STARDUST

Terra Collapse Deep Dive

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An uncollateralized stablecoin is considered one of the holy grails of crypto. In 2018, a company called Basis tried to create one of the first.

An uncollateralized algorithmically managed stablecoin is considered by many to be the holy grail of crypto.

CoinDesk

Opinion

UST Won't Be the End of Algorithmic Stablec

The trail for a monetary "Holy Grail" continues, despite Terra's collapse. do we do about it?

By Daniel Kuhn

Layer 2

May 16, 2022 at 6:14 p.m. UTC

Updated May 16, 2022 at 6:49 p.m. UTC

Forbes

ASIA

Explaining Stable Coins, The Holy

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Algorithm Stablecoin – The Holy Grail of next generation DeFi

Jupiter Zheng CFA, Research Director of HashKey Capital

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Stablecoins: A Holy Grail in Digital Currency

A global currency with no central bank and low volatility may be a key component of the decentralized web

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Stablecoins: The cryptocurrency Holy Grail?

31 May 2019

Basis (formerly Basecoin) was one of the very first attempts.

BASIS

Basis: A Price-Stable Cryptocurrency with an Algorithmic Central Bank

Formerly known as: Basecoin

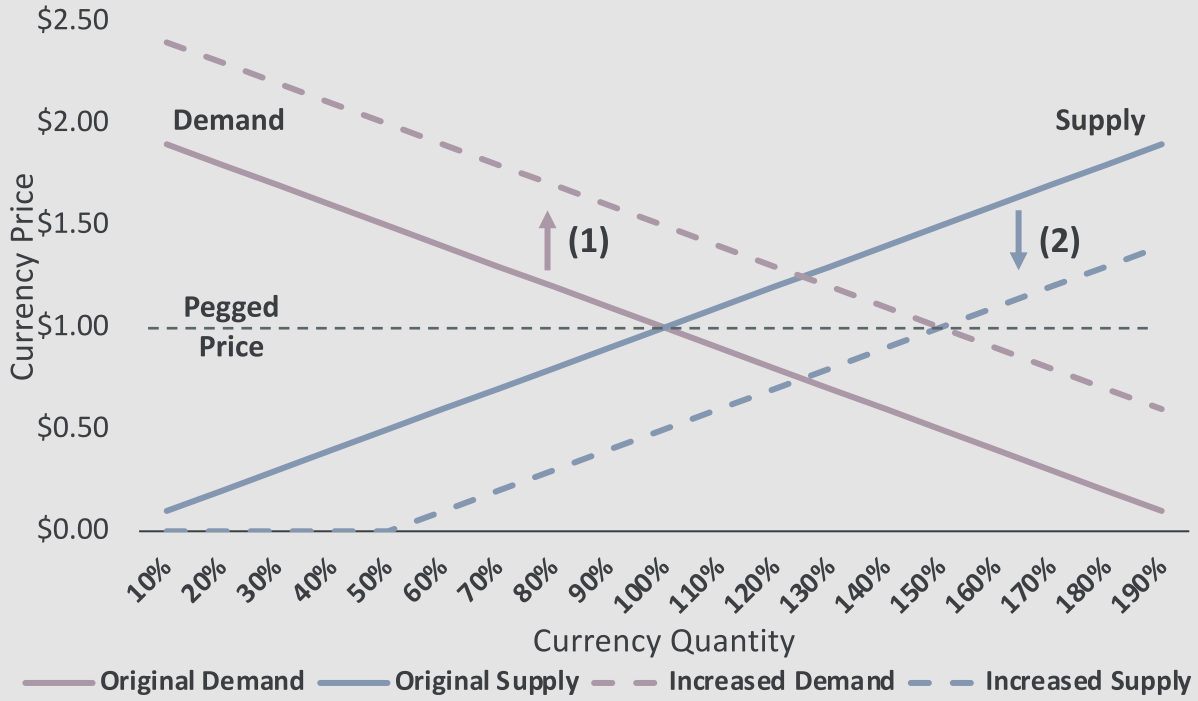
Nader Al-Naji (n@intangiblelabs.co), Josh Chen (j@intangiblelabs.co), Lawrence Diao (l@intangiblelabs.co)

Version 0.99.7
First published: June 20, 2017
Last updated: June 4, 2018

For the most updated version, see:
www.basis.io

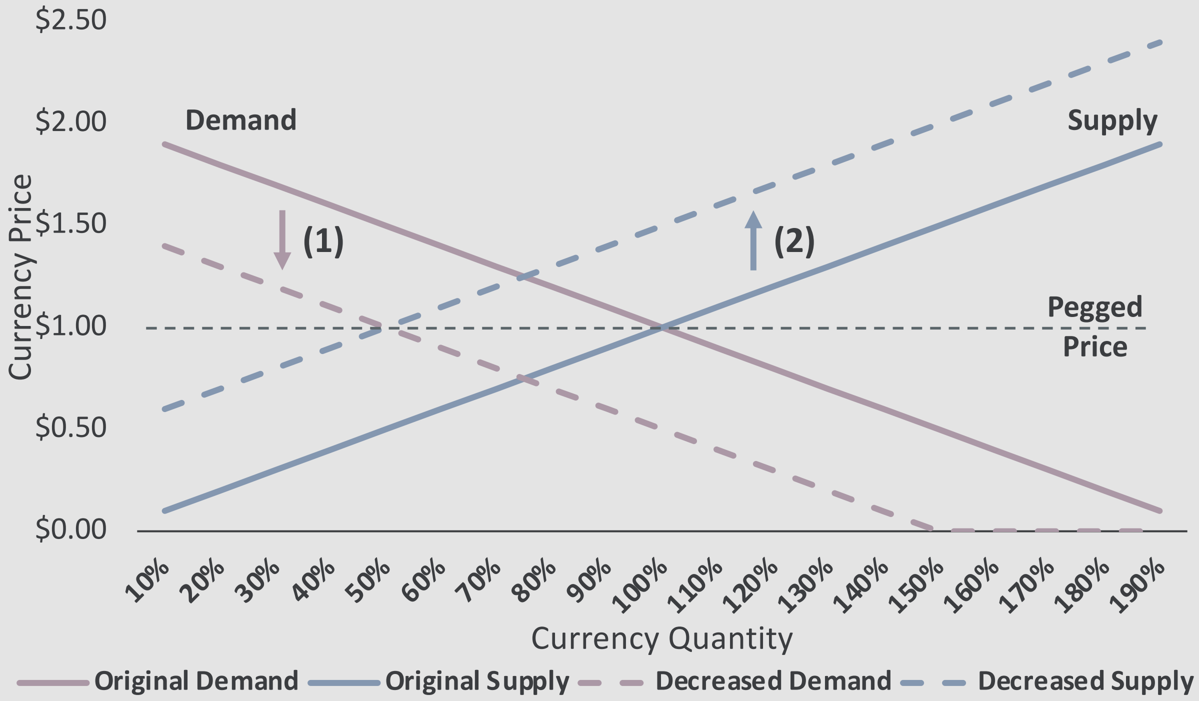
All algorithmic stablecoins, regardless of architecture, attempt to control token supply to match demand to ensure a consistent peg to a reference currency.

When Demand increases (1), the algorithm mints tokens and injects them into the market increasing Supply (2).



Here demand for the stablecoin has increased, illustrated as movement (1). Naturally, this would tend to increase prices, however the algorithm instead increases the overall token supply, illustrated as movement (2). This is trivial to execute as tokens can simply be printed and deployed through open market operations on DEXs and other exchanges.

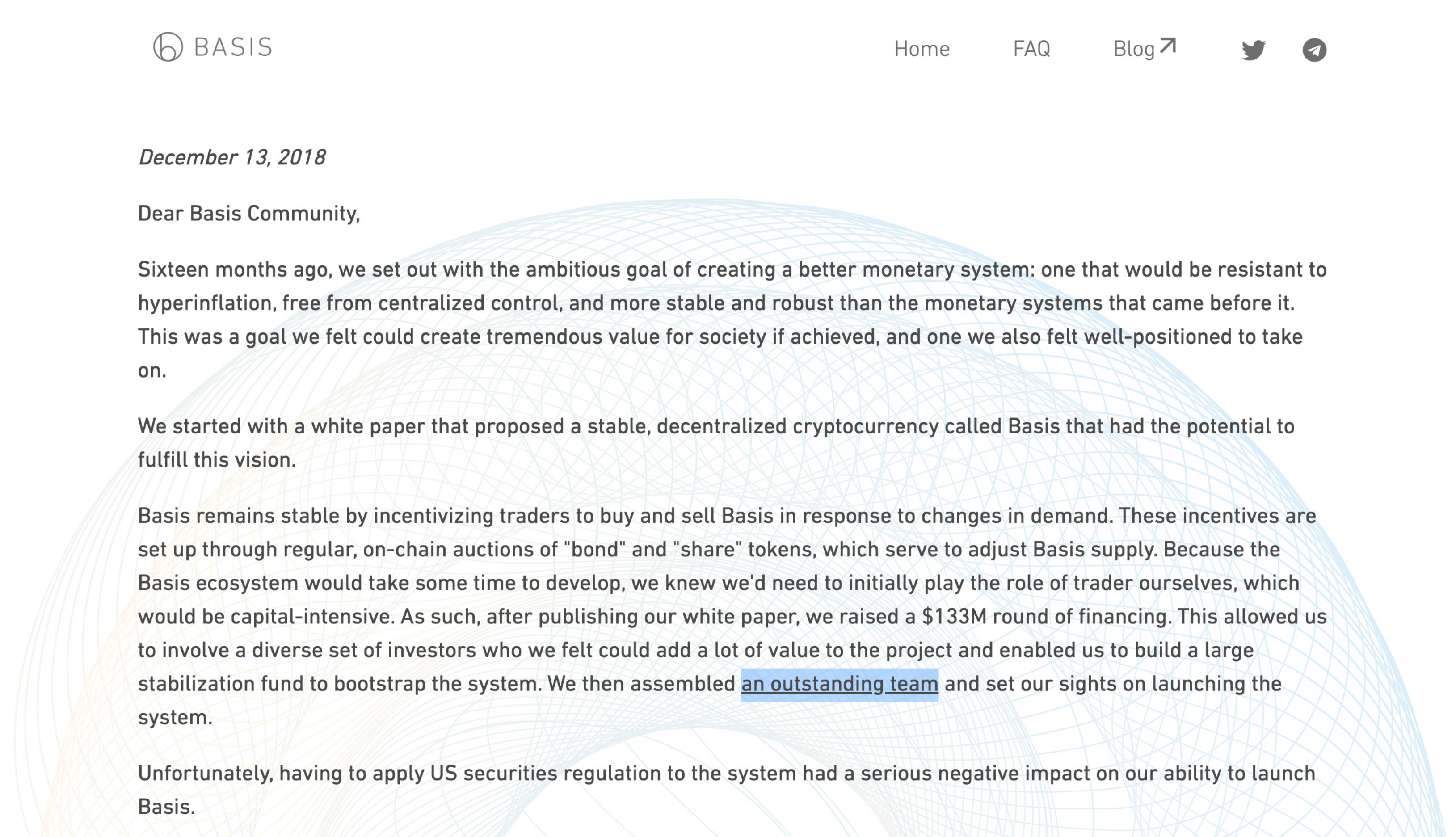
When Demand contracts (1), the algorithm burns tokens and removes oversupply from the market (2).



Here overall demand for the stablecoin has decreased, illustrated as movement (1). Naturally, this would tend to decrease prices. In order to maintain the pegged price, the algorithm decreases the overall token supply, illustrated as movement (2). **This is significantly more difficult to execute as the tokens are in the market and are not easily accessed for destruction**.

Basis planned to institute a stablecoin model superficially based on the principles of central banking, however in late 2018, the project was unable to launch due to US securities regulation.

Basis bonds, the means by which they would buy back tokens to control supply, were considered a security by the SEC.



BASIS

Home FAQ Blog

December 13, 2018

Dear Basis Community,

Sixteen months ago, we set out with the ambitious goal of creating a better monetary system: one that would be resistant to hyperinflation, free from centralized control, and more stable and robust than the monetary systems that came before it. This was a goal we felt could create tremendous value for society if achieved, and one we also felt well-positioned to take on.

