How the Cryptocurrency Market is Connected to the Financial Market

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Abstract

The cryptocurrency market is connected to the traditional financial market through *reserve-backed stablecoins.* A one standard deviation ($330 million) increase in the issuance of major stablecoins (Tether and USD Coin) on a given day results in an 11% increase in the commercial paper issuance quantity, an 18 basis point decrease in the commercial paper yield, and a 15 basis point decrease in the Treasury yield the following day. This shows that the exponential growth of stablecoins created an excess demand for short-term money-like safe assets. I also study the fiat cryptocurrency market's effect on the financial market.

JEL Codes: E40, E50, G23

Keywords: cryptocurrency, stablecoin, safe asset, private money

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1 Introduction

Cryptocurrency is the latest form of private money. Checking accounts that individuals hold in commercial banks, wholesale short-term assets such as repurchase agreement or commercial paper, and shares issued by money market mutual funds are all different forms of private money in the sense that they are safe and liquid. This paper explores how the cryptocurrency market is connected to the traditional private money market. I argue that the two markets are connected through a type of cryptocurrency called reserve-backed stablecoins.

During the Global Financial Crisis in 2007 and 2008, we observed distress in one private money market migrating to other private money markets. There were troubles in the asset-backed commercial paper market in 2007 that spread to the repo market and ultimately to money market mutual funds in 2008 (McCabe 2010; Gorton and Metrick 2012; Covitz, Liang, and Suarez 2013; Schmidt, Timmermann, and Wermers 2016). This interconnectedness of different private money markets, combined with the emergence of cryptocurrencies as one of the newest and the most talked-about forms of private money, begs the question of if and how distress in the cryptocurrency market can spread to a more traditional private money market.

As of now, troubles in the cryptocurrency market do not seem to migrate to existing financial markets. In May of 2021, the price of Bitcoin–currently the biggest cryptocurrency in terms of market capitalization–dropped more than 30% from around $58,000 to approximately $36,000 within a week, without causing much apparent distress in the equity or bond markets. On May 8, 2022, there was a run on a stablecoin named TerraUSD that wiped out TerraUSD's market capitalization of over $18 billion, which also did not create any apparent distress in the traditional financial market.

This paper makes one of the first attempts to study if and how the cryptocurrency market is connected to traditional financial markets that we are more familiar with. In particular, I explore the connection between the cryptocurrency market and the commercial

paper market, and the connection between the cryptocurrency market and the Treasury market. The medium through which the two markets are connected is a type of cryptocurrency called stablecoin. Unlike fiat cryptocurrencies such as Bitcoin or Ethereum whose prices fluctuate, the price of stablecoins is relatively stable over time and pegged to the value of a specific fiat currency such as the US dollar. I take advantage of differences in the price stability mechanism among different stablecoins and use instrumental variable approach to establish a causal link between activities in the cryptocurrency market and activities in the commercial paper/Treasury market.

Tether and USD Coin, the two biggest stablecoins that make up about 75% of stablecoin market capitalization, peg their stablecoin's price to the US dollar by maintaining a reserve of short-term money-like safe assets such as commercial paper, money market mutual fund shares, and the Treasury.[1] The market capitalization of Tether and USD Coin had grown more than threefold from around $30 billion to almost $100 billion in 2021 alone. This exponential growth created an excess demand for traditional private money as stablecoin issuers needed to back this market capitalization growth by buying up assets like commercial paper and Treasury from the market.

I find that a one standard deviation increase in the issuance of Tether and USD Coin on a given day, which amounts to around $330 million, results in an 11% increase in the issuance amount of commercial paper the following day. I find that this positive effect is concentrated in the shortest-maturity commercial paper market as the effect of stablecoin issuance vanishes for commercial paper with a maturity longer than nine days.

I also show that a one standard deviation increase in the issuance of Tether and USD Coin on a given day decreases the yield of the commercial paper by about 18 basis points the following day. A higher issuance quantity along with a lower yield of commercial paper that are associated with a higher issuance quantity of stablecoins indicates that stablecoin issuances created an excess demand for commercial paper. The stablecoin is-

[1] A rough picture of asset allocations of these stablecoin issuers are shown in their attestation reports, such as Tether (2021). It is reproduced in Table 1 that follows.

suers needed to buy commercial paper from the market to maintain the stablecoin's price stability, exerting upward pressure on the demand for commercial paper. Furthermore, looking at the Treasury market, I find that a one standard deviation increase in the issuance of Tether and USD Coin on a given day decreases the Treasury yield by about 15 basis points the following day.

Finally, I conduct an event study that investigates the impact of Tether's shift in their reserve management strategy away from holding commercial paper to holding Treasuries. I find that stablecoin issuers' impact on the commercial paper market was significantly subdued following this strategy shift.

In the second part of the paper, I explore whether the fiat cryptocurrency market[2] affects the commercial paper market as well. As there are frictions to directly exchanging cryptocurrencies for traditional fiat currencies like the US dollar, investors move in and out of their fiat cryptocurrency positions by trading fiat cryptocurrencies with stablecoins. Approximately three-quarters of trading on cryptocurrency trading platforms occur between a stablecoin and other cryptocurrencies (Gensler 2021). Furthermore, stablecoins are used by investors to lever up their positions on fiat cryptocurrencies (Gorton, C. Ross, and S. Ross 2021). Therefore, the demand for stablecoins can decrease when the fiat cryptocurrency market is doing well because investors will want to exchange stablecoins for fiat cryptocurrencies. These changes in demand for stablecoins due to changes in the market condition of fiat cryptocurrencies can in turn, affect the demand for commercial paper and Treasuries.

I find that a one standard deviation increase in the market capitalization change of Bitcoin, Ethereum, and Binance Coin[3] combined on a given day, results in an 11.9% decrease in the issuance amount of commercial paper the following day. Also, as with stablecoins, this negative effect is concentrated in the shortest-maturity commercial paper market.

[2]Examples of fiat cryptocurrencies include Bitcoin, Ethereum, Binance Coin, and Doge Coin. Their prices fluctuate because, as the name suggest, they are not collateralized by any other asset.

[3]Bitcoin, Ethereum, and Binance Coin are the three largest fiat cryptocurrencies in terms of their market capitalization.

Furthermore, a one standard deviation increase in the market capitalization change of Bitcoin, Ethereum, and Binance Coin combined on a given day results in an increase in commercial paper yields the following day by about 20 basis points. A lower issuance amount and a higher yield of commercial paper that is associated with a higher market capitalization change of major fiat cryptocurrencies indicate that a boom in the fiat cryptocurrency market reduces the demand for stablecoins, which in turn reduces the demand for commercial paper. Furthermore, looking at the Treasury market, I find that one standard deviation increase in the market capitalization change of major fiat cryptocurrencies on a given day increases the Treasury yield by about 17 basis points the following day.

Related Literature

This paper contributes to the growing literature on cryptocurrencies and the decentralization of finance through newly-developed distributed ledger and blockchain technology. There exists a set of papers that utilize existing tools in economics to analyze optimal organization and structure of the blockchain technology (Budish 2018; Biais et al. 2019; Gans and Gandal 2019; Saleh 2020; Cong, He, and J. Li 2020; Cong, Y. Li, and Wang 2020; Abadi and Brunnermeier 2022). This paper refrains from exploring the inner workings of the specific blockchain technology that different cryptocurrencies adopt. Instead, I empirically look at the quantities and prices determined in the cryptocurrency-commercial paper/Treasury market equilibria. Papers like Hu, Parlour, and Rajan (2019), Liu and Tsyvinski (2020), and Liu, Tsyvinski, and Wu (2022) use tools developed in the asset pricing literature to study different return properties of fiat cryptocurrencies, mainly Bitcoin. Makarov and Schoar (2020) examine arbitrage opportunities among different exchanges around the world in the cryptocurrency market.

This paper is the closest related to a subset of the cryptocurrency literature that explores stablecoins. Barthélemy, Gardin, and Nguyen (2021) is a contemporaneous paper that is most closely related to this paper as they also study the relationship between the

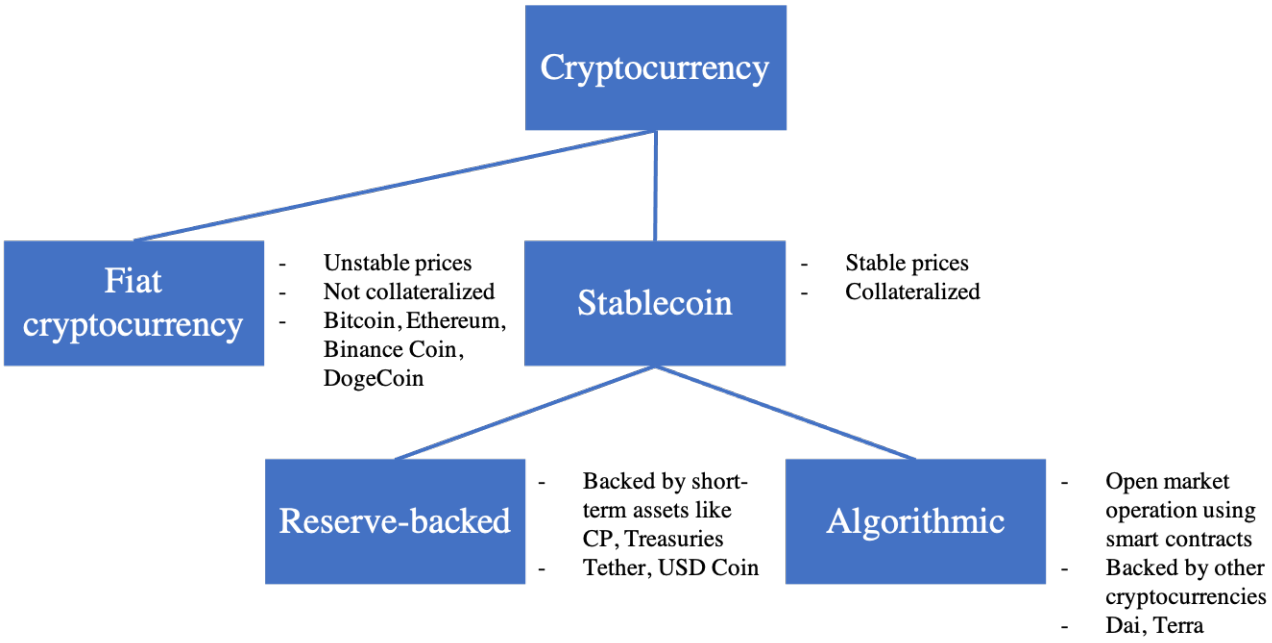
stablecoin market and the commercial paper market. This paper differs from Barthélemy, Gardin, and Nguyen (2021) as I take advantage of differences in price stability mechanisms among different stablecoins and use instrumental variable approach to establish a causal link between activities in the cryptocurrency market and activities in the commercial paper/Treasury market. Furthermore, I explore how the fiat cryptocurrency market affects the commercial paper and Treasury market. Lyons and Viswanath-Natraj (2020), Bellia and Schich (2020), Baur and Hoang (2021), Gorton and Zhang (2021), Gorton, C. Ross, and S. Ross (2021), and Y. Li and Mayer (2022) also study different aspects of the stablecoin market.

