal to 90 days, at 22% by commercial papers issued in the US or abroad ("Yankee CDs"). Since then, Circle publishes a monthly report on the composition of its reserves.

[9] https://am.jpmorgan.com/us/en/asset-management/adv/products/jpmorgan-prime-money-market-fund-morgan-4812a2702#/portfolio

[10] https://www.centre.io/hubfs/pdfs/attestation/Grant-Thorton_circle_usdc_reserves_07162021.pdf

3 Empirical strategy

In this section, we first detail the hypotheses we want to test. We then describe the data we use to test these hypotheses. We finally present our empirical strategy.

3.1 Hypotheses

As we have seen in section 2, commercial papers are one of the reserves assets backing Tether and Circle. As a consequence, the evolution of the quantity of tokens could change the demand of CP from the stablecoins issuers. This change in demand may either push up the supply of CPs or/and exert a negative pressure on CP rates. The intensity of these two effects depend on the price elasticity of supply as well as the quantity of CP effectively purchased by the issuing company. It also depends on the degree of substituability between the CPs purchased by stablecoins issuers and CPs and other short-term assets usually purchased by other market participants.

We thus want to test whether a change in the quantity of tokens circulating has an effect on the quantity of CP issued and its price. We test this hypothesis by analyzing both the overall CP market and some segments of this market. We conjecture that if the firms supplying CPs anticipate the demand addressed by stablecoin firms, the main impact would be through the volume of CPs newly issued, otherwise, the additional demand by stablecoin firms for reserves purpose will lead mainly to a reduction in the rate.

Notice that, before July 2021, the composition of reserves held by stablecoin companies wasn't public. If the firms issuing CPs have anticipated the demand from stablecoin it was either through informal information/rumors or through the observation that when the market capitalization of stablecoin increases the demand for CPs also increases.

3.2 Data

Absent official and regulated sources of data on crypto-assets, we rely mainly on data from the website CoinMarketCap – largely used in the literature and in reports from public authorities. CoinMarketCap aggregates information directly from exchanges.[11]

We retrieve daily data on prices, volumes and market capitalization. Market capitalization is calculated by multiplying the price by the "circulating supply", defined by CoinMarketCap as the *"number of coins that are circulating in the market and in the general public's hands*

[11] Details on the sources and methodologies followed by CoinMarketCap can be found on https://coinmarketcap.com/methodology/

(...) Coins that are locked, reserved, or not able to be sold on the public market are coins that can't affect the price and thus should not be allowed to affect the market capitalization as well."

Data on commercial paper issuance and rates come from the Federal Reserve Board – derived from data supplied by DTCC (Depository Trust & Clearing Corporation), acting as the main clearinghouse, central securities depository and trade repository for these securities in the US. Data are updated daily, based on CP of maturities of 270 days or less, directly issued or placed by dealers.[12]

We rely on breakdowns made by the Federal Reserve. For instance, the reports aggregate under 'AA' commercial papers rated A1+ and A1 by Moody's Investors Service and Standard & Poor's.[13] Similarly, aggregates are reported for 'Non-financials AA", "Non-financials A2/P2", "Financials AA" and "ABCP AA". Rates data are also reported for specific maturities (eg. rates for 90-day CP). We keep these categories unchanged for the analysis.

All other data (VIX, Nasdaq, Tbill 1-month rate, reserves...) come from Bloomberg and from the Federal Reserve (Fred database). Reserves come at a weekly frequency and we suppose them constant during a week in our daily regressions.

Table 2 shows the descriptive statistics. Our sample goes from July 2020 to July 2021, mainly because of the extremely recent creation/adoption of stablecoins, as shown in Fig. 1. Our primary righ-hand side variable intends to capture the additional demand stemming from the stablecoin industry. We start with the two main stablecoins – USDT and USDC – market capitalization. As we face quasi exponential growth for these series, we proceed in two steps. We first take the log of market capitalization to remove the exponential growth. Second, we detrend each time series to take out any linear deterministic trend.

Turning to the commercial paper market, Fig. 8 gives the amount outstanding as reported by the Federal Reserve Board (Fred series: "COMPOUT"). Fig. 10 reports the daily issuance of commercial papers, of all maturities and all issuer types, as reported by the Federal Reserve Board. Fig. 11 shows a scatterplot of these daily issuance and the two main stablecoins (USDT and USDC) market capitalization, suggesting a positive correlation. The next section proposes an empirical strategy to control for possible confounding factors and to confirm this intuition.

[12] Sources and methodology: https://www.federalreserve.gov/releases/cp/about.htm

[13] "Programs with at least one 1 or 1+ rating, but no ratings other than 1" https://www.federalreserve.gov/releases/cp/about.htm'

3.3 Empirical strategy

We build our specifications in the spirit of Krishnamurthy and Vissing-Jorgensen (2012), Sunderam (2015) and Nagel (2016), three papers interested in the link between CP rates or spreads and metrics interpretable as a demand for short-term safe assets (in their case, the relative scarcity of public short term debt).

Our specifications for CP issuances and interest rates are as follows:

$$I_{CP_t} = \alpha + \beta * Log(Market\,Cap_t) + \gamma * Controls_t + \delta * Trend + \epsilon_t \quad (1)$$

where I_{CP_t} is the daily issuance volume of CP of given maturity/characteristics.

$$r_{CP_t} = \alpha + \beta * Log(Market\,Cap_t) + \gamma * Controls_t + \delta * Trend + \epsilon_t \quad (2)$$

where r_{CP_t} is a CP rate of given maturity/characteristics.