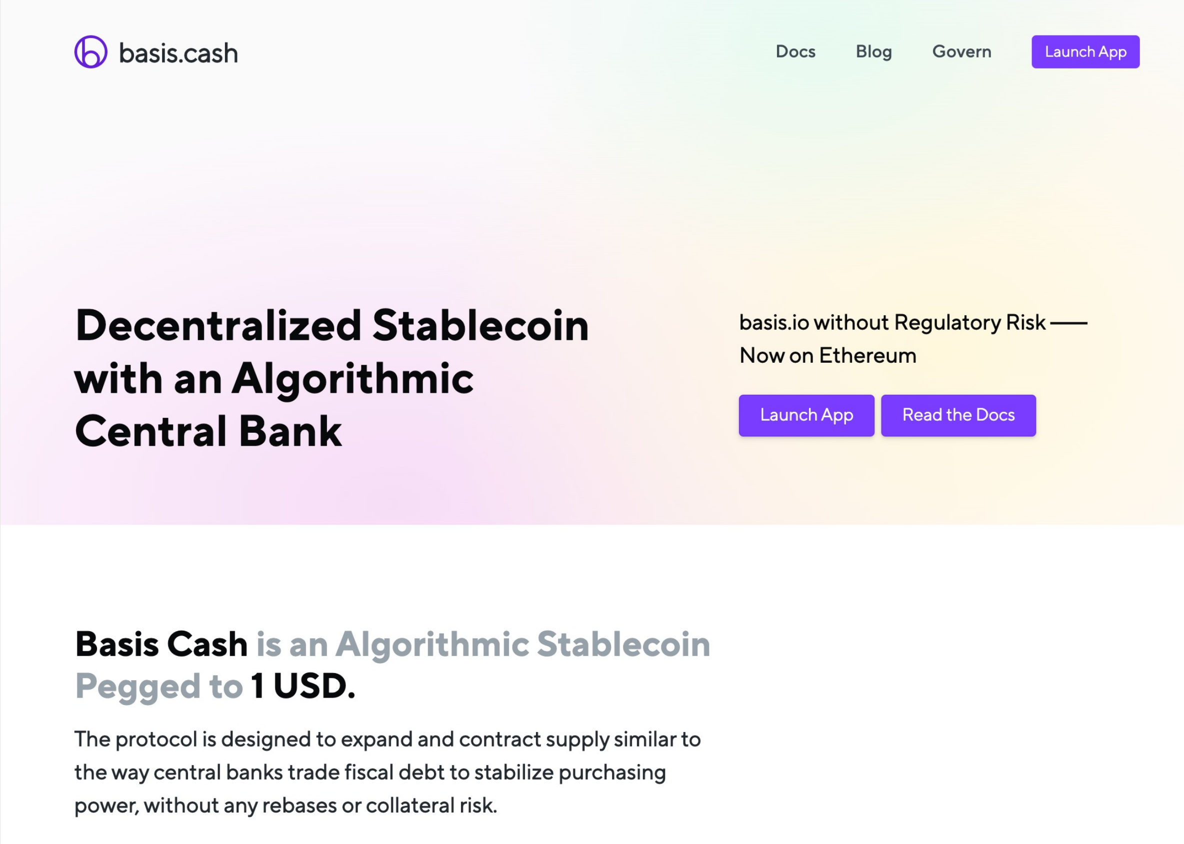
We started with a white paper that proposed a stable, decentralized cryptocurrency called Basis that had the potential to fulfill this vision.

Basis remains stable by incentivizing traders to buy and sell Basis in response to changes in demand. These incentives are set up through regular, on-chain auctions of "bond" and "share" tokens, which serve to adjust Basis supply. Because the Basis ecosystem would take some time to develop, we knew we'd need to initially play the role of trader ourselves, which would be capital-intensive. As such, after publishing our white paper, we raised a $133M round of financing. This allowed us to involve a diverse set of investors who we felt could add a lot of value to the project and enabled us to build a large stabilization fund to bootstrap the system. We then assembled an outstanding team and set our sights on launching the system.

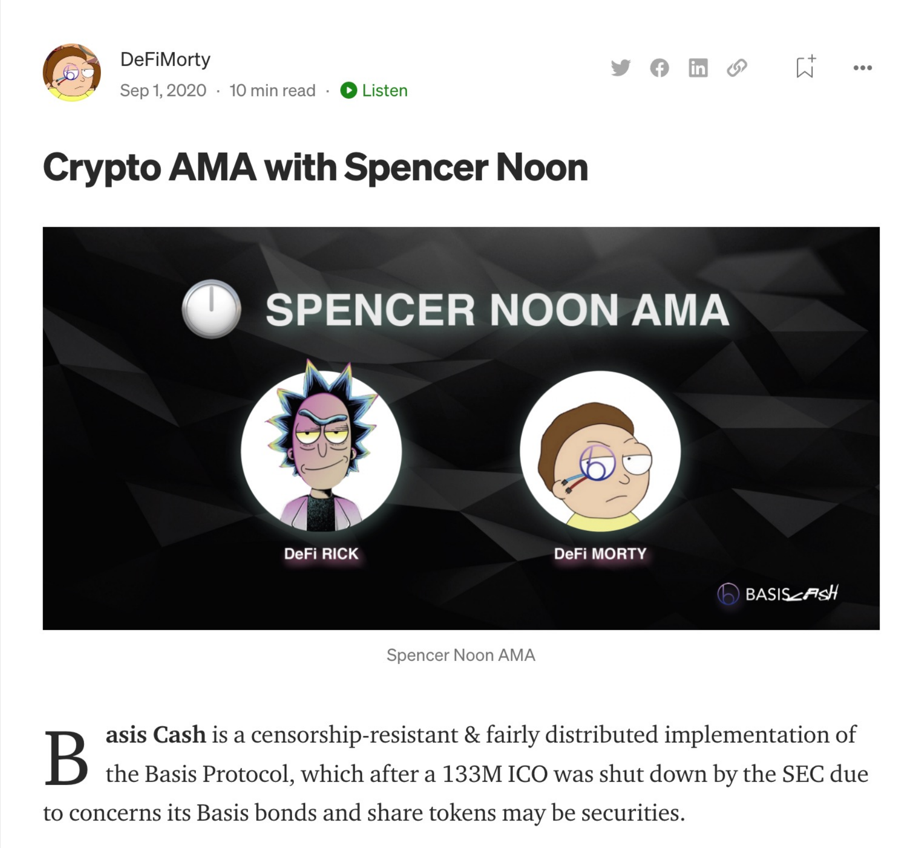
Unfortunately, having to apply US securities regulation to the system had a serious negative impact on our ability to launch Basis.

Despite the shutdown of the original Basis.io project, two anonymous developers, “Rick” and “Morty”, built and launched Basis Cash (BAC) based on the original thesis.

Basis.cash attempted to anonymously develop and deploy a stablecoin based on the architecture invented by Basis.io

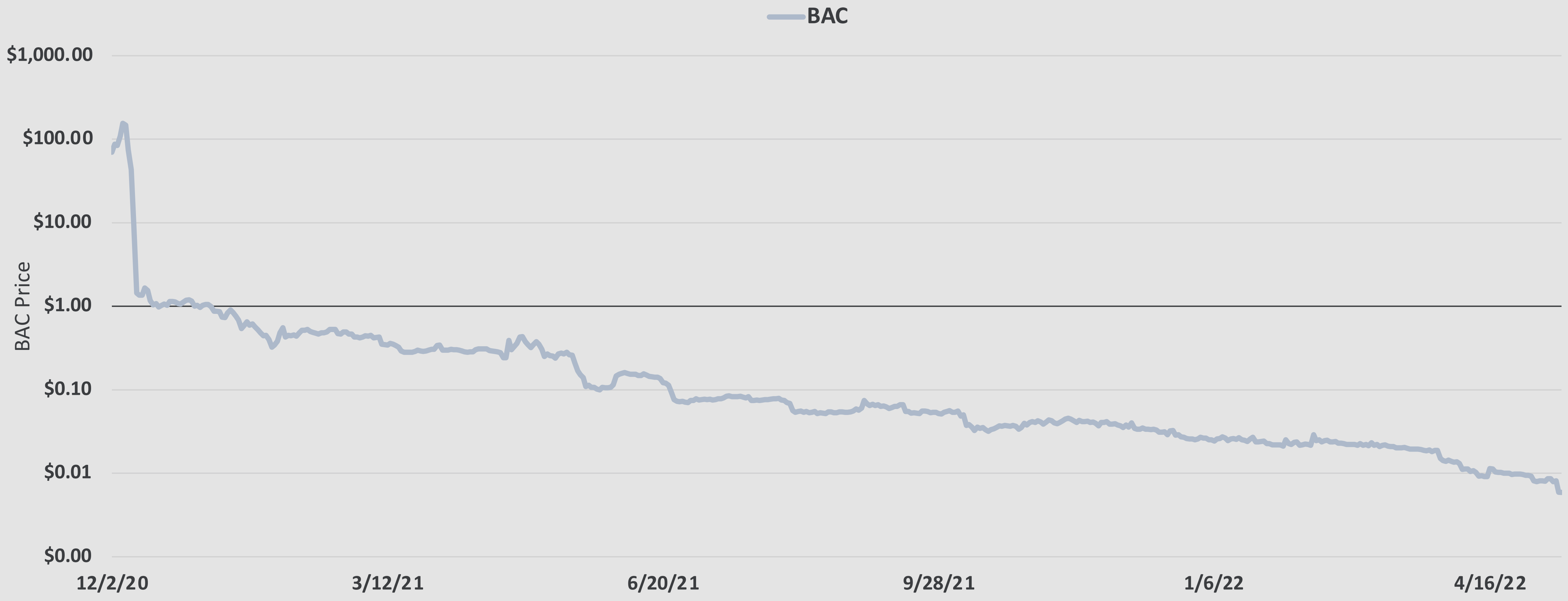


The two primary developers nicknamed themselves “DeFi RICK” and “DeFi MORTY”



Basis Cash failed almost immediately after launch, the stabilization mechanism was completely unable to manage the peg even for a short period of time.

Basis Cash (BAC) was completely unable to maintain the peg to the USD.

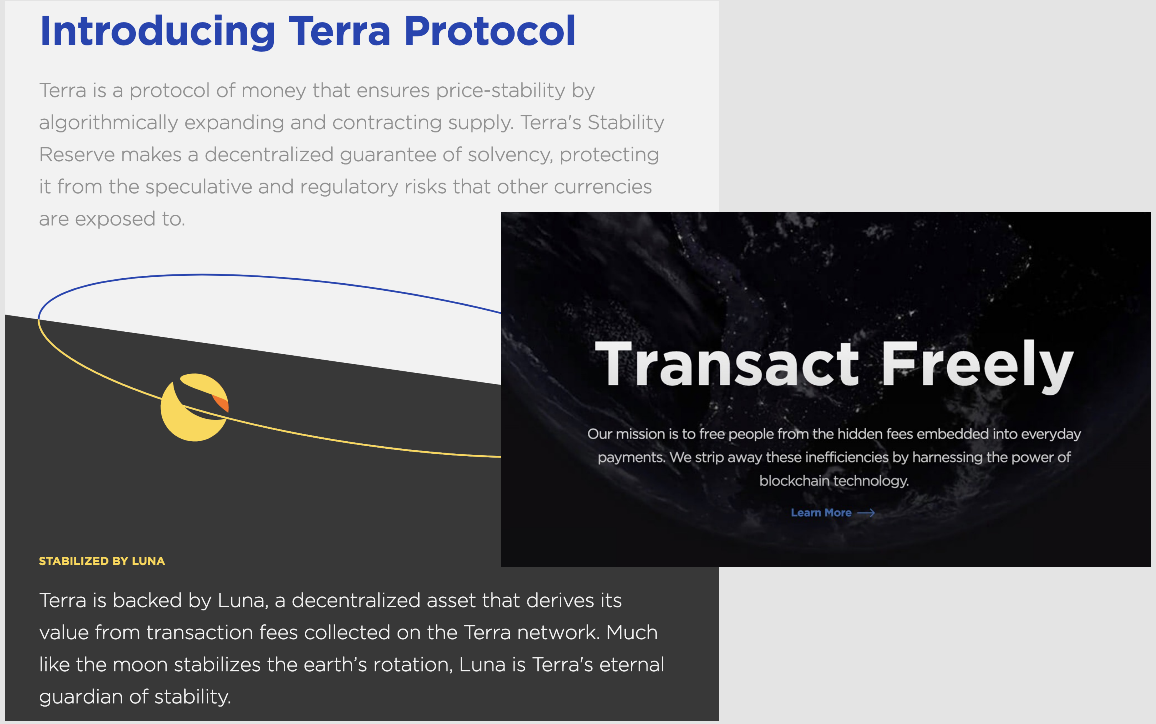


Unbeknownst to most, "DeFi RICK" was Do Kwon, a co-founder of Terraform Labs (TFL). TFL's original strategy was to streamline digital payments in Do Kwon's native home, South Korea.

Terra was originally intended to streamline payments before pivoting to DeFi.