Finally, this paper is related to the literature on safe assets and the private sector's ability to produce safe assets that serve the role of money. A line of literature starting from Diamond and Dybvig (1983) and Gorton and Pennacchi (1990) justifies the role of financial intermediaries as producers of a money-like safe asset. Recent theoretical papers like Dang, Gorton, and Holmström (2012) and Dang, Gorton, Holmström, and Ordonez (2017) build on this idea to argue that short-term debt that is information-insensitive serve the role of money, and banks are optimally opaque to keep them from turning information-sensitive. Papers like Krishnamurthy and Vissing-Jorgensen (2012), Sunderam (2014), and Krishnamurthy and Vissing-Jorgensen (2015) use both economic theory and data to study various aspects of public and private short-term safe debt that are valued for their moneyness properties.

2 Background

In this section, I provide a short overview of the cryptocurrency market. Different names that I use to categorize different cryptocurrencies (e.g. fiat cryptocurrency vs. stablecoin or reserve-backed stablecoin vs algorithmic stablecoin) are specific to this paper. In other settings, different names can be used to denote the same type of cryptocurrency.

Figure 1: Categorizing Cryptocurrencies



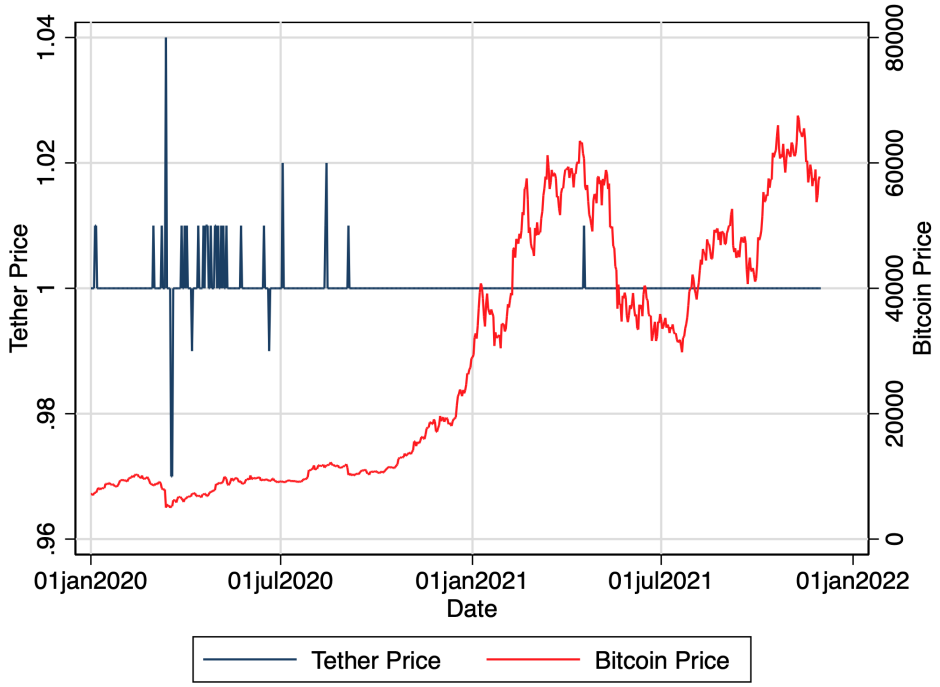
2.1 Categorizing Cryptocurrencies

As of June 2022, there are more than 10,000 cryptocurrencies listed on the CoinMarketCap website.[4] Even though these cryptocurrencies differ widely, we can broadly categorize them into two types: whether their prices are fluctuating or stable. Cryptocurrencies with fluctuating prices are usually called fiat cryptocurrencies, as the value of each coin is not backed by any collateral. Cryptocurrencies with stable prices are usually called stablecoins, as the value of each coin is pegged to the value of a non-crypto asset such as the US dollar.

We can further categorize stablecoins into two types according to how they maintain their price stability. If a stablecoin maintains the peg by keeping a reserve of traditional money-like assets such as commercial paper or Treasuries, it is called the reserve-backed

[4] www.coinmarketcap.com CoinMarketCap is a website that aggregates real-time price and quantity data of different cryptocurrencies traded across different exchanges around the world.

Figure 2: Prices of Bitcoin and Tether



stablecoin. If a stablecoin maintains the peg using blockchain algorithms, it is called the algorithmic stablecoin.

Figure 1 summarizes the categorization of cryptocurrencies.

2.1.1 Fiat Cryptocurrency vs. Stablecoin

Cryptocurrency was introduced as an alternative form of money that could "decentralize" finance away from central governmental control. It gained momentum especially after the Global Financial Crisis of 2007 and 2008, when the government devalued government-issued money by prin ting and disseminating an enormous amount of it through relief programs like quantitative easing. Bitcoin's white paper (Nakamoto 2008) proposed cryptocurrency as an alternative form of private money whose issuance is controlled by a predetermined algorithm–thus outside the scope of human judgment–and transaction records are kept secret and decentralized.

Bitcoin and other well-known cryptocurrencies such as Ethereum, Binance Coin, and DogeCoin are examples of fiat cryptocurrencies as their values are not backed by any other asset, making their prices fluctuate over time. Fiat cryptocurrencies' wildly unstable prices make it hard for them to truly function as a transactional medium.

Tether, USD Coin, and Dai are examples of stablecoins created to address the shortcomings of fiat cryptocurrencies that stem from their price fluctuation. Unlike fiat cryptocurrencies, stablecoins' prices are pegged to the value of a specific asset in the traditional financial market. Prices of major stablecoins such as Tether, USD Coin, and Dai are pegged to the US dollar and do not deviate much from their benchmark value (Gorton, C. Ross, and S. Ross 2021).

Figure 2 plots the prices of Bitcoin and Tether, which are, respectively, the biggest fiat cryptocurrency and the biggest stablecoin in terms of market capitalization as of June of 2022. The price of Bitcoin ranged from around $10,000 to almost $70,000 in a little over a year. On the other hand, the maximum deviation of Tether's price from $1 was when it increased to around $1.04. All significant deviations of Tether's prices from $1 happened early in the time series. When the cryptocurrency market really came into prominence in 2021, deviations of Tether's price from $1 were minimal.

2.1.2 Reserve-backed Stablecoin vs. Algorithmic Stablecoin

Stablecoins can be further categorized into reserved-backed stablecoins and algorithmic stablecoins according to how the issuers of stablecoins maintain their price stability (Liao and Caramichael 2022). Reserve-backed stablecoins maintain their peg to a specific fiat currency by having fiat currency-denominated assets in reserve as a form of collateral. Tether and USD Coin, the top two stablecoins in terms of market capitalization, are examples of reserve-backed stablecoins. On the other hand, algorithmic stablecoins such as Dai maintain their peg to a specific fiat currency by using smart contracts[5] to conduct

[5]Smart contracts can be understood as a form of algorithm on blockchains. CoinMarketCap defines smart contracts as "self-enforcing agreements expressed in software code and executed on the blockchain."

an open market operation similar to that undertaken by central banks. There are some cryptocurrencies like Dai that are not purely algorithmic as they are colleralized by other cryptocurrencies. Throughout this paper, I denote any cryptocurrency that is not collateralized by assets issued in the traditional financial market an algorithmic stablecoin.

2.2 Tether's Balance Sheet and the Shift in Their Asset Allocation Strategy

Table 1: Tether's Balance Sheet

3Q 2021	Asset Type	Amount	Proportion
	Commercial Paper and Certificates of Deposit	$30,595,197,667	44%
	Cash and Bank Deposits	$7,237,204,694	11%
	Money Market Funds	$999,989,000	1%
	Treasury Bills	$19,434,280,489	28%
	Secured Loans	$3,452,029,190	5%
	Corporate Bonds, Funds and Precious Metals	$3,607,629,331	5%
	Other Investments	$3,830,441,303	6%
	Total	$69,156,771,674	

4Q 2021	Asset Type	Amount	Proportion
	Commercial Paper and Certificates of Deposit	$24,165,815,363	31%
	Cash and Bank Deposits	$4,187,004,507	5%
	Money Market Funds	$3,000,083,600	4%
	Treasury Bills	$34,527,886,113	44%
	Secured Loans	$4,142,957,365	5%
	Corporate Bonds, Funds and Precious Metals	$3,628,506,483	5%
	Other Investments	$5,023,389,246	6%
	Total	$78,675,642,677	

Notes: This table is reproduced from Tether's attestation reports published by Tether (2021) on September 30, 2021 and on December 31, 2021, for the third and fourth quarter of 2021.

On February 23, 2021, the New York State Attorney General announced that the issuer of Tether had misled investors about the reserve that was purported to be backing the stablecoin and fined them $18.5 million. The issuer of Tether was also required to submit quarterly attestation reports that showed the breakdown of their asset allocation.

Table 1 reproduces the attestation reports published by Tether (2021) on September

30, 2021, and on December 31, 2021, for the third and fourth quarter of 2021. We can see that Tether holds different types of traditional private money, such as commercial paper, certificates of deposit, and money market fund shares as well as Treasury Bills in their reserve to maintain its stablecoin's price stability.