$Log(Market\ Cap_t)$ is the the sum of USDT and UDSC market capitalization series, expressed in billion USD, transformed in log and detrended.

Controls include the total reserves balances of depository institutions with Federal Reserve banks and the Nasdaq market capitalization (both transformed along the same procedure), the Tbill 1-month rate, the Effective Fed funds rate (EFFR), the VIX and a time trend aiming at controlling for any additional linear trend in the left-hand side variable.

The rationale for controlling for reserves and EFFR is to take into account that the Fed monetary policy may affect at the same time the demand for stablecoin and the commercial paper market. By the same token, we control for the 1-month Tbill rate to reflect possible confounding factors between public short-term debt and the CP market.

Nasdaq market capitalization and VIX reflect more generally stock market conditions. The first is a proxy for financial assets in general, and VIX for investors' risk aversion.

4 Results

4.1 Commercial paper issuance

Table 3 reports the results of our estimation for the new issuance of CPs of all maturities. The first column "Total", presents the results for all the CPs issued, and columns 2-5 a breakdown for issuer types and rating category.

Left hand side variables and our main variable of interest – stablecoins' market cap – are both transformed in log. A 1% (1 standard deviation) increase in the deviation of the log

stablecoins' market cap from its linear trend is associated with an increase of CP issuance by around 0,6% (a fourth of a standard deviation respectively). The breakdown by issuers and ratings suggests that this coefficient, economically and statistically significant, is primarily driven by issuances of CPs by non-financials rated A2/P2 and by financials rated AA.

As we don't know the precise composition of commercial papers held by stablecoins in terms of maturity, we run the same regression on the new issuance of commercial papers of 1 to 4 days of initial maturity, the most active segment in terms of volume, as reported by the Federal Reserve. This second exercise (Table 4) confirms the previous results and suggests that there are weak evidence that the impact is more pronounced for the issuance of shorter maturities.

4.2 Commercial paper rates

Turning to CP rates, we run our main specification with two different maturities, as provided by the Federal Reserve. Table 5 gives the results for the overnight CP rates, for the same four categories of issuers and rating categories. Note that these rates are rates on the issuance market and not secondary market rates. Rates are expressed in percentage per annum, and the coefficient of independent variables transformed in log can be directly interpreted as a change in basis points (bps). When the log stablecoin market cap changes compared to its trend by 1 standard deviation, the overnight rate of CP issued by Non-financials fall by -0.3 bps for AA-rated papers whose standard deviation is 2 bps. Results are intuitive in all cases but for the Non-financial A2/P2 CPs. However, when we look at CP rates for the 90-day maturity (Table 6), all coefficients are negative as expected, of a larger magnitude and very significant, suggesting that prices do adjust the market for longer maturities. The largest coefficient is for the ABCP rate with 90-day maturity and AA rated papers. In this case, a one standard deviation increase in stablecoins' market cap is associated with a lower rate of 1.9 bps, that is, half its standard deviation.

4.3 Additional results, placebo tests, and limits

In table 7, we look at potential differential effects for Tether and Circle. Tether market cap is driving the results for the total issuance of CPs, which may appear intuitive since Tether has the largest market cap and allegedly the largest backing composition in CPs. Table 8 suggests that CP rates are correlated with the issuance of the two stablecoins — non-financial AA and ABCP AA with USDC, and financials AA with USDT. As before, non-financials A2/P2 exhibit a puzzling positive sign.

Finally, table 9 reports placebo tests with other money-like assets than US dollar denominated CPs. Indeed, one may suspect that the results we find result are biased by confounding factors.

We start with the SOFR rate (Secured Overnight Financing Rate) which is a "broad measure of the cost of borrowing cash overnight collateralized by Treasury securities"[14] as repo rates can be seen as a good proxy for risk-free rate (Nagel, 2016). Our baseline regression with SOFR rate at the left-hand side does not show statistically significant coefficient for stablecoins market cap.

Second, we run the placebo test for 1 and 3-month Tbill rates. While both Tether and Circle disclosed they hold US treasuries in their reserves, we suspect that these amounts would be fairly small compared to the Tbill market outstanding, and thus do not expect a correlation between Tbill rates and stablecoins market cap. Columns 2-3 confirm the absence of correlation. Third, we use a CP rate for papers denominated in EUR, issued in Europe (Negotiable European Commercial Paper - NeuCP - market). We know for sure this type of papers are not purchased, contrary to CP issued outside the U.S. but denominated in USD. We include EURUSD as a control. Again, this specification does not point out any correlation with stablecoins market cap.

These placebo tests thus suggest that the correlation we find between CPs rates and stablecoins market cap is truly specific to CPs, confirming the potential economic mechanism through which the stablecoins' reserves exert additional demand for CPs.

We acknowledge several limits to our analysis. Most pertains to the very particular features of stablecoins markets: short time series to exploit due to their short sheer existence ; periods of exponential growth of their market capitalization ; scarce information about the precise composition of reserves.

Concerning the fast evolution of stablecoin market capitalization, an alternative empirical specification could be to first differentiate the market capitalization of stablecoins. However this alternative is of little help as we know nothing about the timing of purchase of CPs, which does not necessarily follow immediately the issuance of new stablecoins.