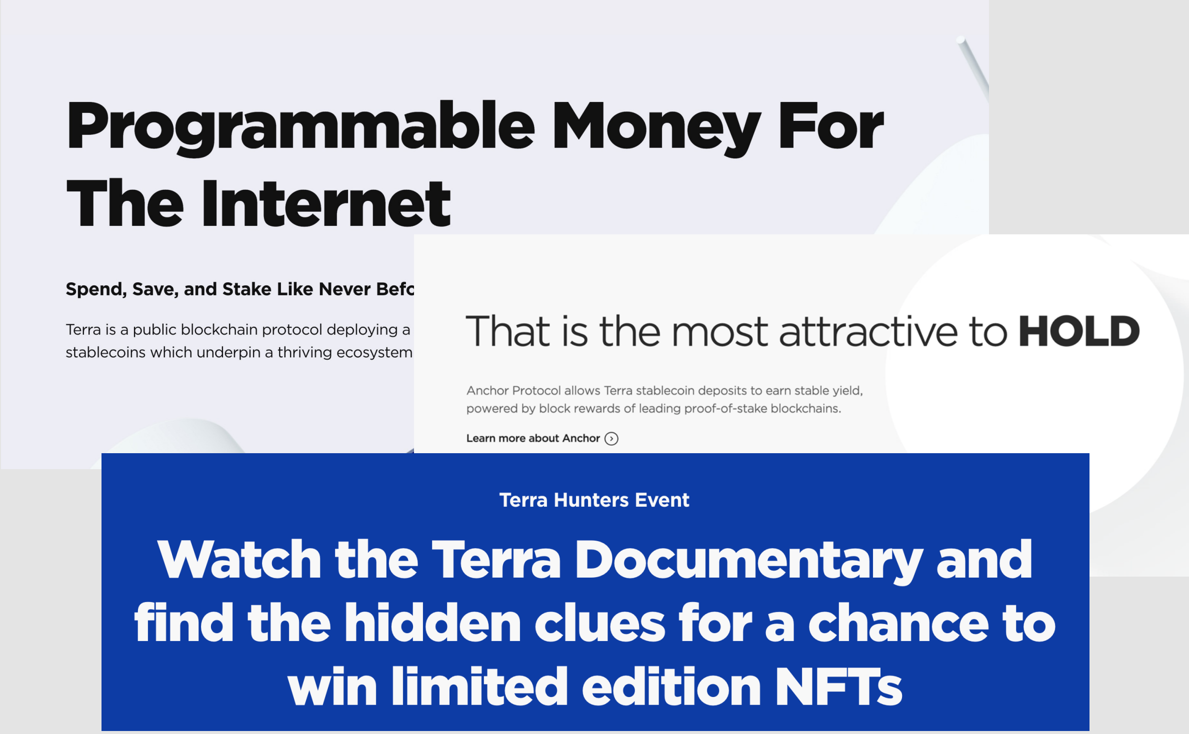
Focus on Payments in the Early Years (2018-2020)

Terra originally was intended to be a payments platform. In order to remedy the currency risks that vendors would be exposed to if they transacted in highly volatile cryptocurrencies, Terra developed a stablecoin backed by transaction fees.



DeFi Focused after late 2020

The transaction platform Chai never saw widespread adoption so Terraform labs appears to have pivoted its strategy to focus heavily on Decentralized Finance applications, particularly securities (Mirror) and lending (Anchor Protocol).



In order to facilitate real world payments, Terra had a built-in stablecoin, known as TerraUSD (UST). It belongs to the class of **multi-token algorithmically managed stablecoins**.

Stability Mechanism

Undersupply of Shares

During periods of undersupply, bond token holders, ex. Luna, are incentivized to burn their tokens to mint the stablecoin, ex. Terra (UST).

"Bond" Token
(Volatile)

TITAN

Luna

Waves

"Shares" Token
(Stablecoin)

Terra

IRON

Neutrino

Oversupply of Shares

During periods of oversupply, stablecoin holders, ex. Terra (UST), are incentivized to burn their stablecoins to mint the bond token, ex. Luna

These tokens, along with other stablecoin architectures are summarized in our state of the industry report. We'll go over the high level features and challenges in this presentation.

Summary

Currency Risk Is Theoretically Segregated:

The logic behind this model is that the store of value stablecoin, ex. Terra, is now insulated from demand/supply shocks which will theoretically be absorbed by the bond token price, ex. Luna.

Assumes Demand for The Underlying Bond Token:

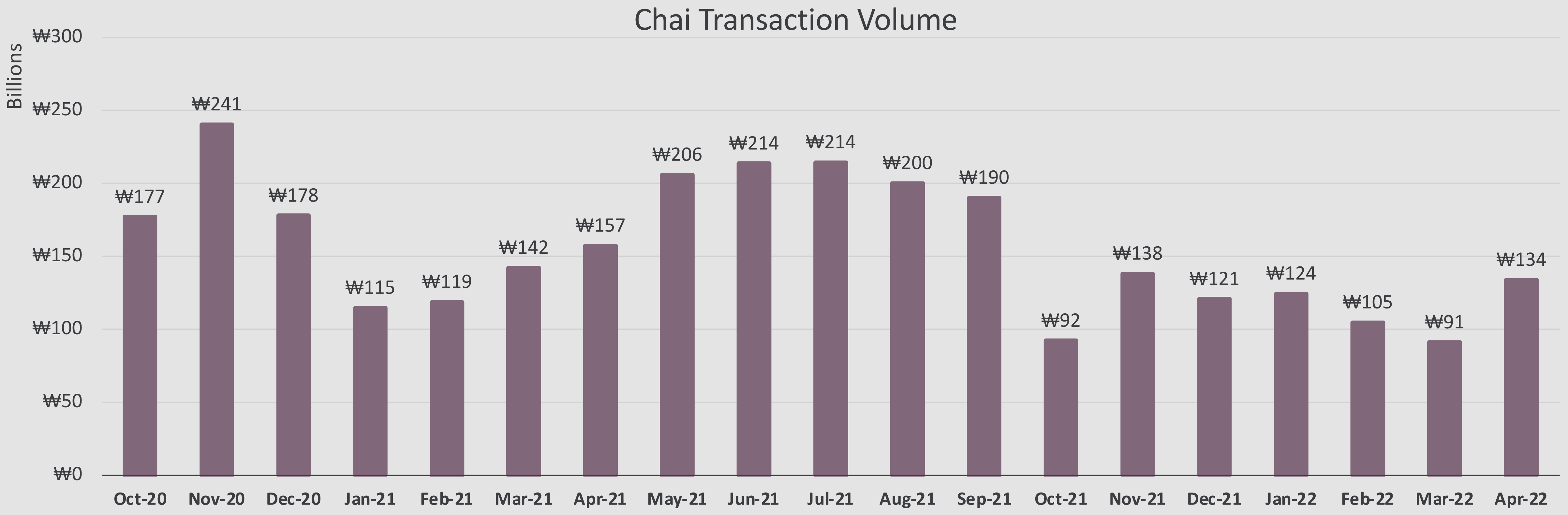
While there is no collateral for either token, Terra is unique in that Luna is the native token of Terra's layer 1 blockchain and is necessary to pay gas fees on the network.

Very Susceptible to Hyperinflation:

In an extreme example, IRON, a stablecoin developed by Iron Finance implemented a version of this model with their second token TITAN. As they are both simple ERC-20 tokens, there is no inherent utility and as such lacked a base demand level. When a few of the largest TITAN holders liquidated a portion of their holdings, it snowballed into a run on the token. Without intrinsic demand, the currency quickly loses its ability to maintain its price, further destabilizing in a runaway effect. Titan today trades at $0.0000001461 USD from its high of $61.23. This effect is analogous to runaway hyperinflation in traditional banking markets. Recently Neutrino, one of the largest stablecoins has slipped from its peg for similar reasons.

While originally intended to serve as a payments platform, the payment platform, Chai, never really took off. Growth plateaued in late 2020 and payment volumes were quickly shrinking.

Payment volume was declining and Chai as a payments platform showed little promise.



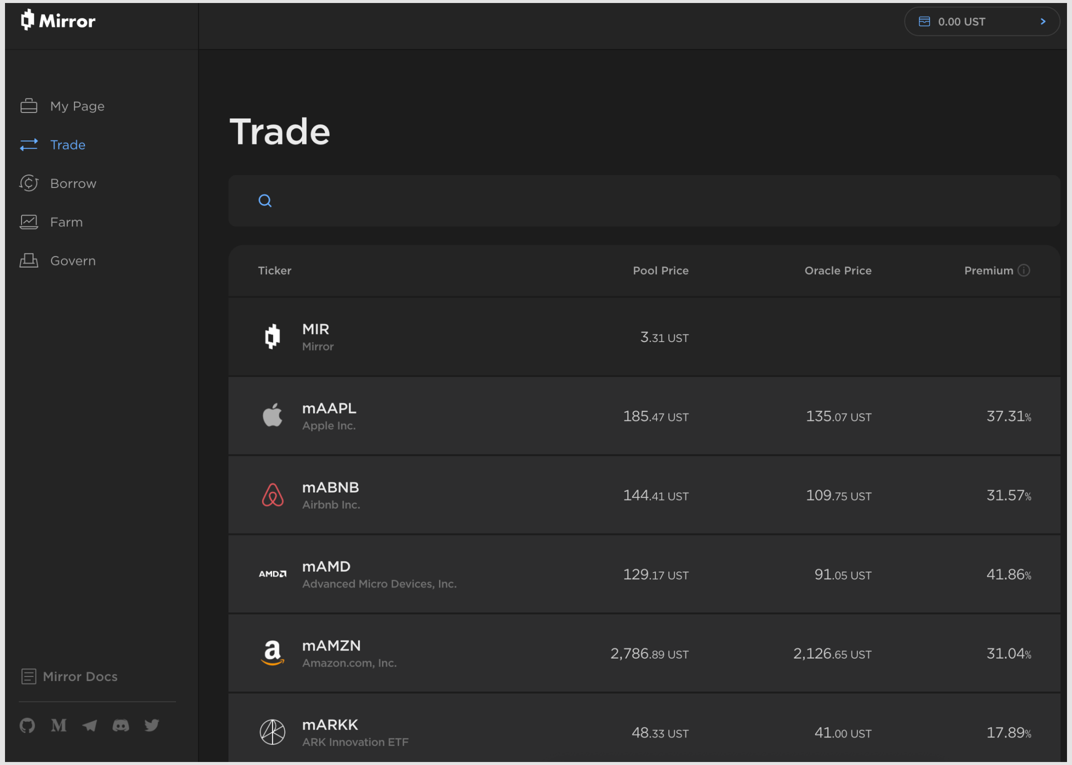
For additional context, just credit card transactions are in excess of ₩800 Trillion a year, meaning Chai volume is less than 0.2% of South Korean credit card transactions alone and shrinking.

Terraform Labs switched strategies from a focus on payments to a focus on DeFi and internally developed two platforms to add utility for their stablecoin, Anchor and Mirror.

These two projects were intended to shift Terra's main utility away from payments to the new world of DeFi.

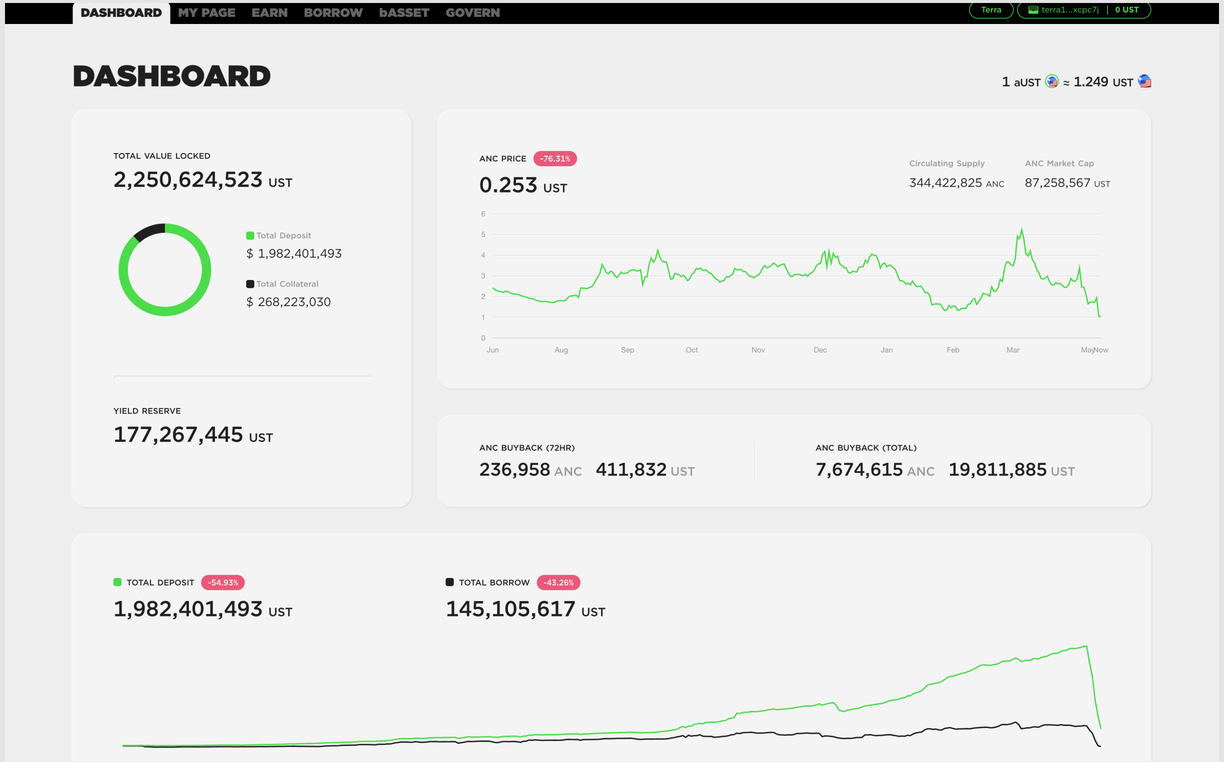
Mirror Protocol

Mirror Protocol was designed to mimic Synthetix on the Ethereum blockchain. It offers synthetic securities, essentially allowing users to mint tokens that serve as proxies for real world securities.