Comparing the top and the bottom panels of Table 1, we can see a notable shift in Tether's asset allocation strategy from the third to the fourth quarter of 2021. In the third quarter of 2021, commercial paper and certificates of deposit made up 44% of Tether's assets, while Treasuries made up 28%. However, in the fourth quarter of 2021, the share of commercial paper and certificates of deposit in Tether's balance sheet decreased to 31%, while the share of Treasuries increased to 44%. This apparent shift in Tether's asset allocation strategy is consistent with their effort to quell investors' concern about the soundness of their collateral. The quality of commercial paper that Tether had in their reserve has always been in doubt. For instance, in September of 2021, there were rumors that Tether was holding a lot of commercial paper issued by a Chinese real estate developer named Evergrande that was on the brink of default.[6] Tether vehemently denied this rumor. In April of 2022, Tether's Chief Technology Officer Paolo Argoino was explicit about this change in their asset allocation strategy, saying they are "not finished with the reduction" and "will keep reducing the commercial paper holding." [7]

3 Data and Empirical Strategy

3.1 Data Sources

The main goal of this paper is to show that the cryptocurrency market is not detached from the traditional financial markets that we are more familiar with. I argue that the

[6] https://www.coindesk.com/markets/2021/09/17/evergrande-and-chinas-looming-risk-to-tether/https://www.reuters.com/business/finance/stablecoin-tether-says-holds-no-evergrande-commercial-paper-2021-09-

[7] https://www.cnbc.com/2022/04/13/tether-to-reduce-commercial-paper-holdings-in-usdt-reserves.html

market for short-term money-like safe assets such as commercial paper and Treasuries is the medium through which the cryptocurrency market is connected to the traditional financial market. The two biggest stablecoins in terms of market capitalization–Tether and USD Coin–are reserve-backed stablecoins. This means the issuers of Tether and USD Coin need to buy different money market instruments such as commercial paper and put them into their reserve to maintain the stablecoins' peg to the US dollar.

The main empirical relationship that I am interested in investigating is how the issuance of stablecoins affects the issuance and the prices of different types of traditional private money. Specifically, I focus on the stablecoin market's effect on the commercial paper market as it is the most significant type of asset besides cash that the attestation reports of major stablecoins claim they own in their reserve.

The stablecoin data comes from CoinMarketCap, a website that aggregates real-time price and quantity data of different cryptocurrencies traded across different exchanges around the world. The primary analysis of the paper uses daily data from January 2020 to November 2021. I choose to end the time series in November of 2021 to account for Tether's shift in their asset allocation strategy away from commercial paper, which started in the fourth quarter of 2021. In Section 4.5 when I study the effect of Tether's strategy shift on the commercial paper market, I include the time series until March of 2022. Also, the main time series include the period before the Covid crisis. In Section 4.4.2, I conduct a robustness check to make sure the results in this paper is not driven by the Covid crisis.

This paper focuses on studying the issuance behavior of the two largest reserved-backed stablecoins: Tether and USD Coin. As papers like Barthélemy, Gardin, and Nguyen (2021) and Liao and Caramichael (2022) show in their figures, Tether and USD Coin are by far the most dominant stablecoins in the market. For the main analysis, I sum up the market capitalization of Tether and USD Coin and treat them as a single stablecoin.

The commercial paper data comes from the Federal Reserve Board's Commercial Paper Rates and Outstanding Summary. The Federal Reserve's commercial paper data have

Table 2: Summary Statistics

Variable	Mean	Standard Deviation	Min	Max
Stablecoin issuance	198	330	-312	2,081
Total CP issuance	87,956	15,542	26,050	125,220
1 - 4 day CP issuance	58,862	12,773	16,973	89,917
5 - 9 day CP issuance	11,065	4,048	2,136	45,792
10 - 20 day CP issuance	2,778	1,285	484	10,491
21 - 40 day CP issuance	4,428	1,481	674	12,164
41 - 80 day CP issuance	2,759	1,056	196	7,480
81 plus day CP issuance	8,064	2,434	1,391	16,635
1 day ABCP rate	0.27	0.45	0.06	1.62
7 day ABCP rate	0.30	0.50	0.04	2.11
15 day ABCP rate	0.31	0.50	0.05	2.16
30 day ABCP rate	0.34	0.51	0.05	2.37
60 day ABCP rate	0.36	0.51	0.07	2.78
1 day financial CP rate	0.22	0.43	0.02	1.58
7 day financial CP rate	0.25	0.47	0.03	1.59
15 day financial CP rate	0.34	0.56	0.04	1.78
30 day financial CP rate	0.40	0.61	0.04	2.3
60 day financial CP rate	0.60	0.73	0.06	2.52
1 day non financial CP rate	0.22	0.43	0.02	1.61
7 day non financial CP rate	0.28	0.52	0.01	1.88
15 day non financial CP rate	0.30	0.53	0.01	2.1
30 day non financial CP rate	0.29	0.50	0.02	1.91
60 day non financial CP rate	0.30	0.49	0.01	1.73

Notes: Units for the issuance numbers are millions of US dollars. Units for the rates are percentage points. The timeframe is from January 2020 to November 2021. The data frequency is daily.

information about the issuance quantity of different types and maturities of commercial paper.[8] Using this information, I can indirectly infer what type of commercial paper the stablecoin issuers are holding by investigating whether stablecoin issuances differentially affect the market of commercial paper across different maturities.

3.2 Summary Statistics

I am interested in how the issuance of stablecoins affects the issuance quantity and prices of commercial paper. I define stablecoin issuance at time t as the change in the market

[8] ABCP, AA nonfinancial, A2/P2 nonfinancial, AA financial. Tether (2021) claims the average rating of the commercial paper that they are holding is A2 or better.

capitalization of stablecoins between two consecutive days. [9]

$$Stablecoin\ Issuance_t \equiv Market\ Capitaliztion_t - Market\ Capitalization_{t-1}$$

I study how the daily issuance of stablecoins affects the daily issuance of commercial paper. One issue with defining stablecoin issuance as a change in market capitalization between two consecutive days is that while stablecoins are issued every day because cryptocurrencies are traded 24/7, commercial paper issuance data is only available for business days. Therefore, the variable $Stablecoin\ Issuance_t$ on a Friday, for example, will be the change in the market capitalization of stablecoins from a Friday to a Monday without considering how the market capitalization changed on a Saturday and a Sunday. To control for outliers, I drop the observations below the 1st percentile and above the 99th percentile.[10]

Table 2 shows the summary statistics for the variables used in this paper. We can see that on average, $198 million worth of Tether and USD Coins were issued every day.

3.3 Identification Strategy

The top two panels of Figure 3 show the relationship between the total dollar value of commercial paper issued and the total dollar value of stablecoins issued daily. The left panel includes the Covid crisis period, and the right panel does not. We can see that there is a clear positive relationship between the two variables. The bottom two panels of Figure 3 show the relationship between 7-day nonfinancial commercial paper yield and the total dollar value of stablecoins issued daily. As before, the left panel includes the

[9] CoinMarketCap defines market capitalization as "The total market value of a cryptocurrency's circulating supply. It is analogous to the free-float capitalization in the stock market. Current price $*$ Circulating supply." As current price is almost always fixed at $1 (or very close $1), a change in market capitalization can be interpreted as a change in circulating supply, which I interpret as being equivalent to stablecoin issuance.

[10] I also drop three observations that is either an error or are extreme outliers in the commercial paper dataset. They have zeroes all across different variables (4/10/2020, 7/3/2020, 4/2/2021).

Covid crisis period, and the right panel does not. We can see a clear negative relationship between the two variables. Note that there are two interest regimes: one before and one after the Covid crisis period when the monetary authority lowered the interest rate close to zero. I conduct a robustness check of the main results of the paper in Section 4.4.2 and Appendix B without the Covid period.

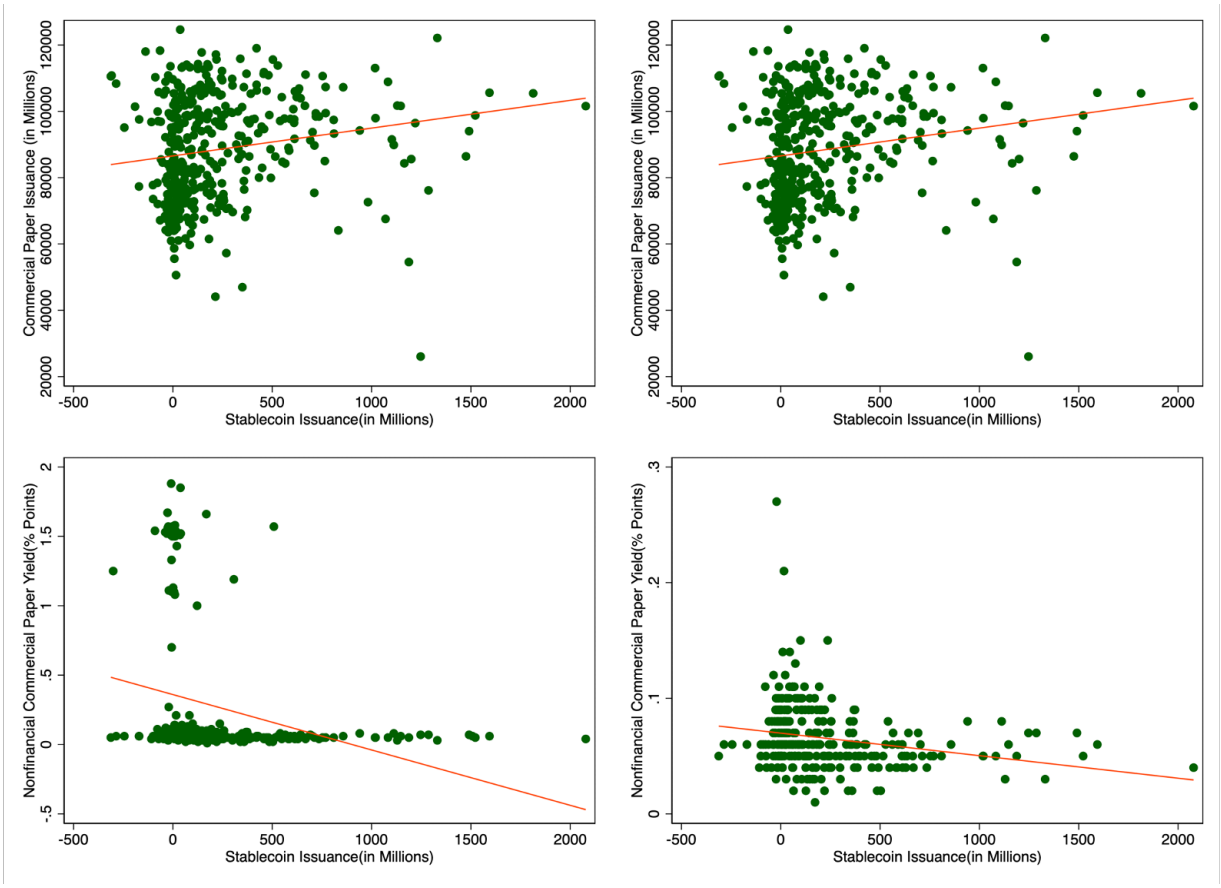
The empirical relationship shown in Figure 3 could merely exhibit a correlation between the two variables. I conduct an instrumental variable analysis to establish a causal link between activities in the cryptocurrency market and activities in the commercial paper market.