Finally, the relative opaqueness of the reserves holdings by stablecoins issuers – compared to the transparency of MMFs for instance – complicates causal inference. It is for instance not possible to track which CPs are bought and which ones are not. We look forward to more transparency of the reserve composition in the future to better assess the impact of stablecoins on CP market.

[14] https://www.newyorkfed.org/markets/reference-rates/sofr

5 Policy implications

Section 2.2 identifies the mechanisms via which stablecoins raise potential risks for "depositors" and for the financing of firms, two risk connecting the crypto universe to the real economy. We present empirical evidence of the latter channel in section 4. To conclude, in this section we derive possible policy implications in terms of financial stability and monetary policy. Applying the same risk, same business, same regulation principle seem to clarify what exactly is stablecoins' business. We first deal with risks for stablecoins' "depositors" 5.1 then turn to the risks for firms financing 5.2, and conclude with the possible implications for monetary policy transmission.

5.1 Risks for "depositors"

From the depositors' point of view – let's call "depositors" investors in stablecoins – the main risk lies in the inability to redeem stablecoin tokens at face value[15], one extreme version being a run on stablecoins' issuers. Whether public authorities want to address this risk is directly related to the spillovers effects such an event may have on the real economy. Crucially, this depends on how much stablecoins are or will be used as an alternative deposit technology, and the type of interaction potential losses or instability may have with traditional finance.

These risks for depositors have led to compare stablecoins to banks or money market funds (Gorton and Zhang, 2021). If they may be seen as similar to deposits, major differences lie in the absence of regulation of stablecoins compared to banks and MMFs, degree of transparency on their holdings, absence of liquidity/capital ratio for the former. In addition, contracts tying stablecoin issuers and stablecoins holders remains implicit (a promise to peg the token's value on par with the US dollar), not legally-binding in most of cases.

The same risk, same business, same regulation principle would call for a regulation similar to deposit-taking banks and risks could be addressed by regulation enforcing liquidity and reserve requirements – a recommendation made for instance by US (2021). This could also include limits on the exposure to specific assets, such as the relatively illiquid commercial papers. An alternative way could be to regulate them as e-money providers or narrow banks by backing every stablecoin token one-to-one with central bank money. These regulated issuers would be akin to a "synthetic CBDC" (Adrian and Mancini-Griffoli, 2019), which raises many regulatory and operational issues.

[15]It should be noted that stablecoins raise a broader set of issues, including and not limited to financial and market integrity, consumer and investor protection, competition and data protection, not developed in this paper (G7 (2019); Arner et al. (2020)

5.2 Risks for firms' financing and monetary policy transmission

As we document in section 4, the changes in the demand for stablecoins can affect the financing of firms if their short-term debt serve as reserve assets by stablecoins' issuers. They may benefit from cheaper rates on this type of debt as long as stablecoins' market capitalization increases, but this new demand may also be destabilizing if volatile – which is likely the case if stablecoins' main purpose is to be a means of payment between multiple volatile crypto-assets. As such, they would be incentivized to switch part of their long-term stable funding towards cheaper, short-term funding that would increase their exposure to roll-over risk, as in the mechanism described for instance by Stein (2012). The empirical literature confirms the strategic issuance of commercial papers by firms when demand is high for money-like substitutes, see for instance Kacperczyk et al. (2021). The recommendation by Carlson et al. (2016); Greenwood et al. (2019) is then to "crowd-out" private short-term debt by safer, public short-term liabilities, such as government debt securities and central bank reserves.

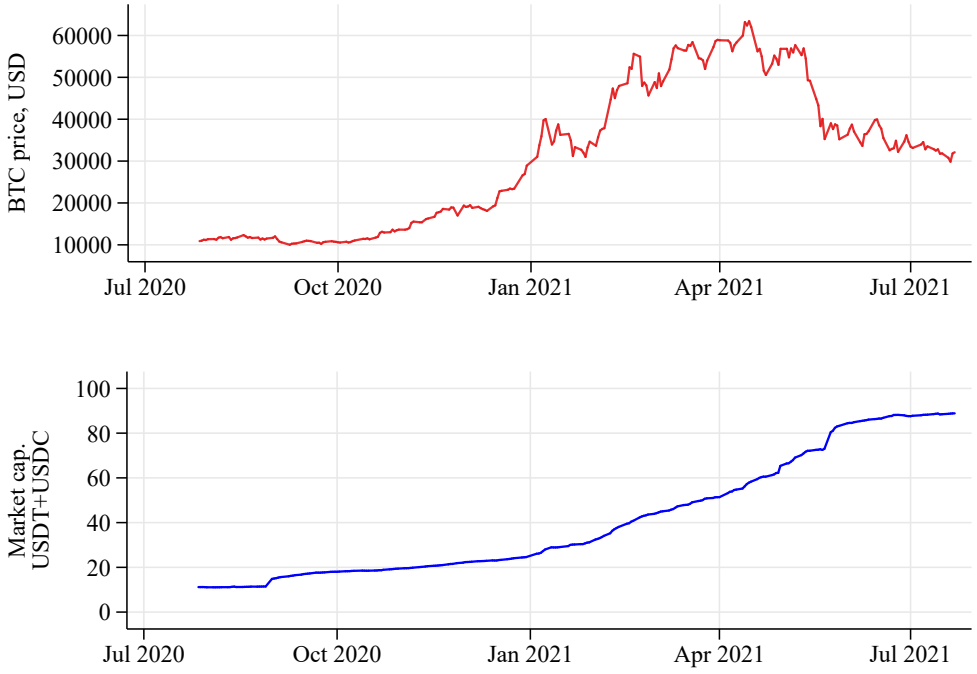
Related to this literature, and on top of the impact on firms financing, large fluctuations in the demand for short-term assets may also more generally impair monetary policy transmission, by decoupling some short-term rates to the policy rate. At the beginning of the Covid-19 outbreak, stress in the commercial paper market and heightened rollover risks triggered the intervention of major central banks to protect the short-term funding markets – the Federal Reserve through a Commercial Paper Funding Facility (CPFF)[16] and the European Central Bank through the inclusion of commercial papers in its Pandemic Emergency Purchase programme (PEPP) (De Guindos and Schnabel, 2020).