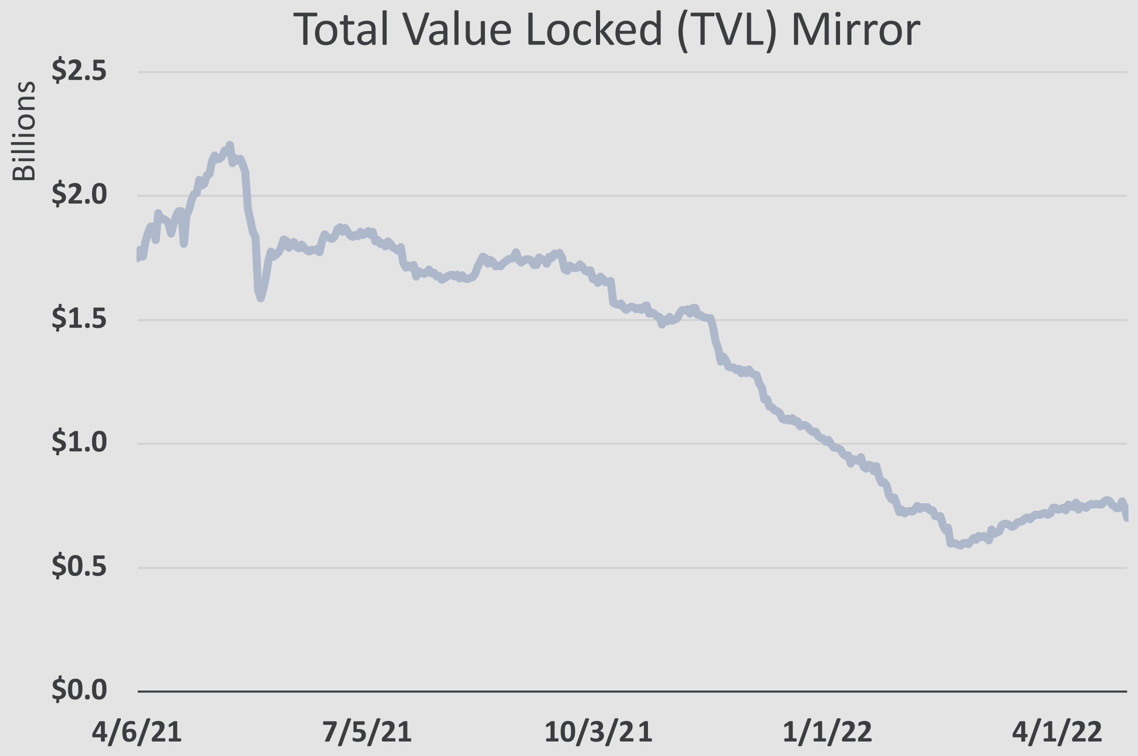
Anchor Protocol

Anchor served as the lending protocol and was by a wide margin the more successful of the two. With a headline figure of 20% interest on a stablecoin, it made yield farming simple and attracted billions of dollars to the platform.



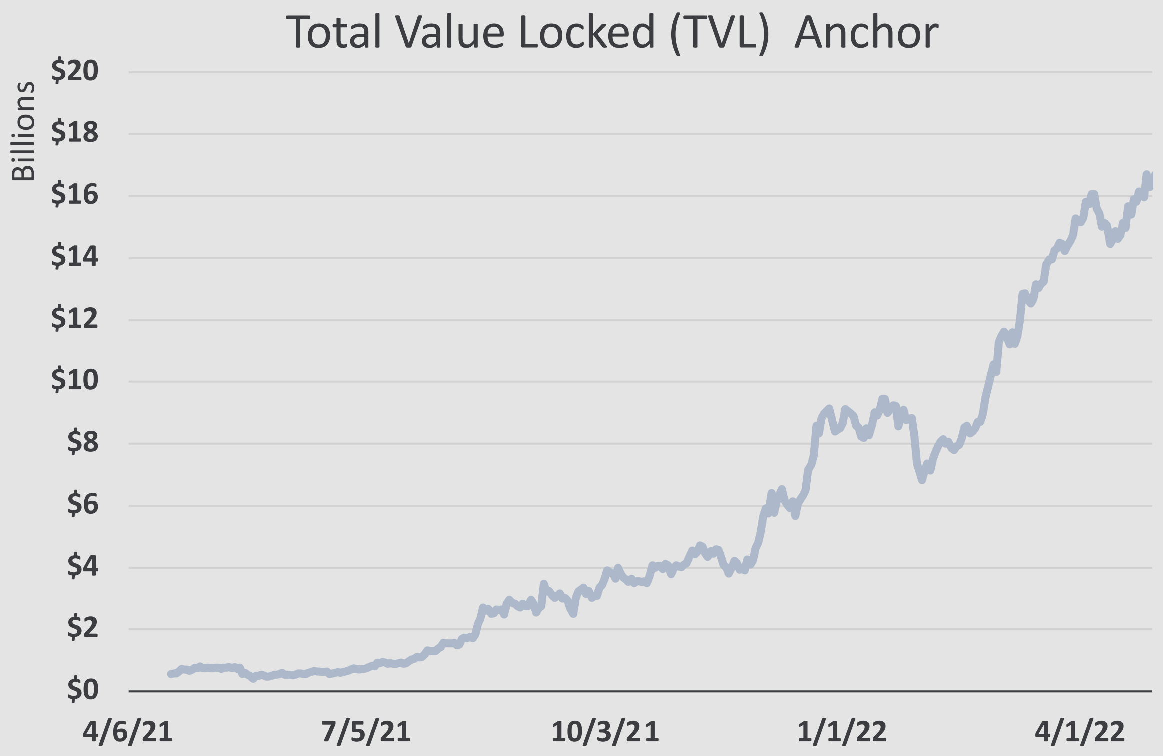
While both created demand for billions of UST, Anchor was by far the killer app of the Terra network with nearly 75% of all UST locked on the platform.

Mirror saw early adoption but wasn't able to sustain its growth.



Mirror never saw widespread adoption. A large part of that was the legal and regulatory challenges it faced in the United States. After peaking in mid-2021 at a paltry $2B in TVL, it quickly shrank through the rest of the year.

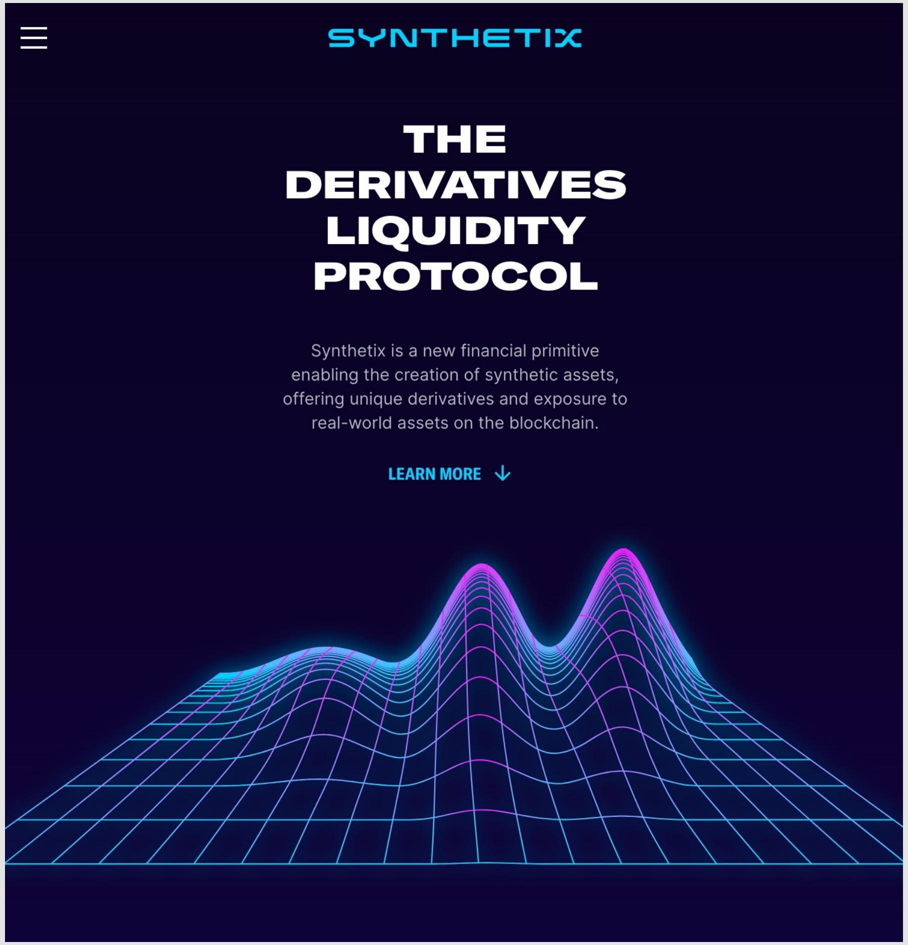
Anchor meanwhile continued to grow strongly off the back of its 20% interest rate.



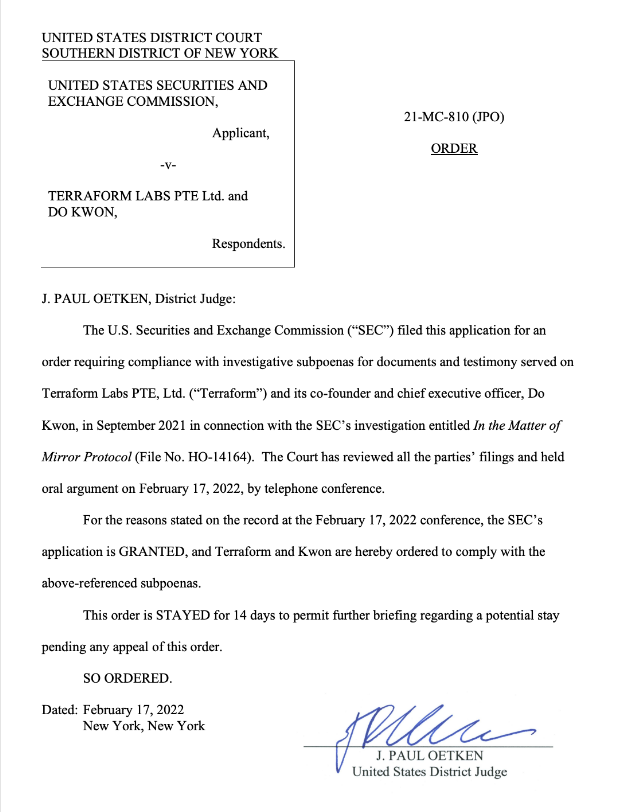
Anchor meanwhile was an overnight success. Its 20% APR attracted billions of dollars of capital to the platform and would regularly double its Total Value Locked (TVL) on a monthly basis, growing to nearly $18B in less than 1 year.

Mirror experienced challenges almost immediately, within 5 months of launch it was subpoenaed by the SEC for potential violation of federal securities laws.

Mirror is very similar to the original synthetic derivative protocol on the Ethereum mainnet, Synthetix



As services like these can be construed as "securities" Terraform Labs was quickly subpoenaed by the SEC.



UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

UNITED STATES SECURITIES AND EXCHANGE COMMISSION,

Applicant,

-v-

TERRAFORM LABS PTE Ltd. and DO KWON,

Respondents.

21-MC-810 (JPO)

ORDER

J. PAUL OETKEN, District Judge:

The U.S. Securities and Exchange Commission ("SEC") filed this application for an order requiring compliance with investigative subpoenas for documents and testimony served on Terraform Labs PTE, Ltd. ("Terraform") and its co-founder and chief executive officer, Do Kwon, in September 2021 in connection with the SEC's investigation entitled *In the Matter of Mirror Protocol* (File No. HO-14164). The Court has reviewed all the parties' filings and held oral argument on February 17, 2022, by telephone conference.