As detailed in Section 2, from a bird's eye view, there are two mechanisms that stablecoin issuers utilize to maintain the stablecoin value's peg to different benchmark fiat currencies such as the US dollar. The first type of stablecoins is reserve-backed stablecoins such as Tether and USD Coin, which maintain a reserve of fiat currency-denominated financial assets to back the coins traded in the market. The second type of stablecoins is algorithmic stablecoins such as Dai that use smart contracts to effectively perform open market operations to maintain the coin's price stability.

To establish the causal link between activities in the cryptocurrency market and the commercial paper/Treasury market, I take advantage of the difference in price stability mechanisms between the two types of stablecoins. I instrument the daily issuance amount of Tether and USD Coin with the daily issuance amount of an algorithmic stablecoin Dai.[11] Papers like Gorton, C. Ross, and S. Ross (2021) show that investors do not distinguish among different stablecoins in the market. This means movements in the issuance of Dai will be closely related to movements in the issuance of Tether or USD Coin regardless of the pegging mechanism behind different stablecoins. This is true especially because Dai is partly collateralized by USD Coin. This makes the issuance of Dai a relevant instrument for the issuance of Tether and USD Coin. I regress the issuance quantity

[11] As mentioned in the previous section, Dai is not purely algorithmic as it is collateralized by other cryptocurrencies including USD Coin.

Figure 3: Total Commercial Paper Issuance and Yield vs. Stablecoin Issuance



Notes: This figures plots scatterplots of stablecoin issuances against commercial paper issuance and 7-day nonfinancial commercial paper yield. The left two panels show the scatterplots with the Covid period included. The right two panels show the scatterplots without the Covid period included. The lines in the scatterplots are the linear regression lines. Note that there are two interest regimes: one before and one after the Covid crisis when the monetary authority lowered the interest rate close to zero. The negative relationship in the bottom panel holds without the high interest regime. The analysis without the Covid period is shown in Section 4.4.2 and Appendix B.

of Tether and USD Coin on the one-day lagged issuance quantity of Dai for the first-stage regression. [12]

Furthermore, for the issuance quantity of Dai to be a valid instrument, it needs to satisfy the exclusion restriction. The issuance quantity of Dai can affect the commercial paper market only through its effect on the primary explanatory variable–the issuance quantity of Tether and USD Coin. As Dai is an algorithmic stablecoin that is not required to hold a reserve of fiat currency-denominated assets to maintain its price stability, it is reasonable to argue that movements in the market for Dai do not directly affect the commercial paper and Treasury market.

4 Stablecoin

4.1 Effect of Stablecoin Issuance on Commercial Paper Issuance

In this subsection, I investigate how the issuance of two major stablecoins–Tether and USD Coin–affects the issuance of commercial paper daily by estimating the following two-stage least squares model:

$$\underbrace{Stablecoin\ Issuance_t}_{\Delta Market\ Capitalization_{t-1 \to t}} = \delta + \eta Dai\ Issuance_{t-1}$$

$$\log(CP\ Issuance_{t+1}) = \alpha + \beta \widehat{Stablecoin\ Issuance_t} \tag{1}$$

where $Stablecoin\ \ Issuance_t$ is calculated as a change in market capitalization of Tether and USD Coin combined from day $t-1$ to day t and likewise, $Dai\ \ Issuance_t$ is calculated as a change in market capitalization of Dai from day $t-1$ to t. I standardize the $Stablecoin\ \ Issuance_t$ variable so that the interpretation of the estimated β is the ef-

[12] Regressing on the lagged Dai issuance quantity rather than the contemporaneous Dai issuance quantity seems to exhibit a higher first-stage F-statistics.

Table 3: Stablecoin's Effect on Commercial Paper Issuance

VARIABLES	(1) CP Issuance	(2) CP Issuance
	OLS	2SLS
Stablecoin Issuance	0.0510***	0.110**
	(0.00753)	(0.0517)
Constant	11.37***	11.37***
	(0.00824)	(0.00900)
Observations	467	453
First Stage F-Stat		17.237

Notes: This table shows the estimated coefficients for equation (1) with and without the instrument. I standardize $Stablecoin\ Issuance_t$ variable so that the interpretation of the estimated β is the effect of a one standard deviation increase in stablecoin issuance on the commerical paper issuance amount in percentage term. Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

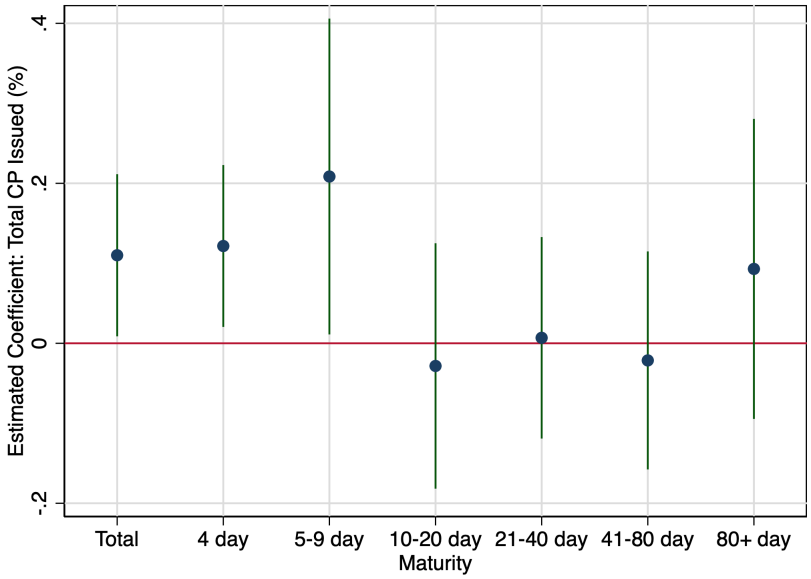
fect of a one standard deviation increase in stablecoin issuance on the commerical paper issuance amount in percentage terms. Table 2 shows that one standard deviation of $Stablecoin\ Issuance_t$ is around $330 million.

Table 3 shows the result of this analysis. The first stage F-statistic is 17.237, which shows that we can reject the hypothesis that the market capitalization of Dai is a weak instrument. We can see that a one standard deviation increase in the issuance of Tether and USD Coin combined on a given day leads to about 11% increase in the issuance of commercial paper the following day.

Figure 4 plots the estimated coefficients for equation (1) across different maturities. The dots show the point estimates and the lines above and below the dots show the 95th confidence interval. We can see that the positive effect of stablecoin issuance on commercial paper issuance is primarily driven by an increase in the issuance of commercial paper with the shortest maturity–nine days or less. For commercial paper with maturity of 10 days or more, the estimated coefficients are statistically insignificant and close to zero.

The result in this subsection provides suggestive evidence that a higher demand for stablecoins in the cryptocurrency market, which is represented by a higher issuance amount of Tether and USD Coin, leads to a higher issuance amount of commercial paper. I argue

Figure 4: Stablecoin's Effect on Commercial Paper Issuance by Maturity



Notes: This figures plots the estimated coefficients for equation (1) across different maturities. The dots show the point estimates and the lines above and below the dots show the 95th confidence interval.

that this is because the issuers of Tether and USD Coin have to back their coin issuance in large part with commercial paper as suggested in Table 1. Furthermore, this result suggests that stablecoin issuers value liquidity as the issuance of Tether and USD Coin affects commercial paper that are of the shortest maturity the most.

4.2 Effect of Stablecoin Issuance on Commercial Paper Yield

In the previous subsection, I showed that an increase in the issuance of Tether and USD Coin results in an increase in the issuance of commercial paper. In this subsection, I study how the stablecoin market affects the prices of commercial paper by investigating how the issuance of Tether and USD Coin affects the yields of commercial paper daily. I estimate the following two-stage least squares model:

$$Stablecoin\ Issuance_t = \delta + \eta Dai\ Issuance_{t-1}$$

$$CP\ Yield_{t+1} = \alpha + \beta \widehat{Stablecoin\ Issuance_t} \tag{2}$$

As before, I instrument the issuance of Tether and USD Coin with the issuance of Dai. I standardize the $Stablecoin\ Issuance_t$ variable so that the interpretation of the estimated β is the effect of a one standard deviation increase in the issuance of Tether and USD Coin on the commercial paper yield in percentage points.

Table 4 shows the result of the instrumental variable analysis where each panel and column shows the estimated coefficients for different types of commercial paper of different maturities. We can see that an increase in the issuance of Tether and USD Coin results in a lower yield or a higher price of commercial paper. Across different types and maturities of commercial paper, a one standard deviation increase in the issuance of Tether and USD Coin decreases the yields by about 18 basis points. This negative effect of the issuance of Tether and USD Coin on the commercial paper yields is consistent across different types of commercial paper and across different maturities.