In the case of stablecoins, it should also be noticed that demand for short-term debt is concentrated in US dollar-denominated instruments, as the main stablecoins are pegged to the US dollar. This means the impact would primariliy affect the transmission of the US monetary policy. However, implications may even go beyond the sole US case, as stablecoin's demand would affect all firms issuing in US-dollar, worldwide.

[16] https://www.federalreserve.gov/newsevents/pressreleases/monetary20200317a.htm

A Figures

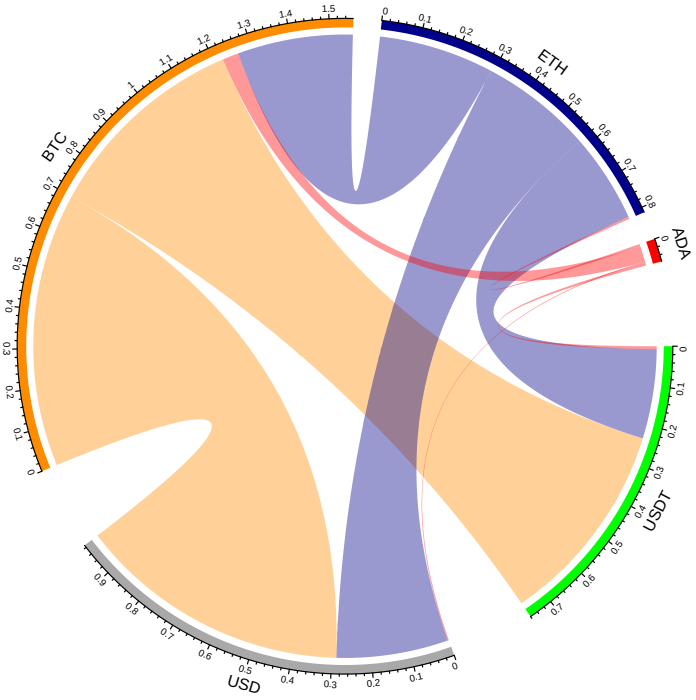
Figure 6: Bitcoin price (BTCUSD) and stablecoins market capitalization



Source: Bloomberg, CoinMarketCap.

Figure 7: Average daily volume traded between pairs (USD bn), two sub-periods

(a) Jan 2018-Jun 2018



(b) Jan 2021-Jun 2021

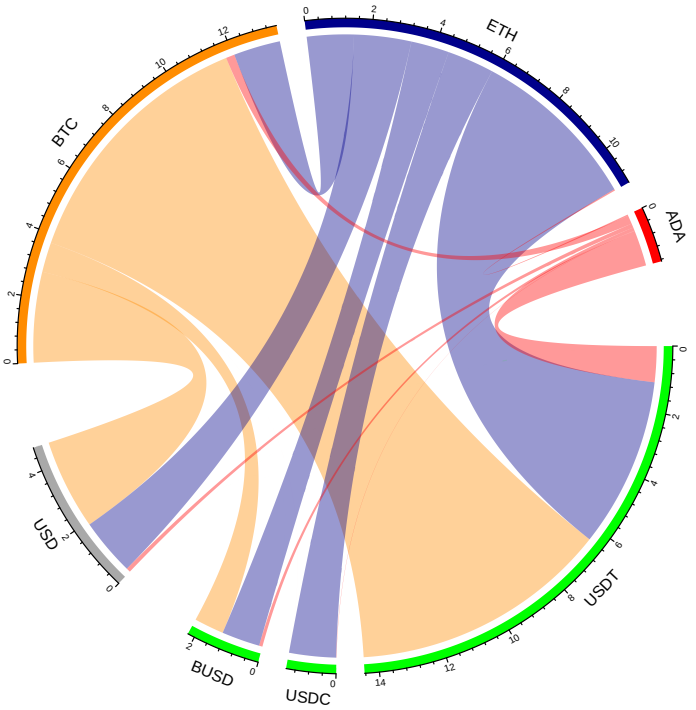
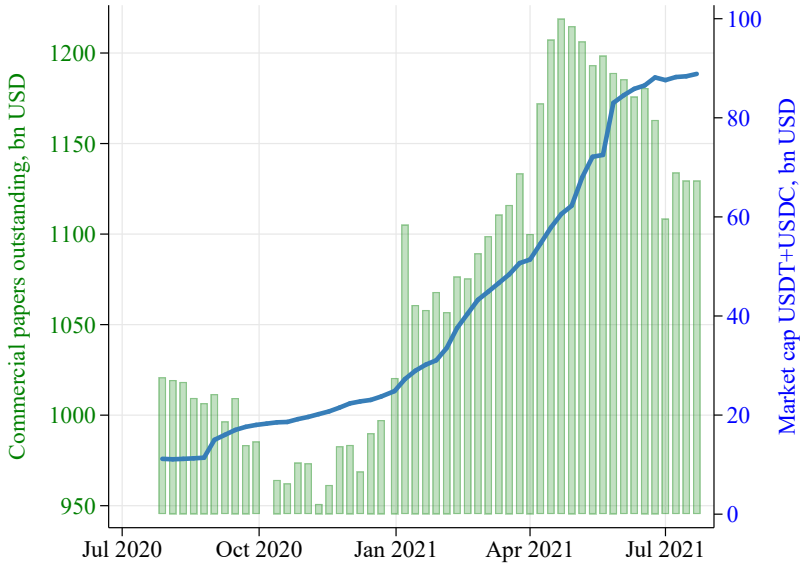
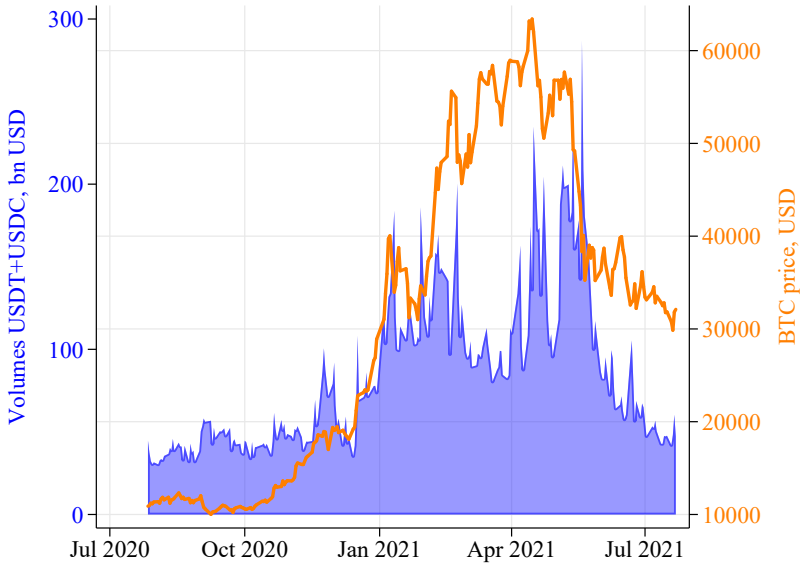