For the reasons stated on the record at the February 17, 2022 conference, the SEC's application is GRANTED, and Terraform and Kwon are hereby ordered to comply with the above-referenced subpoenas.

This order is STAYED for 14 days to permit further briefing regarding a potential stay pending any appeal of this order.

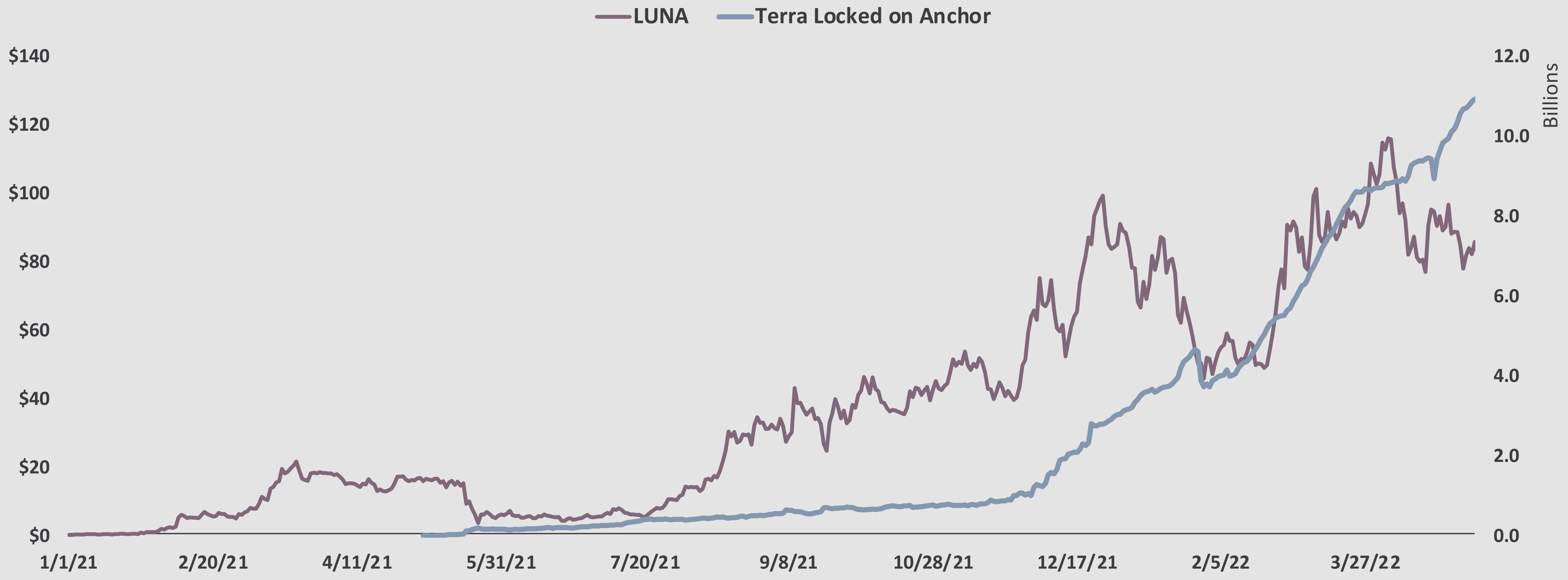
SO ORDERED.

Dated: February 17, 2022
New York, New York

J. PAUL OETKEN
United States District Judge

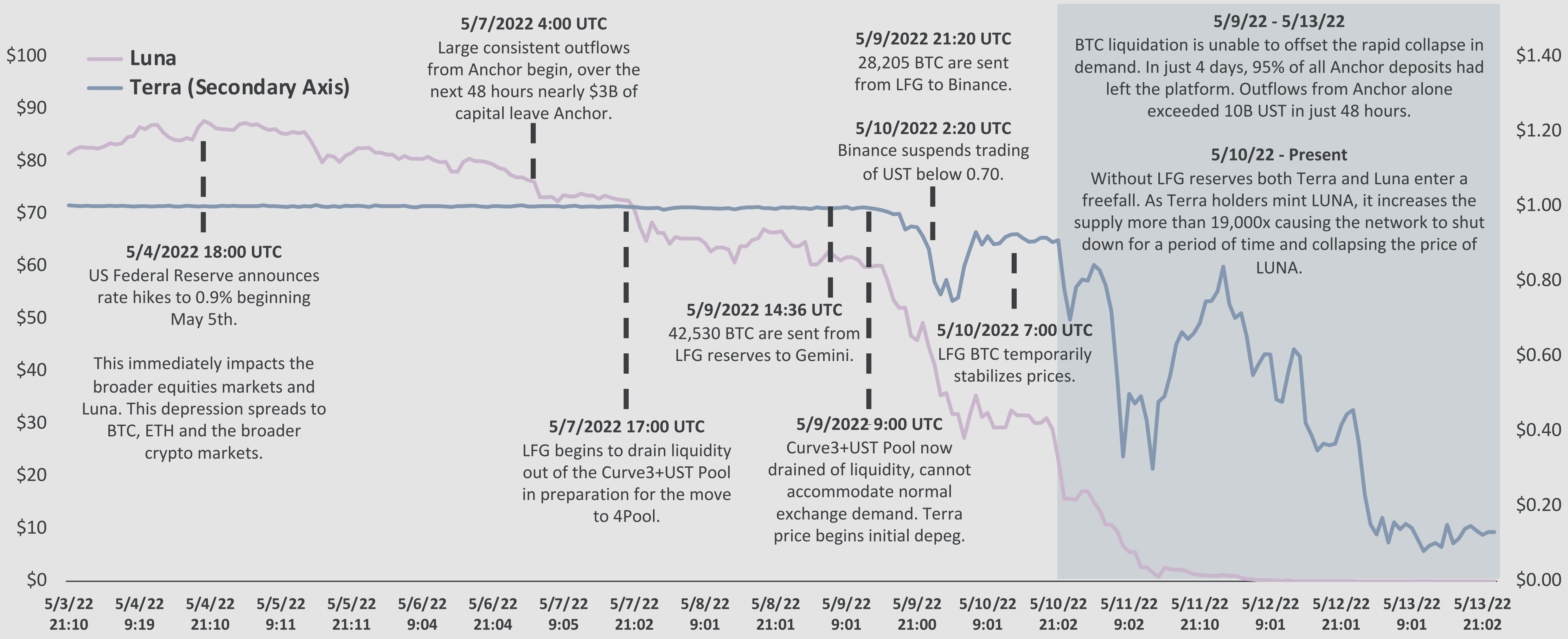
Luckily for Terraform Labs, the market's craving for Anchor was insatiable and it generated more than $10B of UST demand in less than 12 months, spiking the value of Luna.

Stablecoins by Market Cap and Type (Measured on January 1st 2022)



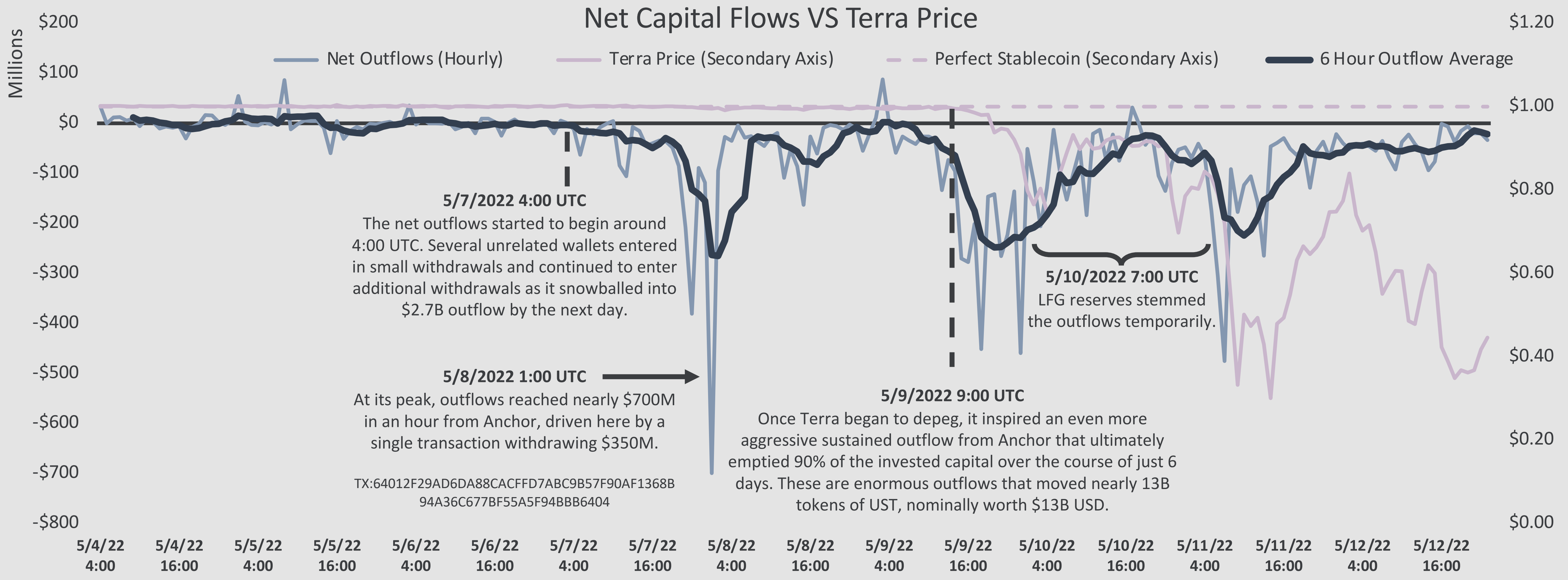
This demand for Anchor fell even quicker, leading to the complete collapse of Terra. Over the next few slides we'll breakdown the events and dynamics that lead to its demise.

Summary of Events



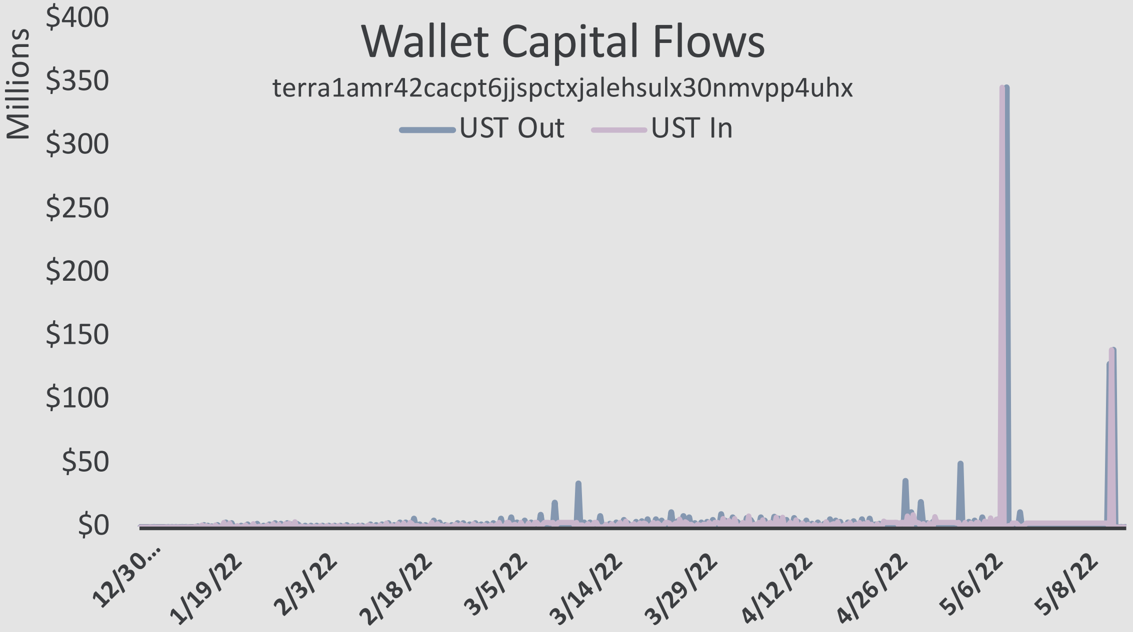
Ultimately, the loss of demand for Anchor, Terra's key product, is the primary cause of the collapse. Capital began its sustained net outflow from Anchor on May 7th 4:00 UTC.

No specific event seems have triggered these outflows as the actual flows on-chain are from unrelated wallets withdrawing money throughout the day at randomly distributed timings. Some wallets continued to withdraw through the 13th.