4.3 Effect of Stablecoin Issuance on Treasury Yields

Table 1 shows that Treasuries also make up a large portion of reserve-backed stablecoin issuers' balance sheets. In this section, I explore how the stablecoin issuance affects the Treasury market by estimating the following two-stage least squares model:

$$Stablecoin\ Issuance_t = \delta + \eta Dai\ Issuance_{t-1}$$

$$Treasury\ Yield_{t+1} = \alpha + \beta \widehat{Stablecoin\ Issuance_t} \tag{3}$$

The fourth panel of Table 4 shows the estimated coefficients for (3) across different maturities. We can see that the estimated coefficients are consistent with the result shown in the previous subsection that showed stablecoin issuance's effect on commercial paper yields. We can see that an increase in the issuance of Tether and USD Coin results in a

Table 4: Stablecoin's Effect on CP/Treasury Yields

ABCP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.182***	-0.229***	-0.219***	-0.255***	-0.250***
	(0.0598)	(0.0757)	(0.0716)	(0.0823)	(0.0828)
Constant	0.240***	0.268***	0.279***	0.307***	0.324***
	(0.0192)	(0.0223)	(0.0227)	(0.0227)	(0.0230)
Observations	456	456	433	456	446
First Stage F-Stat	17.237	17.237	17.862	17.237	16.998
Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.157***	-0.157***	-0.219	-0.394***	-1.229
	(0.0580)	(0.0580)	(0.142)	(0.130)	(0.975)
Constant	0.213***	0.213***	0.255***	0.365***	0.450***
	(0.0236)	(0.0236)	(0.0351)	(0.0468)	(0.149)
Observations	337	337	185	173	79
First Stage F-Stat	15.582	15.582	10.266	11.301	1.31
Non Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.162***	-0.269***	-0.284***	-0.248***	-0.259***
	(0.0536)	(0.0856)	(0.105)	(0.0772)	(0.0835)
Constant	0.182***	0.232***	0.256***	0.247***	0.263***
	(0.0184)	(0.0251)	(0.0261)	(0.0234)	(0.0225)
Observations	455	350	349	403	418
First Stage F-Stat	17.205	9.476	17.254	20.441	16.497
Treasury	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 month	2 month	3 month	6 month	1 year
Stablecoin Issuance	-0.157***	-0.158***	-0.151***	-0.151***	-0.149***
	(0.0531)	(0.0533)	(0.0511)	(0.0505)	(0.0488)
Constant	0.169***	0.174***	0.174***	0.185***	0.199***
	(0.0174)	(0.0172)	(0.0167)	(0.0163)	(0.0152)
Observations	456	456	456	456	456
First Stage F-Stat	17.237	17.237	17.237	17.237	17.237

Notes: Each panel shows the estimated coefficients for equation (2) for different types of commercial paper. Each column shows the estimated coefficients for different maturities. This table only shows the result of the instrumental variable analysis. First stage F-Statistics is sufficiently high except for the estimate for 60-day financial commercial paper. Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

lower yield or a higher price of Treasuries. Across different maturities of Treasuries, a one standard deviation increase in the issuance of Tether and USD Coin decreases the yields by about 15 basis points.

Without the quantity data, it is hard to infer if the higher prices of Treasuries resulting from a higher issuance quantity of stablecoins are due to an excess demand for Treasuries. But considering that the result in this subsection is consistent with the result in the previous subsections that analyzed the commercial paper market, I argue that a higher issuance of reserve-backed stablecoins created a need for the issuers to buy the Treasuries from the market and put an upward pressure on the prices of Treasuries.

4.4 Robustness

4.4.1 Effect of Algorithmic Stablecoins on the Commercial Paper Market?

Throughout this section, I showed that the issuance of Tether and USD Coin affects both the issuance quantity and the yields of commercial paper. I argued that this was because Tether and USD Coin are reserved-backed stablecoins, which means in order to issue more stablecoins, the issuers need to buy fiat currency-denominated assets like commercial paper from the market and put them into their reserve.

I took advantage of the difference in the price stability mechanism of algorithmic stablecoin like Dai that does not need to back their stablecoins with fiat currency-denominated assets to identify the causal link. This difference in the price stability mechanism also implies that the issuance of algorithmic stablecoin Dai should not affect the commercial paper market as much as the issuance of Tether or USD Coin. If this is the case, this serves as a placebo test for the results shown in the previous subsections. Furthermore, it validates that the issuance quantity of Dai satisfies the exclusion restriction.

To test this hypothesis, I estimate the 2SLS models (1) and (2) but with the issuance of Dai as the explanatory variable. I instrument the issuance of Dai with the issuance of

another algorithmic stablecoin, TerraUSD, in order to identify the causality. As TerraUSD has come into prominence more recently than Tether, USD Coin, and Dai, I conduct the analysis on data after February of 2021.

The results are shown in Appendix A. Tables A.1 and A.2 reproduce Tables 3 and 4 with the issaunce of Dai as the explanatory variable and instrumenting it with the issuance of TerraUSD. First of all, we can see that many of the estimates have very low first stage F-statistics or are estimated on a very small number of observations, which means we have to take the result with a grain of salt. This is because TerraUSD has come into prominence very recently, making its correlation with other stablecoins weaker.

Taking this shortcoming into account, we can see that most of the estimated coefficients in Tables A.1 and A.2 are statistically insignificant. The effect that the issuance of Dai has on the issuance amount and the yields of commercial paper is negligible, which makes sense as Dai issuers do not need to buy commercial paper from the market when they issue their stablecoin.

The result in this subsection provides a suggestive evidence why the recent distress in the cryptocurrency market that was instigated by a run on TerraUSD did not spill over to the financial market. TerraUSD was an algorithmic stablecoin that did not hold any commercial paper or Treasuries. It used other cryptocurrencies such as Luna to maintain its peg to the US dollar. TerraUSD being an algorithmic stablecoin might be the reason why we didn't see its distress spill over to the financial market even when at its height it had a market capitalization of over $18 billion.

4.4.2 Taking Out the Covid Period

The Covid crisis and the ensuing policy interventions might have influenced the results in this section. I reproduce the results in this section using data starting from April 1 of 2020 before which the monetary authority conducted its major policy interventions such as lowering the interest rate close to zero.

The results are shown in Appendix B. We can see that overall, the estimated coefficients line up with those shown in this section. The estimated coefficients for the issuance quantity analysis are very similar to those with the Covid period. On the other hand, the estimated coefficients for the yield analysis are smaller as the monetary authority lowered the interest rate close to zero due to the Covid crisis. Despite the lower level of yields, most estimates are still statistically significant.

4.5 The Effect of Tether's Shift in Reserve Management Strategy

On February 23, 2021, the New York State Attorney General announced that the issuer of Tether had misled investors about the reserve that was purported to be backing the stablecoin and fined them $18.5 million on top of banning them from engaging in trading activities with the people in New York. The issuer of Tether was also required to submit quarterly attestation reports that show the breakdown of their asset portfolio.

Following this incident, the issuer of Tether has shifted from holding commercial paper to other types of assets such as Treasury bills in their reserves. Table 1 in Section 2 showed how this shift in Tether's reserve management strategy affected their balance sheet. In the third quarter of 2021, commercial paper and certificates of deposit made up 44% of Tether's assets, while Treasuries made up 28%. However, in the fourth quarter of 2021, the share of commercial paper and certificates of deposit in Tether's balance sheet decreased to 31%, while the share of Treasuries increased to 44%. In April of 2022, Tether's Chief Technology Officer Paolo Argoino announced during the Paris Blockchain Week Summit that they are "not finished with the reduction" and "will keep reducing the commercial paper holding."[13]

The analysis until now has shown that the issuance of stablecoins had a significant impact on the commercial paper market in the United States, at least until November of

[13] https://www.cnbc.com/2022/04/13/tether-to-reduce-commercial-paper-holdings-in-usdt-reserves.html

Table 5: Stablecoin's Effect on CP Issuance Post 4Q of 2021

VARIABLES	(1) Total	(2) 4 days	(3) 5-9 days	(4) 10-20 days	(5) 21-40 days
Issuance $\times \mathbb{1}\{t \geq$ 4Q of 2021$\}$	-0.0803**	-0.0984**	-0.0469	-0.122**	-0.0954
	(0.0387)	(0.0432)	(0.0546)	(0.0615)	(0.0655)
Issuance	0.0346***	0.0491***	0.00945	0.0169	0.00607
	(0.0118)	(0.0134)	(0.0173)	(0.0187)	(0.0144)
Constant	11.42***	11.02***	9.276***	7.898***	8.387***
	(0.00882)	(0.0103)	(0.0162)	(0.0195)	(0.0151)
Observations	574	574	574	574	574

Notes: Each panel shows the estimated coefficients for equation (4). No instrument is used. $\mathbb{1}\{t \geq$ 4Q of 2021$\}$ is an indicator variable that equals 1 if the time is in or after the fourth quarter of 2021 when Tether started unloading commercial paper. Robust standard errors in parentheses *** p$<$\$0.01, ** p$<$\$0.05, * p$<$\$0.1

2021. An increase in the issuance of stablecoins increased the commercial paper issuance and decreased the commercial paper yields.

In this section, I analyze whether Tether's decision to reduce its holding of commercial paper that started around the fourth quarter of 2021 impacted the commercial paper market. To conduct this analysis, I extend the time series to March of 2022 and estimate the following equation:

$$\log(CP\ Issuance_{t+1}) = \alpha + \beta_1 Stablecoin\ Issuance_t \times \mathbb{1}\{t \geq \text{4Q of 2021}\} + \beta_2 Stablecoin\ Issuance_t \tag{4}$$

The analysis in the previous section showed that the estimated coefficient β_2 is positive, which means an increase in the issuance of stablecoins led to an increase in the issuance of commercial paper. The hypothesis was that commercial paper was a favored type of asset for stablecoin issuers, as shown in their balance sheet in Table 1.