Figure 8: CP amount outstanding and stablecoins market capitalization



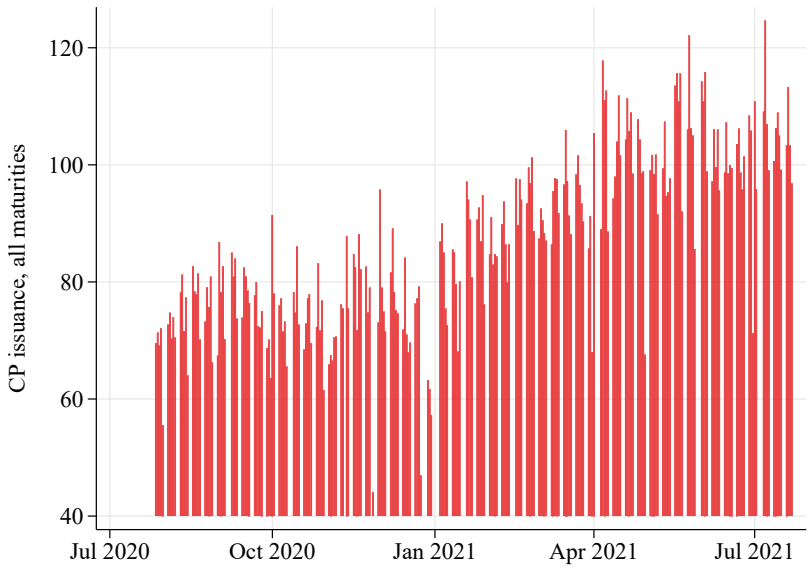
Note: Green bars report the weekly outstanding amount of Commercial Papers denominated in US dollar as reported by the Federal Reserve Board. Source: CoinMarketCap, Federal reserve Board, DTCC.

Figure 9: Bitcoin price (BTCUSD) and stablecoins daily traded volumes



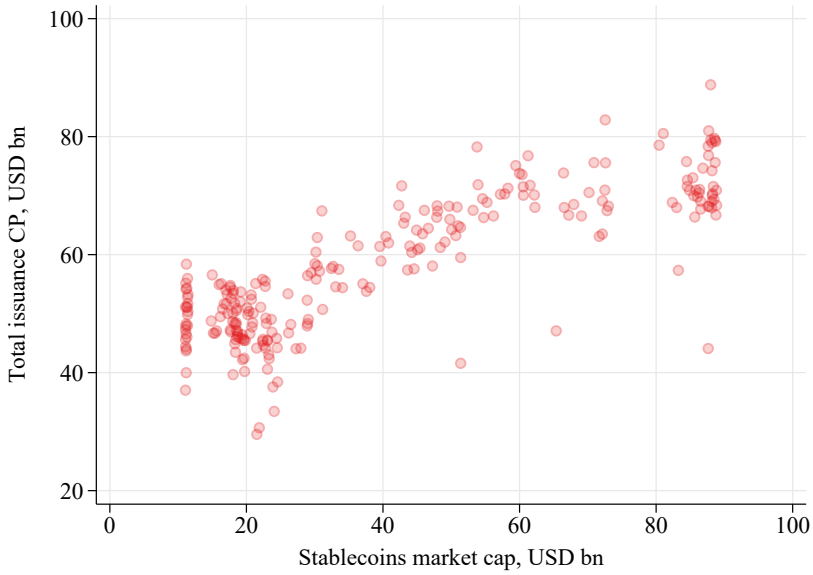
Note: Blue bars are the traded volumes of USDT and USDC, as reported by CoinMarketCap. Source: Bloomberg, CoinMarketCap