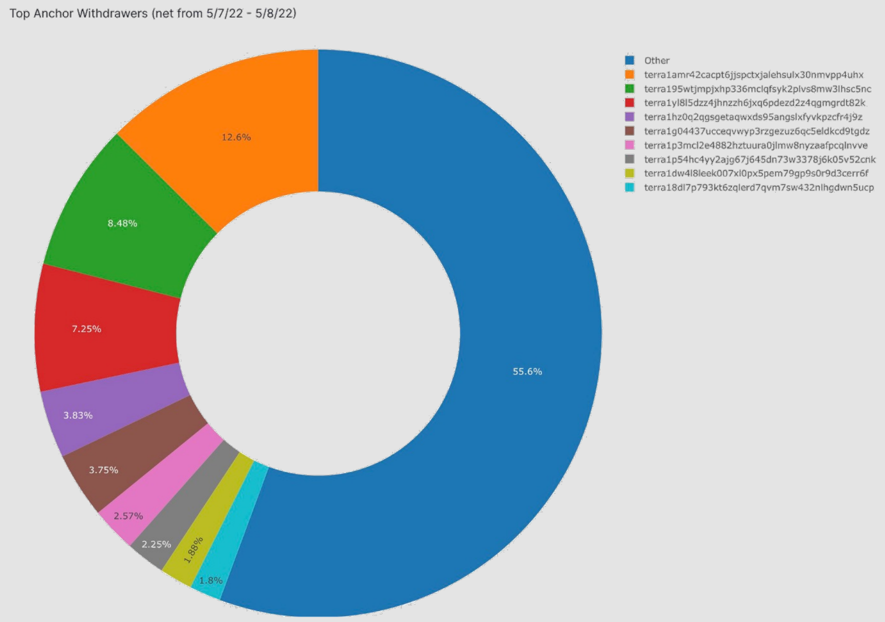
There are circulating rumors that these outflows were an attack. While not conclusive, the evidence doesn't seem to indicate any malicious activity or even intent.

This wallet, responsible for the $350M outflow on the 7th, appears to be an automatic bot making regular purchases.



This wallet regularly deposited into Anchor, cashed out all the generated interest, and made a separate withdrawal transaction everyday for months, leading us to believe it is a wallet for a smart contract or third party investing service. In addition, it made a large withdrawal on the 7th but still left sizable holdings in Anchor which it only withdrew after the price for UST had collapsed, an indicator that it wasn't an intentional or even purposeful attack.

The withdrawing wallets seem to be disjointed and random, with the majority of volume coming from small wallets.



@pedroexplore1 on twitter had identified the outflows the day of and highlighted their disjointed nature. 55.6% of total volume was coming from smaller wallets. While the wallet mentioned on the left of this slide was responsible for 12.6% of volume, it doesn't seem to be pre-meditated or even intentional. It seems it's a bot batching orders and there was simply a market demand for net withdrawals in light of market volatility the previous day.

The rumors, originating on unmoderated forums and Twitter, specifically mention Gemini, Citadel and Blackrock. However, each has issued an official release denying any involvement.

Blackrock, Gemini, and other's have officially responded and with denials, and the incentives don't align.

Official Denials

Gemini
@Gemini

We are aware of a recent story that suggested Gemini made a 100K BTC loan to large institutional counter-parties that reportedly resulted in a selloff in $LUNA. Gemini made no such loan.

12:37 PM · May 11, 2022 · Twitter Web App

This was followed by a statement from Citadel spokesperson who said: "We had nothing to do with this situation and we do not trade stablecoins including UST."

A BlackRock spokesperson added: "Rumours that BlackRock had a role in the collapse of UST are categorically false. In fact, BlackRock does not trade UST."

Blanket Official Denials:

Every accused company has publicly gone on record to deny and refute every activity they were rumored to have done. Gemini has stated they have not made any Bitcoin Loans and Black Rock and Citadel both deny participating in any attack.

Non-Credible Sources:

The ultimate source of these rumors seems to be speculation on 4Chan, an unmoderated anonymous English-language imageboard website. Most outlets with substantive credibility have at best not reported on these claims with most outright refuting them. It was amplified by Cardano's founder on twitter before being subsequently deleted.

Incongruent Incentives

While their denials can reasonably be doubted, the incentives don't align.

Implausibly Large Capital Loans:

The original thread indicated that an individual or firm borrowed 100K BTC ($4.6B) to execute this attack. That is a sizable amount of capital as Gemini only had $30B in custody in 2021 across all crypto assets. 100K BTC might be the majority of their BTC holding.

Difficult to Coordinate and Possibly Unprofitable Firm Wide:

For an attack to be successful, the hedge fund needs to coordinate an attack while ensuring it has suspended all other long strategies. These strategies are then deployed back into the market after a successful attack, something we haven't observed on-chain.

Unpredictable Contagion:

Even if a hedge fund of that size could coordinate an attack, collapsing a $60B ecosystem would introduce unpredictable contagion possibly to their counterparties and possibly their own positions.

Attracting Significant Regulatory Scrutiny:

The collapse of Terra has already attracted interest from Janet Yellen and other large regulators. It is highly unlikely that an hedge fund would seek to attract that sort of regulatory scrutiny in the current market environment in the US where both parties are seeking to restrict Wall Street activities.

There were many exogenous reasons to withdraw. On May 4th, the Fed announced it was increasing rates which generally depressed asset prices across the board.

The original implementation note was issued May 4th for an effective rise on May 5th.

Board of Governors of the Federal Reserve System

The Federal Reserve, the central bank of the United States, provides the nation with a safe, flexible, and stable monetary and financial system.

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Home > News & Events > Press Releases > Federal Reserve issues FOMC statement

Press Release

May 04, 2022

Implementation Note issued May 4, 2022

Decisions Regarding Monetary Policy Implementation

The Federal Reserve has made the following decisions to implement the monetary policy stance announced by the Federal Open Market Committee in its statement on May 4, 2022:

- The Board of Governors of the Federal Reserve System voted unanimously to raise the interest rate paid on reserve balances to 0.9 percent, effective May 5, 2022.
- As part of its policy decision, the Federal Open Market Committee voted to authorize and direct the Open Market Desk at the Federal Reserve Bank of New York, until instructed otherwise, to execute transactions in the System Open Market Account in accordance with the following domestic policy directive:

  "Effective May 5, 2022, the Federal Open Market Committee directs the Desk to:

  - Undertake open market operations as necessary to maintain the federal funds rate in a target range of 3/4 to 1 percent.
  - Conduct overnight repurchase agreement operations with a minimum bid rate of 1.0 percent and with an aggregate operation limit of $500 billion; the aggregate operation limit can be temporarily increased at the discretion of the Chair.
  - Conduct overnight reverse repurchase agreement operations at an offering rate of 0.8 percent and with a per-counterparty limit of $160 billion per day; the per-counterparty limit can be temporarily increased at the discretion of the Chair.
  - Roll over at auction the amount of principal payments from the Federal

Related Information

Statement Regarding Plans for Reducing SOMA Holdings of Treasury Securities, Agency Debt, and Agency Mortgage-Backed Securities

After impacting equities, the selloff continued into the cryptocurrency market suppressing prices.

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CRYPTOCURRENCIES

Bitcoin Prices Plunge as Stock Market Selloff Spreads to Cryptocurrencies

By Jack Denton Follow Updated May 5, 2022 1:20 pm ET / Original May 5, 2022 6:27 am ET Order Reprints Print Article

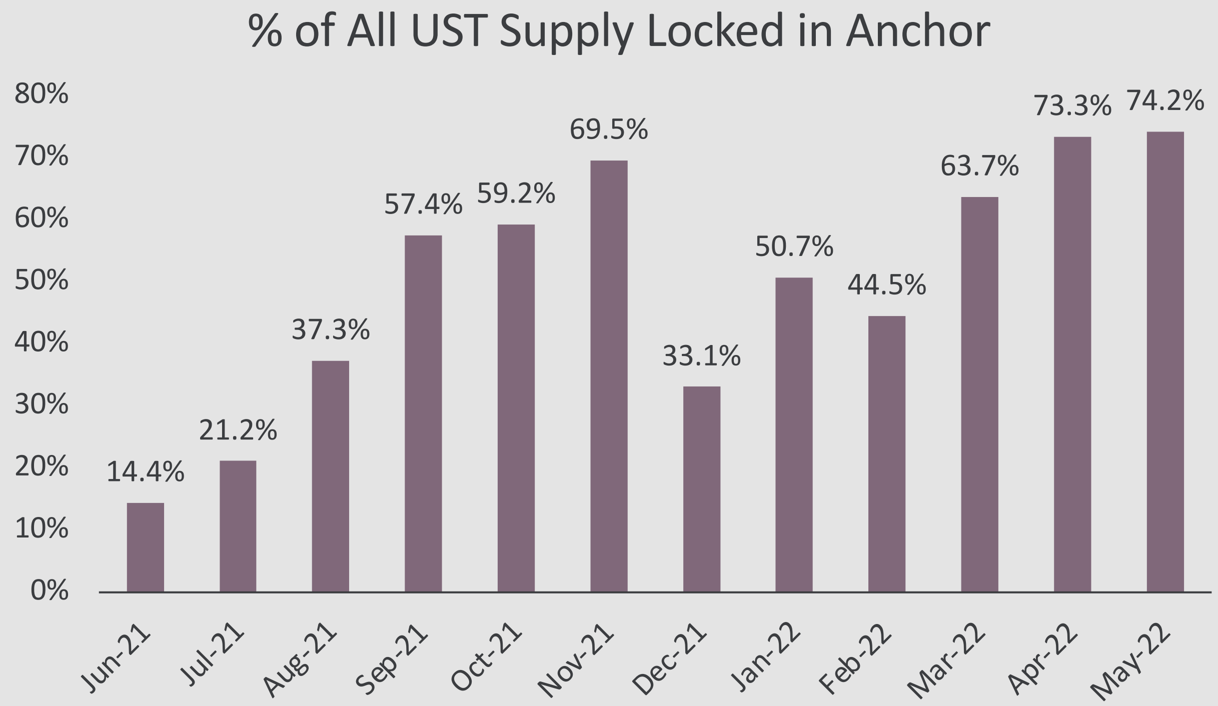
Bitcoin was trading around $37,000 Thursday.
Rutmer Visser/Dreamstime

Text size

The price of Bitcoin BTCUSD +0.39%, Ether, and other cryptocurrencies slumped on Thursday, reversing a recent rally as a deep selloff in the stock market spread to digital assets..

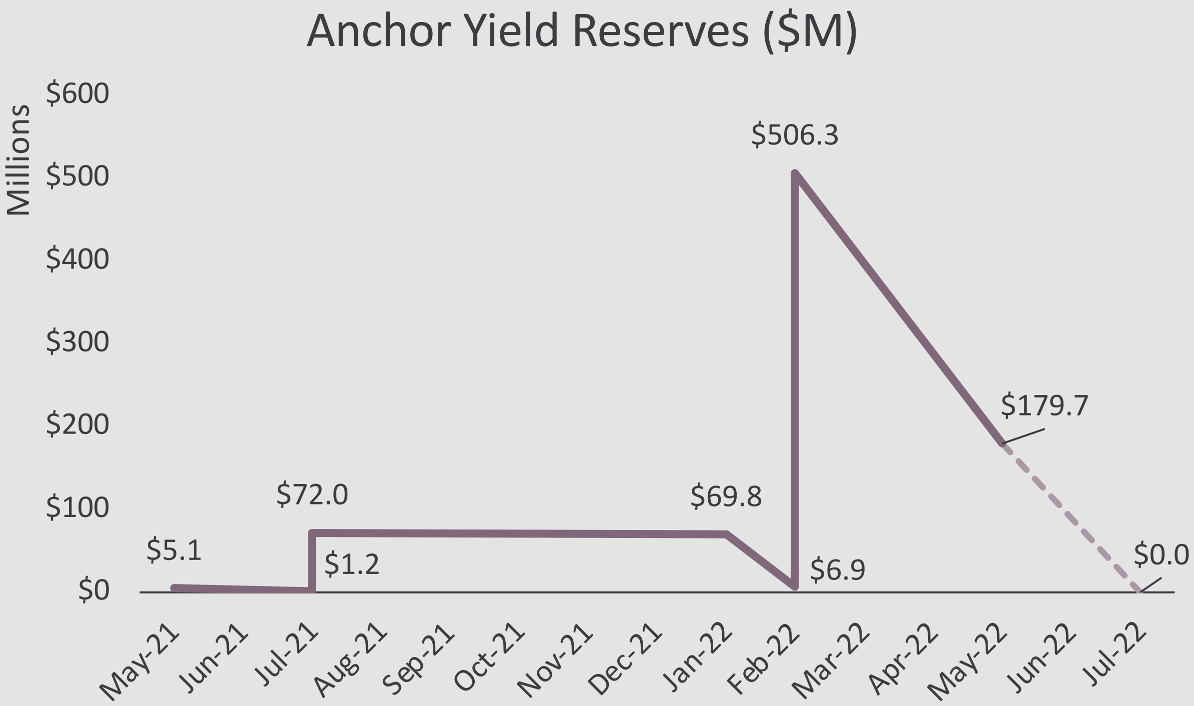
Furthermore, Anchor, which drove 75% of all UST demand, was quickly running out of reserves. It was common knowledge that the window to collect subsidized returns was quickly closing.