Table 5 shows that the estimated coefficients for β_1 are either statistically insignificant or even negative. This means that after the fourth quarter of 2021, an increase in the issuance of stablecoins did not affect the issuance of commercial paper or actually had a negative effect on the issuance quantity of commercial paper.

Table 6: Stablecoin's Effect on CP Yield Post 4Q of 2021

VARIABLES	(1) ABCP	(2) Fin CP	(3) Nonfin CP
Issuance $\times \mathbb{1}\{t \geq$ 4Q of 2021$\}$	0.0274	0.0365*	0.0423*
	(0.0243)	(0.0213)	(0.0224)
Issuance	-0.0869***	-0.0762***	-0.0796***
	(0.0156)	(0.0139)	(0.0147)
Constant	0.265***	0.206***	0.204***
	(0.0175)	(0.0166)	(0.0170)
Observations	574	574	573

Notes: Each panel shows the estimated coefficients for equation (5). No instrument is used. $\mathbb{1}\{t \geq$ 4Q of 2021$\}$ is an indicator variable that equals 1 if the time is in or after the fourth quarter of 2021 when Tether started unloading commercial paper. Robust standard errors in parentheses *** p$<$\$0.01, ** p$<$\$0.05, * p$<$\$0.1

I further analyze the effect of Tether's shift in reserve management strategy on the commercial paper market by investigating the impact on commercial paper yields. To conduct this analysis, I estimate the following equation:

$$CP\ Yield_{t+1} = \alpha + \beta_1 Stablecoin\ Issuance_t * \mathbb{1}\{t \geq \text{4Q of 2021}\} + \beta_2 Stablecoin\ Issuance_t \tag{5}$$

The analysis in the previous section showed that the estimated coefficient β_2 is negative, which means an increase in the issuance of stablecoins led to a decrease in commercial paper yields as there was an excess demand for commercial paper.

The first row of Table 6 shows that estimated coefficients for β_1 are either statistically insignificant or even positive for various types of commercial paper. This provides suggestive evidence that after the fourth quarter of 2021, stablecoin issuers were unloading commercial paper from their reserves.

In this subsection, I showed that since the fourth quarter of 2021, when Tether changed its reserve management strategy from holding commercial paper to holding Treasury bills, the effect of stablecoin issuance on the commercial paper market has been significantly different from what we had seen until then.

4.6 Summary and Interpretation of Results

This section explored the connection between the stablecoin market and the commercial paper market by looking at how the reserve-backed stablecoin issuance affects commercial paper issuance amount and yields. I showed that an increase in the issuance of Tether and USD Coin increased the commercial paper issuance amount and decreased the commercial paper yields. I also explored the connection between the stablecoin market and the Treasury market and showed that an increase in the issuance of Tether and USD Coin decreased Treasury yields.

I interpreted this result to mean that an increase in the issuance of reserve-backed stablecoins created an excess demand for money-like assets like commercial paper and Treasuries as issuers of reserve-backed stablecoins need to put these assets in their reserve to maintain the coins' peg to the US dollar. I established the causality of the emprical relationship by taking advantage of the difference in the pegging mechanism between reserve-backed stablecoins and algorithmic stablecoins.

I also showed that Tether's shift in its reserve management strategy away from commercial paper affected the commercial paper market starting the fourth quarter of 2021. The robust empirical patterns between the stablecoin market and the commercial paper market vanished after the fourth quarter of 2021.

5 Fiat Cryptocurrency

In this section, I explore how movements in the fiat cryptocurrency market affect the commercial paper market. Stablecoins are a form of safe asset in the cryptocurrency market. Investors reduce their exposure to fiat cryptocurrencies by exchanging fiat cryptocurrencies for stablecoins, instead of traditional fiat currencies like the US dollar, when the market is down. This is especially true because there are limitations to exchanging

cryptocurrencies directly with traditional fiat currencies.[14] Approximately three quarters of trading on cryptocurrency trading platforms occurs between a stablecoin and other cryptocurrencies (Gensler 2021). The demand for stablecoins can decrease when the fiat cryptocurrency market is booming because investors will want to exchange stablecoins for fiat cryptocurrencies. These changes in demand for stablecoins due to changes in the market condition of fiat cryptocurrencies can in turn affect the demand for commercial paper.

5.1 Effect of Fiat Cryptocurrency on Commercial Paper Issuance Quantity

In this subsection, I study how movements in the fiat cryptocurrency market affect commercial paper issuance. I focus on the top three fiat cryptocurrencies in terms of their market capitalization–Bitcoin, Ethereum, and Binance Coin. I define the market capitalization of a fiat cryptocurrency as the sum of the market capitalizations of these three fiat cryptocurrencies. As before, I estimate the two-stage least squares model with the issuance of stablecoin Dai as an instrument to identify the causal link between the fiat cryptocurrency market and the commercial paper market. I estimate the following model:

$$\Delta Fiat\ Market\ Cap_t = \delta + \eta Dai\ Issuance_{t-1}$$

$$\log(CP\ Issuance_{t+1}) = \alpha + \beta \Delta \widehat{Fiat\ Market\ Cap_t} \tag{6}$$

The variable $\Delta Fiat\ \ Market\ \ Cap_t$ is standardized so that the interpretation of the estimated β is the effect of a one standard deviation increase in the change of the market capitalization of fiat cryptocurrencies on the commerical paper issuance amount in percentage terms. As before, I use the change in the market capitalization of the top

[14] Different frictions like exchange fees or redemption gates for different cryptocurrencies and exchanges are described well in Gorton and Zhang (2021).

Table 7: Fiat Cryptocurrency's Effect on Commercial Paper Issuance

VARIABLES	(1) CP Issuance	(2) CP Issuance
	OLS	2SLS
Δ Market Cap	-0.00448	-0.119*
	(0.00852)	(0.0733)
Constant	11.37***	11.37***
	(0.00852)	(0.0103)
Observations	478	464
First Stage F-Stat		10.211

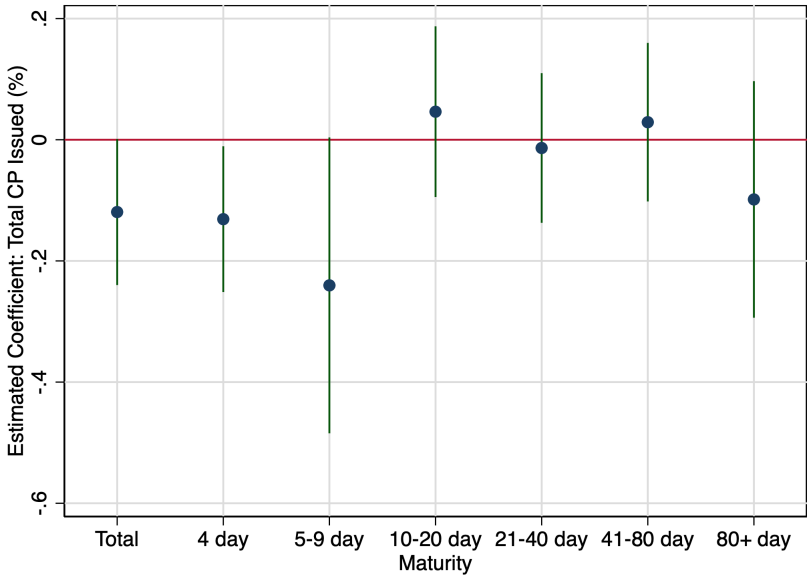
Notes: The left column shows OLS estimate, and the right column shows 2SLS estimate for equation (6) . Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

three fiat cryptocurrencies as my independent variable so that $\Delta Fiat\ \ Market\ \ Cap_t = Fiat\ Market\ Cap_t - Fiat\ Market\ Cap_{t-1}$.

Table 7 shows the estimated coefficient for equation (6). We can see that a one standard deviation increase in the market capitalization change of Bitcoin, Ethereum, and Binance Coin combined on a given day results in an 11.9% decrease in the commercial paper issuance the following day.

Figure 5 plots the estimated coefficients for equation (6) across different maturity. The lines above and below the point estimates show the 90th precentile confidence interval. We can see that the negative effect of the market capitalization change of fiat cryptocurrencies on the commercial paper issuance is primarily driven by a decrease in the issuance of commercial paper with the shortest maturity that are nine days or less. This result is consistent with the result in the previous section in Figure 4 where the effect of the stablecoin issuance on the commercial paper issuance was almost entirely driven by the issuance of commercial paper with the shortest maturity. As before, the same analysis done without the Covid period is shown in Appendix B, which is consistent with the result in this section.

Figure 5: Fiat Cryptocurrency's Effect on Commercial Paper Issuance by Maturity



Notes: This figures plots the estimated coefficients for equation (6) across different maturities. The dots show the point estimates and the lines above and below the dots show the 90th confidence interval.

5.2 Effect of Fiat Cryptocurrency on Commercial Paper Yield

In this subsection, I study how the fiat cryptocurrency market affects the prices of commercial paper by investigating how the changes in the market capitalization of top three fiat cryptocurrencies affects the yields of commercial paper daily. I estimate the following model :

$$\Delta Fiat\ Market\ Cap_t = \delta + \eta Dai\ Issuance_{t-1}$$

$$CP\ Yield_{t+1} = \alpha + \beta \Delta \widehat{Fiat\ Market\ Cap_t} \tag{7}$$

Table 8 shows the estimated coefficient for equation (7). We can see that an increase in the changes in the market capitalization of fiat cryptocurrencies results in higher commercial paper yields.