Figure 10: Total issuance of CP, all maturities, USD bn



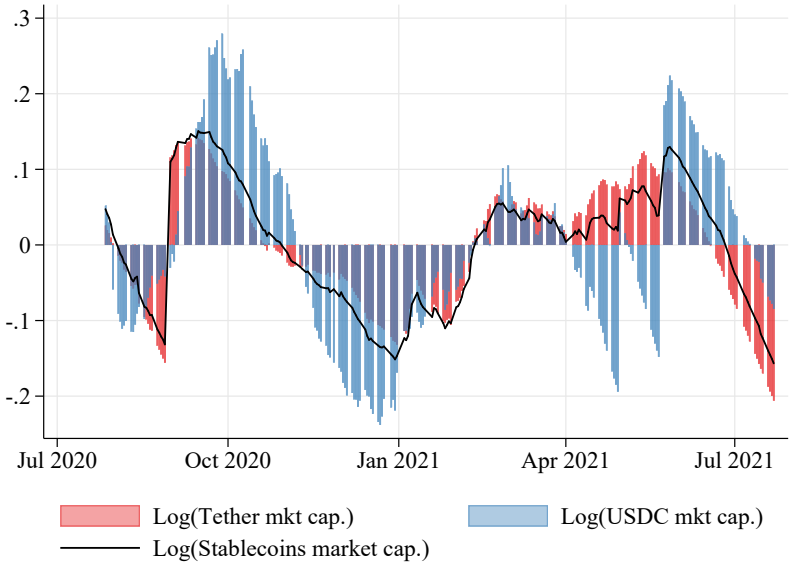
Note: Total issuance of CPs, all maturities, all rating and issuer types. Source: Federal Reserve Board.

Figure 11: Total issuance of CP and stablecoins market capitalization



Note: Total issuance of CPs of maturity comprised between 1-4 days, all rating and issuer types. Stablecoins market cap defined as before as the sum of USDT and USDC market cap. Source: Federal Reserve Board, CoinMarketCap.

Figure 12: Detrended time series



Note: This graph shows the main right-hand side variables of interest, after transformation: we first take the log of market cap series and then detrend them. Black line corresponds to the 'stablecoins market cap' series, and we show USDT and USDC own series.

B Tables

Table 2: Summary statistics

Variable	Obs	Mean	Std. Dev.	P10	P50	P90
Stablecoins mkt cap. (USD bn)	248	41.3	26.38	11.44	30.38	86.54
USDT mkt cap. (USD bn)	248	32.47	18.57	10.2	24.96	62.18
USDC mkt cap. (USD bn)	248	8.83	8.06	1.42	5.46	23.95
Log(Stablecoins mkt cap)	248	3.5	.67	2.44	3.41	4.46
Log(Stablecoins mkt cap), detrended	248	0	.08	-.12	.02	.12
Reserves at FRB (USD bn)	246	3332.45	442.98	2827.69	3168.24	3919.81
Log(New issuance) of CPs, all mat.	248	4.45	.19	4.24	4.46	4.67
Log(New issuance) of CPs, Non-fin. AA, all mat.	248	.86	.84	-.08	.79	2.02
Log(New issuance) of CPs, Non-fin. A2/P2, all mat.	248	1.47	.31	1.22	1.46	1.77
Log(New issuance) of CPs, Fin. AA, all mat.	248	2.06	.42	1.7	2.09	2.47
Log(New issuance) of CPs, ABCP AA, all mat.	248	2.77	.16	2.64	2.77	2.94
Log(New issuance) of CPs, 1-4days mat.	248	4.04	.22	3.79	4.02	4.29
Log(New issuance) of CPs, Non-fin. AA, 1-4days mat.	248	-.17	1.54	-2.08	-.4	1.92
Log(New issuance) of CPs, Non-fin. A2/P2, 1-4days mat.	248	1.05	.34	.83	1.09	1.31
Log(New issuance) of CPs, Fin. AA, 1-4days mat.	248	2.01	.43	1.66	2.03	2.43
Log(New issuance) of CPs, ABCP AA, 1-4days mat.	248	2.41	.19	2.3	2.42	2.55
CP rate, Non-fin AA, O/N	248	.06	.02	.04	.06	.09
CP rate, Non-fin A2/P2, O/N	248	.14	.02	.12	.13	.16
CP rate, Fin. AA, O/N	248	.07	.02	.04	.08	.09
CP rate, ABCP AA, O/N	248	.11	.02	.08	.11	.12
CP rate, Non-fin AA, 90d	229	.09	.03	.05	.09	.13
CP rate, Non-fin A2/P2, 90d	187	.24	.06	.18	.23	.31
CP rate, Fin. AA, 90d	190	.12	.03	.08	.12	.17
CP rate, ABCP AA, 90d	248	.17	.04	.1	.17	.22
Tbill 1m rate	248	.05	.03	0	.05	.09
Effective Fed funds rate	248	.08	.01	.06	.09	.1
VIX	248	22.53	4.68	16.74	22.16	28.51