Anchor was the predominant, and in the later stages only, major DeFi use case and platform for UST.



In the final stages of the ecosystem, nearly 75% of all UST supply was deposited on Anchor. Even what limited UST borrowing demand there was seemed to be only so that a user could deposit that UST back into Anchor. Ultimately, this strongly tied Terra demand to Anchor.

Furthermore, these returns were sustained by liquidating the yield reserve which was quickly running out.



Anchor's 20% rates were unsustainable and were draining a treasury reserve. Terra was likely funding the unsustainable rate in order to grow the network quickly, however even at its current size, the treasury could only sustain the rate for another month before it required topping up or ran out of funds.

Even hedge funds that were bearish on Terra were invested in Anchor just to access the treasury reserves. Nearly all of them were likely ready to exit at the earliest sign of any sort of volatility.

Bankless - UST: New Paradigm or Ticking Time Bomb?

While we don't have insider access to these crypto hedge fund strategy, Jordi Alexander of Selini Capital provides key insights into his thoughts on Terra during a taping on April 6th, well before any market volatility even appeared possible. Specifically being in Anchor while being bearish (Jump to 0:22:50)

https://www.youtube.com/watch?v=6eOU5OaKd8s

Key Highlights and Summary

Funds Were in Anchor:

Even bearish funds like Selini Capital were taking advantage of Anchor's 20% protocol. They had clear information as to the size and capacity of the Anchor Yield Reserves and were sufficiently sophisticated to be able to rapidly react to any market volatility. Gaining access to the $450M+ of Yield reserve was seen as a simple straight forward strategy with manageable risks and had high capital efficiency, the exact kind of investment that is most attractive to a large well capitalized fund.

In Place Exit Strategies:

Jordi mentions a specific exit strategy which is to exit via the curve pool. For most retail investors this is a difficult process as it requires withdrawing Terra from Anchor, pushing it across the wormhole bridge to the Ethereum ecosystem, and then exchanging it on Curve.fi. Even sophisticated investors would struggle to justify the high fees on the Ethereum network unless they were moving significant amounts of capital.

Funds vs Retail:

One of the key highlights was the fact that funds, due to their sophistication and analytics, would be able to react to signals much faster than retail investors. This would allow them to easily beat investors to liquidity pools, but also requires them to be relatively more risk adverse and to quickly exit at the earliest signs of volatility.

The reason these funds want to exit first, is that algorithmic multi-token stablecoins have a self-enforcing feedback loop that quickly causes a death spiral.

These models reward the first person to exit the ecosystem, creating a race to the exits at the earliest signs of instability.

Terra

When any stablecoin, such as Terra, loses the peg, risk-averse users start to exit in order to get the highest prices, and race to the exit.

If trading out on the open market, these exits drop the demand for Terra, dropping its price further. Meanwhile newly minting Luna supply drops its price at a time when its demand was already shrinking.

Terra

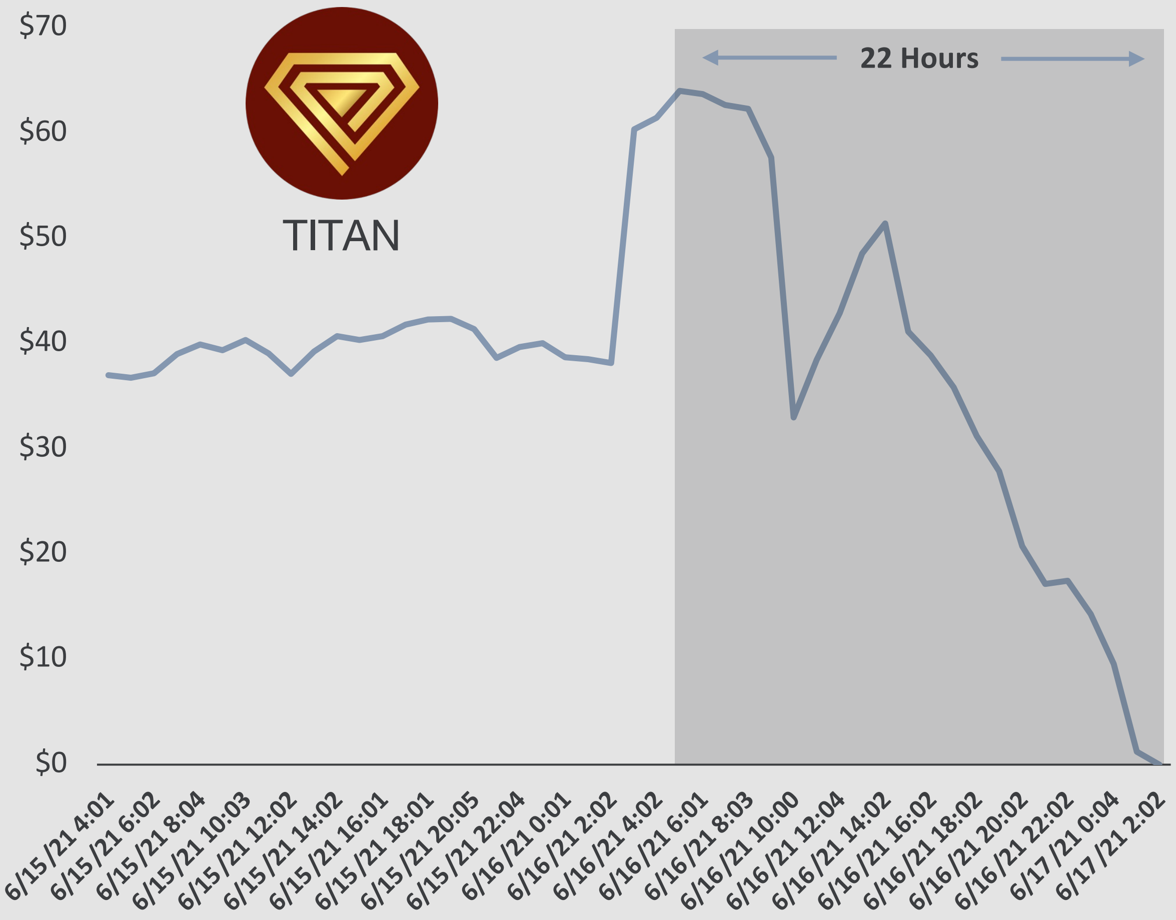
The dropping price now gives the next risk-tranche of users a reason to exit driving a rapid spiral that ultimately collapses the price.

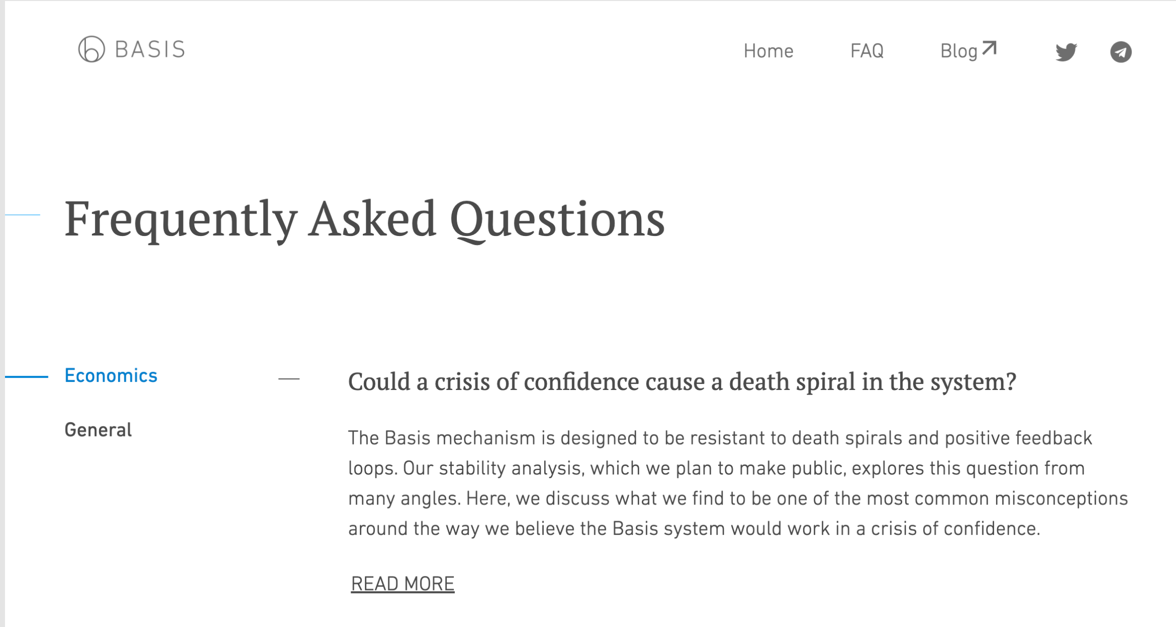
This cycle rapidly repeats until the value of the currency is completely wiped out.

The reason that the price of Terra cannot maintain the peg at all times is that there is a set amount of Terra that can be redeemed for Luna per day, originally $20M, but during the crises it was $100M.

This feedback loop is well known and isn’t unique to Terra. As the price of TITAN fell, more and more users rushed to the exits rapidly collapsing the price in just 22 hours.

A death spiral stemming from a crisis of confidence is a common problem in all algorithmically managed stablecoins.



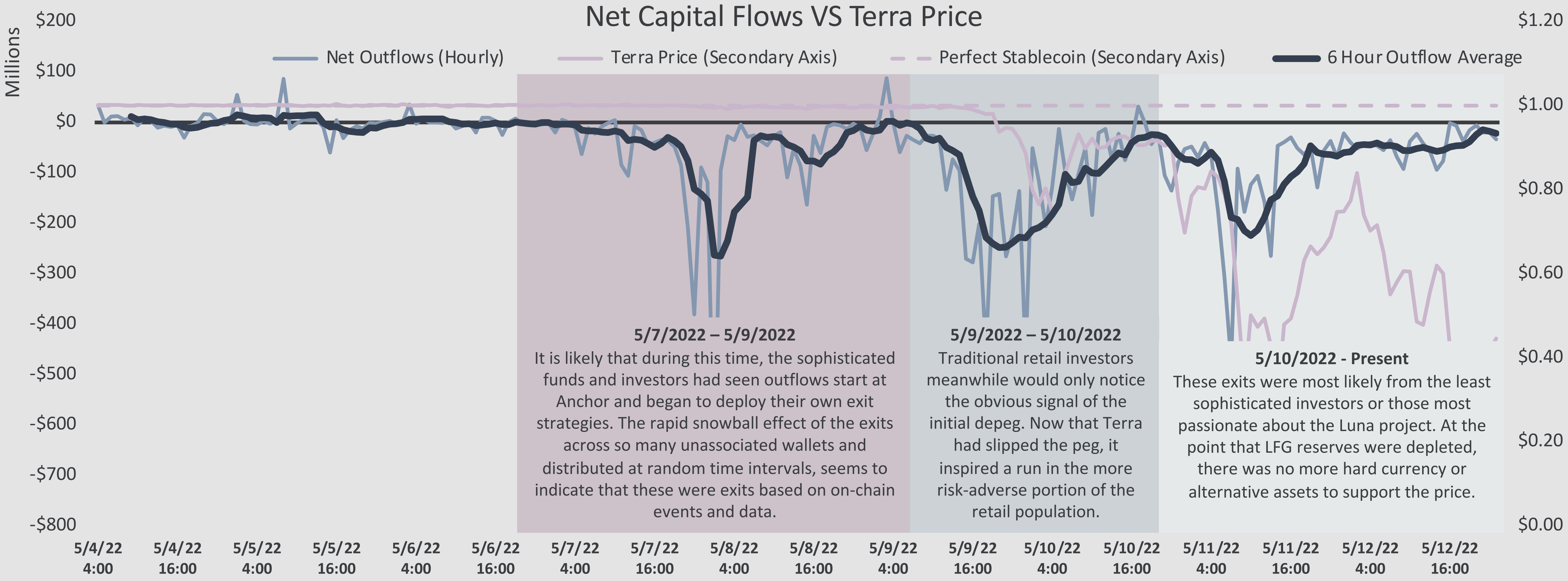


This feedback loop has been known for decades when it comes to central banks. Even for Basis, the original algorithmically managed stable coin first envisioned in 2018, the most frequent asked question was “*Could a crisis of confidence cause a death spiral in the system?*” and has an entire webpage dedicated solely to the question.

https://www.basis.io/article/could-a-crisis-of-confidence-cause

It's likely that large funds exited quickly at the first signs of outflow. The comparatively unsophisticated retail investors likely only recognized the signs of distress as UST broke the peg on May 9th.

No specific event seems to have triggered these outflows as the actual flows on-chain are from unrelated wallets withdrawing throughout the day at randomly distributed timings. Some wallets continued to withdraw through the 13th.