Table 8: Fiat Cryptocurrency's Effect on CP/Treasury Yields

ABCP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.213**	0.264**	0.290*	0.293**	0.290**
	(0.102)	(0.125)	(0.149)	(0.138)	(0.142)
Constant	0.237***	0.264***	0.279***	0.303***	0.316***
	(0.0214)	(0.0249)	(0.0263)	(0.0258)	(0.0258)
Observations	464	464	441	464	454
First Stage F-Stat	16.231	16.231	14.064	16.231	15.094
Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.171**	0.207	0.272	0.534**	-1.691
	(0.0832)	(0.136)	(0.254)	(0.270)	(1.324)
Constant	0.179***	0.206***	0.247***	0.391***	0.575***
	(0.0193)	(0.0248)	(0.0426)	(0.0624)	(0.165)
Observations	464	342	187	177	81
First Stage F-Stat	16.231	10.761	6.559	7.645	1.499
Non Fin AA	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.189**	0.212**	0.329*	0.244	0.329**
	(0.0915)	(0.106)	(0.197)	(0.166)	(0.163)
Constant	0.180***	0.238***	0.259***	0.250***	0.271***
	(0.0202)	(0.0273)	(0.0323)	(0.0261)	(0.0279)
Observations	463	358	355	411	426
First Stage F-Stat	10.223	13.981	6.125	7.442	8.895
Treasury	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 month	2 month	3 month	6 month	1 year
ΔMarket Cap	0.181**	0.182**	0.173**	0.172**	0.172**
	(0.0879)	(0.0876)	(0.0844)	(0.0831)	(0.0821)
Constant	0.165***	0.170***	0.169***	0.181***	0.195***
	(0.0190)	(0.0188)	(0.0182)	(0.0178)	(0.0168)
Observations	464	464	464	464	464
First Stage F-Stat	16.201	20.241	11.883	13.329	15.371

Notes: Each panel shows the estimated coefficients for equation (7) for different types of commercial paper. Each column shows the estimated coefficients for different maturities. This table only shows the result of the instrumental variable analysis. Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

5.3 Effect of Fiat Cryptocurrency on Treasury Yields

Table 1 shows that Treasuries also make up a large portion of reserve-backed stablecoin issuers' balance sheets. In this subsection, I study how the fiat cryptocurrency market affects the prices of Treasury yields by estimating the following two-stage least squares model :

$$Stablecoin\ Issuance_t = \delta + \eta Dai\ Issuance_{t-1}$$

$$Treasury\ Yield_{t+1} = \alpha + \beta \widehat{Stablecoin\ Issuance_t} \tag{8}$$

The fourth panel of Table 8 shows the the estimated coefficients for (8) across different maturities. We can see that the estimated coefficients are consistent with the result shown in the previous subsection that showed the effect of fiat cryptocurrency's market capitalization change on commercial paper yields. We can see that an increase in the market capitalization change of major fiat cryptocurrency results in a higher yield or a lower price of Treasuries. Across different maturities of Treasuries, a one standard deviation increase in the issuance of Tether and USD Coin increases the yields by about 17 to 18 basis points.

As with stablecoins, without the quantity data, it is hard to infer if the lower prices of Treasuries is resulting from a market capitalization change are due to a lower demand for Treasuries. But I argue that a higher market capitalization change of major fiat cryptocurrencies made the investors trade stablecoins for fiat cryptocurrencies, which lowered the demand for stablecoins thus Treasuries. This resulted in higher Treasury yields or lower Treasury prices.

5.4 Summary and Interpretation of Results

This section explored the connection between the fiat cryptocurrency market and the commercial paper market by looking at how the market capitalization change of Bitcoin, Ethereum, and Binance Coin affects the commercial paper issuance amount and yields. I showed that an increase in the market capitalization change of fiat cryptocurrencies

decreased the commercial paper issuance amount and increased the commercial paper yields. I also explored the connection between the fiat cryptocurrency market and the Treasury market and showed that an increase in the market capitalization change of fiat cryptocurrencies increased the Treasury yields.

I interpreted this result to mean that an increase in the market capitalization change, which signifies a bull fiat cryptocurrency market, makes investors exchange stablecoins for fiat cryptocurrencies and increase their exposure to the fiat cryptocurrency market. This decreases the demand for stablecoins, which in turn decreases the demand for money-like assets like commercial paper and Treasuries.

6 Policy Implications

A financial crisis is an event when lenders run on privately produced short-term safe asset because it loses its role as money (Gorton 2018). In that sense, the Global Financial Crisis of 2007-2008 was fundamentally similar to any other financial crises that we have experienced throughout history. During the National Banking Era from 1863 to 1914, for example, there was a frequent run on bank's demand deposits when macroeconomic conditions signaled a recession (Gorton 1988). Demand deposits were money-like in that they could almost always be valued at par with no questions asked. However, the holders of demand deposits sometimes feared adverse selection as they did not have full information about the riskiness of the collateral that was backing demand deposits. Therefore, a negative shock incentivized them to conduct costly due diligence on the collateral. When this happened, the demand deposit turned information-sensitive and no longer served the role of money, leading to a run.

The advent of deposit insurance in 1934 rendered a run on retail banks obsolete. With this, the potential for a run on a money-like safe asset migrated from the retail banking sector to the wholesale banking sector. This potential manifested itself as a run on secu-

rities such as repurchase agreement and asset-backed commercial paper (ABCP) in the Global Financial Crisis of 2007-2008 (Gorton and Metrick 2012). The demand deposit of the National Banking Era in the 1800s or the repurchase agreement of the modern era were all privately-produced short-term safe assets created by financial intermediaries as relatively safe means to transfer wealth intertemporally and facilitate transactions among market participants.

According to Gorton and Zhang (2021), cryptocurrencies, especially reserve-backed stablecoins, can be viewed as another form of private money. If this is the case, the issuers of these stablecoins can be viewed as banks that issue stablecoins with money-like characteristics. If stablecoins are just another form of short-term money-like debt, Gorton (2018) suggests that there is a potential for a run on stablecoins when stablecoin holders get anxious about the reserve that the stablecoin issuers are managing. In this sense, Tether's commitment to substitute commercial paper with the Treasuries could be seen as an effort to curb stablecoin holders' anxiety about the reserve asset.

We recently saw a run on a major stablecoin called TerraUSD that boasted a market capitalization of more than $18 billion at its height. The analysis in Section 4.5 argued that TerraUSD's being an algorithmic stablecoin is the reason why its distress did not spill over to the financial market. However, financial history suggests that we should not be complacent: a run on even the reserve-backed stablecoins like Tether and USD Coin is bound to happen. The analysis in this paper indicates that distress in the reserve-backed stablecoin market can spread to the traditional financial market and ultimately to the real economy through the commercial paper and Treasury market. A run on stablecoins means stablecoin holders exchange stablecoins for US dollars en masse. To honor these exchange requests, the stablecoin issuers need to sell off their assets, including commercial paper. This selloff will put an extreme upward pressure on the commercial paper yields, shooting up financing costs for every market participant in the commercial paper market.

As of May 2022, the market capitalization of Tether and USD Coin is around $136 billion. If we think of stablecoin issuers as prime money market mutual funds, for example, this means Tether and USD Coin combined has by far the largest asset under management in the world.[15] What's more surprising–and perhaps frightening–is the pace of growth of these stablecoins, as the market capitalization of Tether and USD Coin was less than half of what it was in May of 2022.

If we think of stablecoin issuers as banks or money market mutual funds, we can experiment with applying the same set of regulations that we use on banks or MMFs to stablecoin issuers. A standard capital requirement that requires the debt issuer to maintain a certain level of equity can be the starting point for regulating stablecoin issuers. We can also think of risk-weighting different types of assets in the reserve when calculating the reserve requirement so that stablecoin issuers will be more incentivized to hold assets like the Treasuries over lower-rated commercial paper.[16]

7 Conclusion

This paper explored if and how the recently-booming cryptocurrency market is connected to the traditional financial market. I showed that the stablecoin market is the medium through which the two markets are connected. Reserve-backed stablecoin issuers manage a reserve of short-term money-like safe assets such as commercial paper and Treasuries to maintain the stablecoin's peg to the price of the benchmark fiat currency. An increase in the stablecoin issuance results in an increase in the commercial paper issuance and a decrease in commercial paper yields. This indicates that stablecoin issuers created an excess demand for commercial paper that pushed up the issuance amount and pushed down the yields. On the other hand, an increase in the market capitalization change of fiat

[15] JP Morgan Prime Money Market Fund is one of the largest prime MMF in the world with the AUM of over $100 billion.

[16] Y. Li and Mayer (2022) for example builds a dynamic model to theoretically study different policy instruments.

cryptocurrencies results in a decrease in commercial paper issuance and an increase in the commercial paper yields. I hypothesized that this is due to fiat cryptocurrency investors' demand to exchange stablecoins with fiat cryptocurrencies when the market capitalization change of fiat cryptocurrencies is high, which lowers the demand for stablecoins.

The reduced-form nature of this paper's empirical analysis limits the scope for studying the specific mechanism through which the supplies and demands for traditional private money, stablecoins, and fiat cryptocurrencies interact with each other, thereby determining equilibria in each market. The result of this paper calls for a structural model that holistically takes into account not only the movements in the cryptocurrency market, but also how the cryptocurrency market interacts with the traditional financial market and what the policy implications are when the exponential growth of the cryptocurrency market increases its impact on the traditional financial market.