Table 3: New issuance of CPs (all maturities) and stablecoins market capitalization

	(1) Total	(2) Non-Fin. AA	(3) Non-Fin.A2/P2	(4) Fin. AA	(5) ABCP AA
Stablecoins mkt cap.	0.575***	0.828	1.083***	1.395**	0.127
	(0.171)	(0.903)	(0.279)	(0.594)	(0.171)
Reserves	0.455	-3.445*	-0.615	2.654**	0.101
	(0.327)	(1.819)	(0.523)	(1.049)	(0.276)
Nasdaq mkt cap.	0.573**	-2.624	0.580	2.629***	0.586*
	(0.232)	(1.993)	(0.464)	(0.576)	(0.307)
Tbill 1m rate	-1.692	-0.301	-4.388*	2.445	-1.946
	(1.289)	(6.700)	(2.395)	(4.304)	(1.709)
Effective Fed funds rate	3.060**	-1.697	7.812**	0.883	2.510
	(1.545)	(10.29)	(3.514)	(4.008)	(2.696)
VIX	0.000495	-0.00780	0.000497	-0.00703	0.0110***
	(0.00226)	(0.0217)	(0.00521)	(0.00644)	(0.00410)
Trend	Yes	Yes	Yes	Yes	Yes
R^2	0.556	0.037	0.291	0.156	0.081
Observations	246	246	246	246	246

Standard errors in parentheses

Note: Stablecoins market cap as the sum of Tether (USDT) and USD Coin (USDC) market cap

All amounts (issuance, market cap and reserves) in log USD bn and detrended

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: New issuance of CPs (1-4 days) and stablecoins market capitalization

	(1)	(2)	(3)	(4)	(5)
	Total	Non-Fin. AA	Non-Fin.A2/P2	Fin. AA	ABCP AA
Stablecoins mkt cap.	0.755***	0.730	1.656***	1.513**	0.323
	(0.182)	(1.707)	(0.378)	(0.606)	(0.207)
Reserves	0.539	-5.942	-0.732	2.803***	0.162
	(0.335)	(3.611)	(0.563)	(1.061)	(0.285)
Nasdaq mkt cap.	0.458*	-6.282	0.508	2.574***	0.744*
	(0.257)	(3.869)	(0.611)	(0.565)	(0.386)
Tbill 1m rate	-2.787**	3.931	-7.066***	2.671	-2.640
	(1.273)	(11.39)	(2.480)	(4.377)	(1.607)
Effective Fed funds rate	5.359***	-9.544	14.33***	1.503	3.896
	(1.572)	(15.32)	(4.039)	(4.058)	(2.872)
VIX	0.000224	-0.0427	0.00623	-0.00992*	0.0171***
	(0.00261)	(0.0373)	(0.00684)	(0.00591)	(0.00495)
Trend	Yes	Yes	Yes	Yes	Yes
R^2	0.624	0.045	0.216	0.170	0.150
Observations	246	246	246	246	246

Standard errors in parentheses

Note: Stablecoins market cap as the sum of Tether (USDT) and USD Coin (USDC) market cap

All amounts (issuance, market cap and reserves) in log USD bn and detrended.

Columns 1-4: CP with a maturity between 1 and 4 days.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: O/N CP rates and stablecoins market capitalization

	(1) Non-Fin.AA	(2) Non-fin.A2/P2	(3) Fin. AA	(4) ABCP AA
Stablecoins mkt cap.	-0.0421***	0.0378***	-0.0203***	-0.0301***
	(0.0159)	(0.0124)	(0.00618)	(0.00722)
Reserves	0.0401	0.0950***	0.0290	0.0880***
	(0.0327)	(0.0300)	(0.0182)	(0.0193)
Nasdaq mkt cap.	0.0810**	0.0237	0.0749***	0.101***
	(0.0360)	(0.0281)	(0.0161)	(0.0192)
Tbill 1m rate	0.396***	-0.402***	0.0242	-0.0179
	(0.103)	(0.0741)	(0.0470)	(0.0496)
Effective Fed funds rate	0.0303	0.701***	0.789***	0.363***
	(0.140)	(0.116)	(0.0648)	(0.0765)
VIX	0.000399	-0.000464	0.000635***	0.00110***
	(0.000299)	(0.000297)	(0.000157)	(0.000199)
Trend	Yes	Yes	Yes	Yes
R^2	0.587	0.457	0.830	0.845
Observations	246	246	246	246

Standard errors in parentheses

Note: Stablecoins market cap as the sum of Tether (USDT) and USD Coin (USDC) market cap

All amounts (market cap and reserves) in log USD bn and detrended. All CP rates are O/N.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: 90-day CP rates and stablecoins market capitalization

	(1) Non-fin AA	(2) Non-fin A2/P2	(3) Fin. AA	(4) ABCP AA
Stablecoins mkt cap.	-0.0926***	-0.182***	-0.155***	-0.236***
	(0.0221)	(0.0618)	(0.0329)	(0.0235)
Reserves	-0.0189	0.362**	0.0855	0.257***
	(0.0401)	(0.147)	(0.0725)	(0.0419)
Nasdaq mkt cap.	-0.0632	0.0631	-0.0400	0.0197
	(0.0414)	(0.132)	(0.0644)	(0.0412)
Tbill 1m rate	0.198	0.584*	0.345*	0.499***
	(0.127)	(0.332)	(0.190)	(0.137)
Effective Fed funds rate	0.123	-0.496	-0.190	-0.609***
	(0.176)	(0.466)	(0.259)	(0.221)
VIX	0.000253	0.000825	0.0000230	0.000998**
	(0.000374)	(0.000956)	(0.000588)	(0.000392)
Trend	Yes	Yes	Yes	Yes
R^2	0.722	0.235	0.425	0.799
Observations	227	185	190	246

Standard errors in parentheses

Note: Stablecoins market cap as the sum of Tether (USDT) and USD Coin (USDC) market cap All amounts (market cap and reserves) in log USD bn and detrended. All CP rates are 90days.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C Additional results

Table 7: New issuance of CPs (all maturities) and stablecoins market capitalization

	(1) Total	(2) Non-Fin. AA	(3) Non-Fin.A2/P2	(4) Fin. AA	(5) ABCP AA
Log(Tether mkt cap.)	0.431***	1.271	0.521**	0.826*	0.106
	(0.164)	(1.132)	(0.242)	(0.450)	(0.150)
Log(USDC mkt cap.)	0.114	-0.264	0.366**	0.405*	0.0516
	(0.0901)	(0.659)	(0.178)	(0.238)	(0.114)
Reserves	0.442	-4.311*	-0.315	2.888**	0.132
	(0.394)	(2.197)	(0.560)	(1.184)	(0.299)
Nasdaq mkt cap.	0.481**	-3.102	0.482	2.491***	0.627*
	(0.242)	(2.015)	(0.503)	(0.571)	(0.321)
Tbill 1m rate	-1.730	-0.569	-4.405*	2.409	-1.925
	(1.298)	(6.659)	(2.392)	(4.321)	(1.682)
Effective Fed funds rate	3.270**	-0.0367	7.537**	0.910	2.634
	(1.596)	(10.24)	(3.454)	(4.161)	(2.606)
VIX	-0.000273	-0.00989	-0.000535	-0.00857	0.0109***
	(0.00229)	(0.0216)	(0.00525)	(0.00664)	(0.00408)
Trend	Yes	Yes	Yes	Yes	Yes
R^2	0.552	0.039	0.283	0.150	0.083
Observations	246	246	246	246	246

Standard errors in parentheses

Note: All amounts (issuance, market cap and reserves) in log USD bn and detrended

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: O/N CP rates and stablecoins market capitalization

	(1) Non-fin AA	(2) Non-fin A2/P2	(3) Fin. AA	(4) ABCP AA
Log(Tether mkt cap.)	-0.00138	0.0434***	-0.0242***	-0.00325
	(0.0206)	(0.0122)	(0.00882)	(0.0108)
Log(USDC mkt cap.)	-0.0247**	-0.00154	0.00364	-0.0146***
	(0.0102)	(0.00815)	(0.00446)	(0.00511)
Reserves	0.0104	0.0768**	0.0392*	0.0696***
	(0.0405)	(0.0331)	(0.0212)	(0.0229)
Nasdaq mkt cap.	0.0771**	0.00950	0.0878***	0.103***
	(0.0379)	(0.0289)	(0.0165)	(0.0200)
Tbill 1m rate	0.409***	-0.401***	0.0112	-0.0155
	(0.103)	(0.0742)	(0.0438)	(0.0506)
Effective Fed funds rate	0.0638	0.739***	0.787***	0.396***
	(0.144)	(0.119)	(0.0680)	(0.0808)
VIX	0.000405	-0.000550*	0.000679***	0.00111***
	(0.000295)	(0.000305)	(0.000165)	(0.000195)
Trend	Yes	Yes	Yes	Yes
R^2	0.591	0.460	0.837	0.843
Observations	245	245	245	245

Standard errors in parentheses

Note: All amounts (market cap and reserves) in log USD bn and detrended. All CP rates are O/N.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Placebo tests - money-like assets and stablecoins market capitalization

	(1) SOFR	(2) Tbill 3m	(3) Tbill 1m	(4) EU CP
Stablecoins mkt cap.	-0.00379	-0.00188	-0.0166	0.0663
	(0.0132)	(0.00706)	(0.0115)	(0.0404)
Reserves	-0.00947	-0.0474**	-0.164***	-0.186**
	(0.0480)	(0.0189)	(0.0225)	(0.0865)
Nasdaq mkt cap.	0.0337	-0.0287*	-0.0594*	-0.0290
	(0.0330)	(0.0157)	(0.0316)	(0.106)
Tbill 1m rate	0.568***	0.722***		-0.474**
	(0.0877)	(0.0463)		(0.218)
Effective Fed funds rate	1.747***	0.146**	1.013***	0.0125
	(0.271)	(0.0613)	(0.0617)	(0.302)
VIX	0.000681	0.0000655	0.000266	-0.00139*
	(0.000413)	(0.000183)	(0.000253)	(0.000809)
EURUSD				-0.838***
				(0.182)
Trend	Yes	Yes	Yes	Yes
R^2	0.821	0.966	0.898	0.444
Observations	154	245	245	243

Standard errors in parentheses

Note: Stablecoins market cap as the sum of Tether (USDT) and USD Coin (USDC) market cap

All amounts (market cap and reserves) in log USD bn and detrended.

EU CP rates are denominated in Euro, 3m maturity and issued by financial corporations rated A1/F1. Source: Banque de France.

SOFR sample from 2020-07-20 to 2021-03-14, as the SOFR rate is stuck at the IOER rate since then.

Source: https://www.newyorkfed.org/markets/reference-rates/sofr

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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