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Appendix

A Effect of Dai Issuance on the Commercial Paper Market

Table A.1: Dai's Effect on Commecial Paper Issuance

OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Total	4 days	5-9 days	10-20 days	21-40 days	41-80 days	80+ days
Dai Issuance	-0.00804*	-0.00166	-0.0499***	-0.0233	0.00699	-0.00163	-0.00323
	(0.00449)	(0.00548)	(0.0151)	(0.0170)	(0.0146)	(0.0148)	(0.0159)
Constant	11.51***	11.14***	9.328***	7.983***	8.394***	7.893***	8.989***
	(0.00796)	(0.00919)	(0.0240)	(0.0257)	(0.0212)	(0.0246)	(0.0202)
Observations	208	208	208	208	208	208	208
2SLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Total	4 days	5-9 days	10-20 days	21-40 days	41-80 days	80+ days
Dai Issuance	-0.0742	-0.0906	-0.119	-0.141	0.298	-0.0194	0.322**
	(0.0749)	(0.0939)	(0.166)	(0.227)	(0.190)	(0.200)	(0.132)
Constant	11.53***	11.16***	9.341***	8.006***	8.337***	7.896***	8.925***
	(0.0198)	(0.0246)	(0.0452)	(0.0593)	(0.0522)	(0.0520)	(0.0450)
Observations	208	208	208	208	208	208	208
First Stage F-Stat	8.627	8.627	8.627	8.627	8.627	8.627	8.627

s: Each panel shows the estimated coefficients for equation (2) with the explanatory variable being the daily issuance quantity of Dai instead of er and USD Coin. The issuance quantity of Dai is instrumented by another algorithmic stablecoin, TerraUSD. Each column shows the estimated ficients for different maturities. Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

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Table B.3: Stablecoin's Effect on Commercial Paper Issuance

VARIABLES	(1) OLS	(2) 2SLS
Stablecoin Issuance	0.0505***	0.114**
	(0.00813)	(0.0574)
Constant	11.37***	11.36***
	(0.00922)	(0.0109)
Observations	408	408
First Stage F-Stat		15.561

Figure B.1: Stablecoin's Effect on Commercial Paper Issuance by Maturity

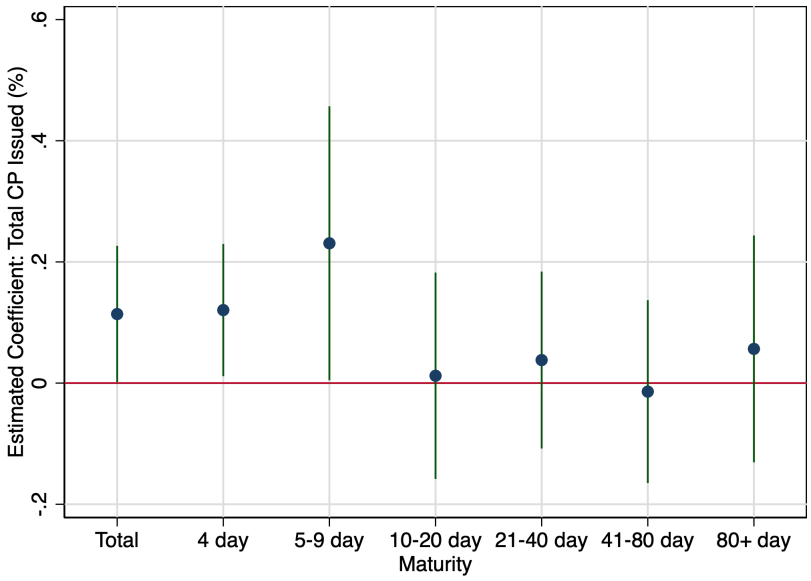

Table A.2: Dai's Effect on Commecial Paper Yields

ABCP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Dai Issuance	0.0227***	0.0194***	0.0236**	0.00906	-0.0120
	(0.00739)	(0.00671)	(0.0109)	(0.00915)	(0.0119)
Constant	0.0881***	0.0788***	0.0815***	0.0978***	0.117***
	(0.00253)	(0.00228)	(0.00327)	(0.00244)	(0.00295)
Observations	208	208	198	208	206
First Stage F-Stat	8.627	8.627	6.269	8.627	8.395
Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Dai Issuance	-0.00170	-0.00170	-0.00147	0.00344	-0.00700
	(0.00291)	(0.00291)	(0.00411)	(0.0179)	(0.0593)
Constant	0.0638***	0.0638***	0.0679***	0.0744***	0.107***
	(0.000986)	(0.000986)	(0.00215)	(0.00960)	(0.0155)
Observations	164	164	69	67	32
First Stage F-Stat	6.089	6.089	5.838	2.199	0.238
Non Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Dai Issuance	0.00367	0.00439	-0.00192	0.00909	0.000113
	(0.00308)	(0.00399)	(0.00499)	(0.00560)	(0.00709)
Constant	0.0496***	0.0499***	0.0478***	0.0558***	0.0550***
	(0.000860)	(0.00111)	(0.00117)	(0.00632)	(0.00195)
Observations	208	165	164	184	187
First Stage F-Stat	8.627	4.742	5.749	9.252	5.781

Notes: Each panel shows the estimated coefficients for equation (2) with the explanatory variable being the daily issuance volume of Dai instead of Tether and USD Coin. The issuance volume of Dai is instrumented by another algorithmic stablecoin, Terra. Each column shows the estimated coefficients for different maturities. This table only shows the result of the instrumental variable analysis. Robust standard errors in parentheses *** p$<$0.01, ** p$<$0.05, * p$<$0.1

Table B.4: Stablecoin's Effect on CP/Treasury Yields

ABCP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.0101*	-0.0246**	-0.0332**	-0.0580**	-0.0574**
	(0.00581)	(0.0123)	(0.0147)	(0.0238)	(0.0246)
Constant	0.108***	0.113***	0.127***	0.157***	0.175***
	(0.000956)	(0.00232)	(0.00389)	(0.00709)	(0.00695)
Observations	408	408	388	408	399
First Stage F-Stat	15.561	15.561	16.435	15.561	15.306
Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.00641	-0.00958	-0.00745	-0.0200**	-0.0789
	(0.00505)	(0.00616)	(0.0117)	(0.00916)	(0.149)
Constant	0.0709***	0.0745***	0.0813***	0.0940***	0.129***
	(0.000885)	(0.00141)	(0.00168)	(0.00289)	(0.0216)
Observations	408	300	160	141	57
First Stage F-Stat	15.561	14.234	9.351	8.127	0.252
Non Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
Stablecoin Issuance	-0.0851***	-0.0982***	-0.107***	-0.175***	-0.207**
	(0.0318)	(0.0357)	(0.0393)	(0.0610)	(0.0856)
Constant	0.204***	0.207***	0.226***	0.306***	0.358***
	(0.0117)	(0.0125)	(0.0139)	(0.0210)	(0.0229)
Observations	408	407	407	405	378
First Stage F-Stat	15.561	15.562	15.508	15.571	13.612
Treasury	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 month	2 month	3 month	6 month	1 year
Stablecoin Issuance	-0.0425***	-0.0375**	-0.0352**	-0.0388**	-0.0441***
	(0.0162)	(0.0155)	(0.0148)	(0.0154)	(0.0165)
Constant	0.114***	0.0761***	0.0796***	0.0941***	0.114***
	(0.00280)	(0.00245)	(0.00249)	(0.00267)	(0.00286)
Observations	408	408	408	408	408
First Stage F-Stat	15.561	15.561	15.561	15.561	15.561

Table B.5: Fiat Cryptocurrency's Effect on Commercial Paper Issuance

VARIABLES	(1) OLS	(2) 2SLS
Δ Market Cap	-0.00502	-0.111*
	(0.00838)	(0.0688)
Constant	11.37***	11.37***
	(0.00942)	(0.0108)
Observations	416	416
First Stage F-Stat		10.741

Figure B.2: Fiat Cryptocurrency's Effect on Commercial Paper Issuance by Maturity

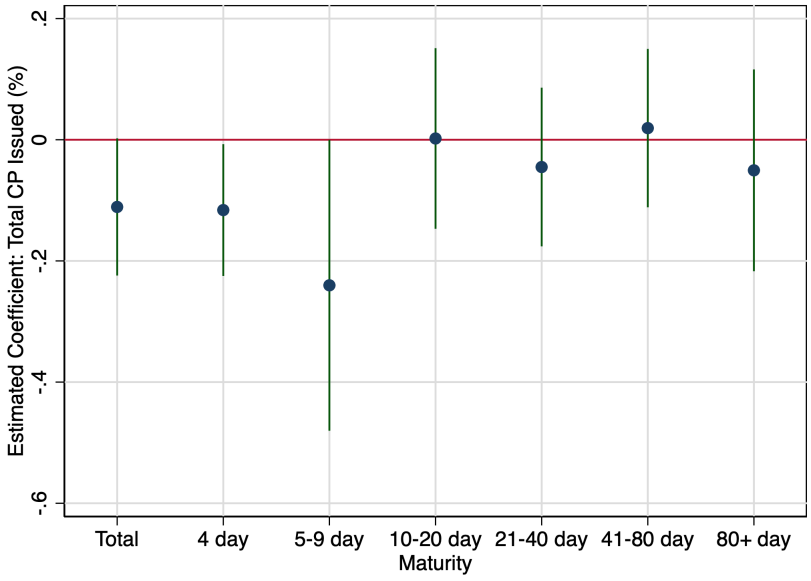

Table B.6: Fiat Cryptocurrency's Effect on CP/Treasury Yields

ABCP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.0112	0.0265*	0.0438*	0.0627**	0.0595*
	(0.00745)	(0.0144)	(0.0250)	(0.0320)	(0.0317)
Constant	0.107***	0.112***	0.126***	0.154***	0.170***
	(0.00104)	(0.00259)	(0.00451)	(0.00734)	(0.00704)
Observations	416	416	396	416	407
First Stage F-Stat	10.741	10.741	8.620	10.741	9.800
Fin CP	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.00798	0.0123	0.0126	0.0260**	-0.0729
	(0.00644)	(0.0114)	(0.0164)	(0.0129)	(0.0590)
Constant	0.0701***	0.0730***	0.0799***	0.0922***	0.123***
	(0.000837)	(0.00122)	(0.00238)	(0.00317)	(0.0104)
Observations	416	305	163	144	58
First Stage F-Stat	10.741	6.036	3.267	6.547	1.662
Non Fin	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 day	7 day	15 day	30 day	60 day
ΔMarket Cap	0.0940**	0.110**	0.115**	0.199**	0.181*
	(0.0458)	(0.0525)	(0.0560)	(0.0951)	(0.0963)
Constant	0.201***	0.201***	0.221***	0.300***	0.359***
	(0.0122)	(0.0130)	(0.0143)	(0.0225)	(0.0247)
Observations	416	415	415	413	385
First Stage F-Stat	10.741	10.740	10.751	10.387	10.921
Treasury	(1)	(2)	(3)	(4)	(5)
VARIABLES	1 month	2 month	3 month	6 month	1 year
ΔMarket Cap	0.0359*	0.0397*	0.0370*	0.0404*	0.0476**
	(0.0194)	(0.0205)	(0.0201)	(0.0206)	(0.0234)
Constant	0.0657***	0.0726***	0.0762***	0.0903***	0.110***
	(0.00258)	(0.00288)	(0.00288)	(0.00309)	(0.00332)
Observations	416	416	416	416	416
First Stage F-Stat	10.741	10.741	10.741	10.741	10.741