Terra's crash had 3 discrete liquidity runs instead of a consistent, linear crash like there was for IRON. This is likely because Terra was downplaying the significance of the events throughout the crisis.

Many unsophisticated investors were likely misled by Terra's official communications. During the initial stages of the crisis, Terra was downplaying the impact of Anchor withdrawals, its susceptibility to a run and the instability of the peg mechanism.

Impact of Withdrawals

During May 8th when Anchor was experiencing $2.7B of withdrawals, Terra was downplaying the significance of the sizable volume of outflowing capital by conflating volume of withdrawals with a proportion of all deposited wallets.

> Tweet
>
> Terra 🌍 Powered by LUNA 🌕 @terra_money
>
> Excellent analysis yet again by @pedroexplore1 exploring recent @anchor_protocol deposit/withdrawal flows.
>
> 87% of Anchor users either made no moves or added to deposits.
>
> A small % of whales accounted for the bulk of outflows.

Susceptibility to a Run

Even during the initial stages of the depeg and crisis of confidence, Terra was officially tweeting that there was no death spiral despite several historical examples, empirical evidence that it was occurring to Terra, and the rapidly diverging peg necessitating the deployment of LFG reserves.

> Terra 🌍 Powered by LUNA 🌕 @terra_money
>
> 2/ UST MCAP > LUNA -- No death spiral happens.
>
> > MeetWawa @MeetWawa · May 8
> > 5/12 But what happens if $LUNA's market cap drops below $UST's market cap? Well, there will initially be a lot of FUD (fear uncertainty doubt) on how $UST is undercollateralized.
> >
> > But this is important!
> >
> > $UST is not backed by $LUNA, but rather, the demand of $LUNA.
> > Show this thread
>
> 3:39 PM · May 9, 2022 · Twitter Web App

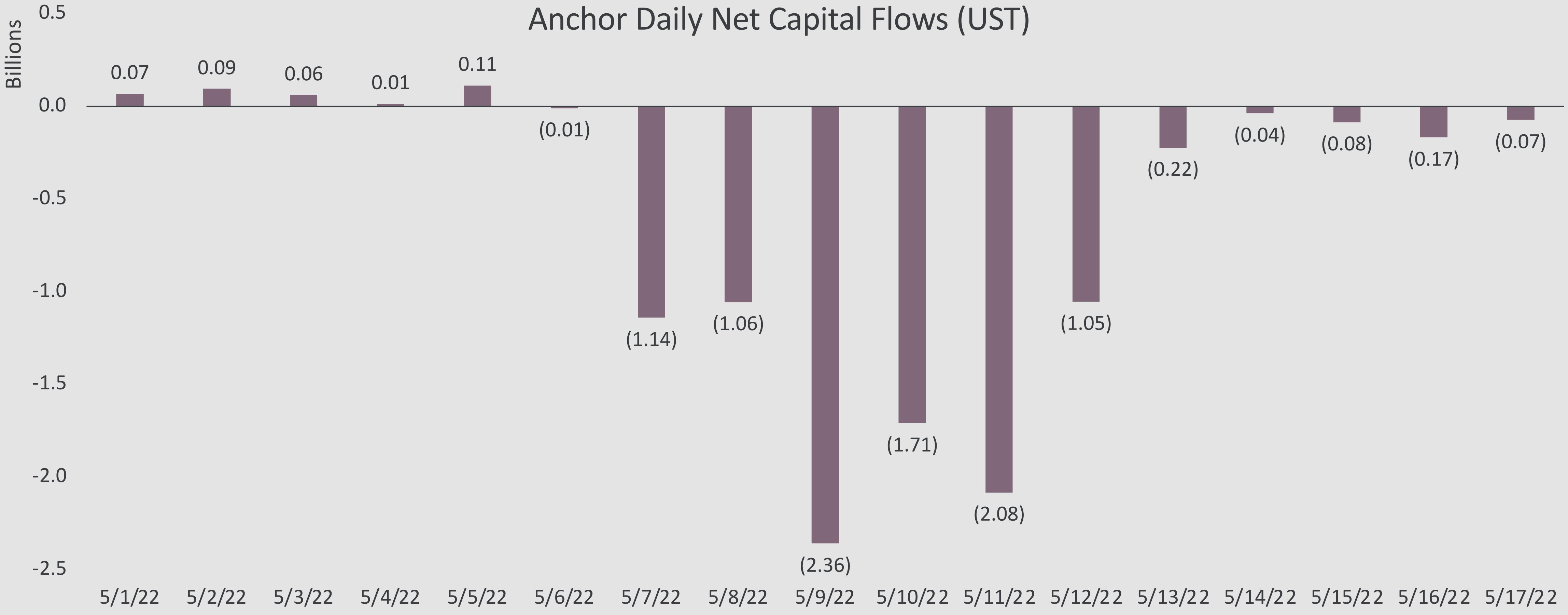
Stability of Peg Mechanism

TFL has always been nebulous about the effectiveness of their peg stability mechanism. At times, Terra has lent the impression that their peg mechanism guarantees immediate stability, and at others that it takes time to recover. Though neither are really true as the stability of the system is predicated on underlying demand for Luna.

> Terra 🌍 Powered by LUNA 🌕 @terra_money
>
> 5/ Peg regaining takes time to do so given the parameters, but it bounces back:
>
> > will chen @stablechen · May 9
> > $UST is designed to withstand shocks, that's what an algorithmic stablecoin does
> >
> > compare if $UST goes to $0.90 or $1.1 vs $USDT - the peg bends in one and breaks in the other.
> >
> > I blame TFL for creating the wrong expectation with prior posts implying instantaneous peg stability
>
> 3:39 PM · May 9, 2022 · Twitter Web App

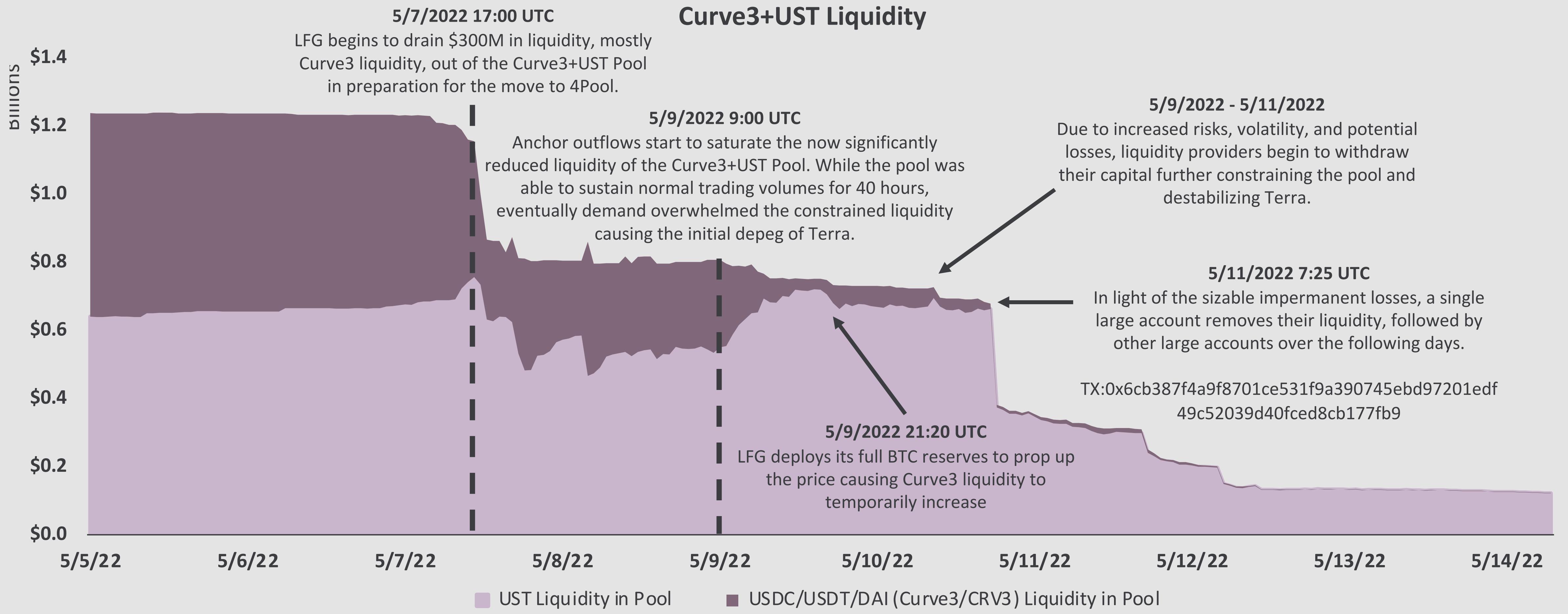
Terra’s assessments, whether genuinely held or not, were incorrect. These withdrawals were massive and mortal. Ultimately draining all of Anchor, UST’s primary source of demand, in just a few days.

Anchor net outflows completely devastated demand and there was no alternative use for UST. As far as we’ve seen, even borrowed Terra was only ever used to deposit back into Anchor to mint more ANC reward tokens.



While the market might have been able to eventually absorb these outflows, LFG's decision to remove liquidity from the Curve3+UST pool likely led to the the peg breaking before buyers could be found.

During this market volatility, LFG constrained liquidity in the Curve3 pool. While the pool was able to sustain outflows for 40 hours, it eventually was overwhelmed causing the initial depeg of Terra on the Ethereum network.



The on-chain data does not provide evidence of an attack on Curve either. From the chain data, most of the users of the Curve pool that day seemed to be consistent traders there.

Most accounts showed consistent trading activity and the one that didn't actually moved to support the peg.

On Chain Data is Consistent

DateTime	From	To	Quantity	Method
5/9/22 16:18	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	72,605,457.55	Remove_liquidity_one_coin
5/9/22 16:18	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	72,605,457.55	Remove_liquidity_one_coin
5/9/22 16:15	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	67,594,138.20	Add_liquidity
5/8/22 14:40	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	59,892,383.93	Add_liquidity
5/8/22 14:40	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	59,892,383.93	Remove_liquidity_one_coin
5/8/22 14:40	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	59,892,383.93	Remove_liquidity_one_coin
5/8/22 14:50	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	59,819,351.77	Add_liquidity
5/8/22 14:51	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	59,819,351.77	Remove_liquidity_one_coin
5/8/22 14:51	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	59,819,351.77	Remove_liquidity_one_coin
5/8/22 14:59	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	59,769,596.09	Add_liquidity
5/8/22 15:00	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	59,769,596.09	Remove_liquidity_one_coin
5/8/22 15:00	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	59,769,596.09	Remove_liquidity_one_coin
5/8/22 3:16	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	42,245,914.38	Remove_liquidity_one_coin
5/8/22 3:16	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	42,245,914.38	Remove_liquidity_one_coin
5/8/22 3:11	0x7182a1b9cf88e87b83e936d3553c91f9e7bebdd7	0xa79828df1850e8a3a3064576f380d90aecdd3359	42,051,833.99	Remove_liquidity_one_coin
5/8/22 3:11	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	42,051,833.99	Remove_liquidity_one_coin
5/9/22 1:31	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	39,909,196.60	Remove_liquidity_one_coin
5/9/22 1:31	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	39,909,196.60	Remove_liquidity_one_coin
5/8/22 3:01	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	22,255,391.23	Add_liquidity
5/9/22 22:10	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	21,418,352.85	Add_liquidity
5/9/22 22:11	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	0xa79828df1850e8a3a3064576f380d90aecdd3359	21,418,352.85	Remove_liquidity_one_coin
5/9/22 22:11	0xa79828df1850e8a3a3064576f380d90aecdd3359	0x0000000000000000000000000000000000000000	21,418,352.85	Remove_liquidity_one_coin
5/9/22 17:11	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	20,151,521.52	Add_liquidity
5/8/22 20:48	0x0000000000000000000000000000000000000000	0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0	19,955,396.14	Add_liquidity

Many Users Moved to Support the Peg

0xf51b61ea17b6ad88f78…	Transfer Tokens	14752253	2 days 18 hrs ago	0x59964a45f2efbb00185…	OUT	Wormhole: Token Bridge	0 Ether	0.004645992675
0x359df35cdeda41aacff…	Exchange_underly...	14745321	3 days 21 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0586732
0xe6c5e5bac9eb24e308…	Exchange_underly...	14745317	3 days 21 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0586732
0xd51381e694f2034709…	Exchange_underly...	14745288	3 days 21 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.04087496
0x65b6e23901dcf0e091…	Exchange_underly...	14745220	3 days 21 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0583928
0x1db18b34b78d7924bb…	Exchange_underly...	14745124	3 days 21 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0583928
0xe0759e97749912113f…	Exchange_underly...	14745076	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0583928
0x46c9db4f2138386892…	Exchange_underly...	14745070	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	0xceaf7747579696a2f0b…	0 Ether	0.0583904
0x6d633aea51b9ac2f86…	Remove_liquidity...	14744983	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0254496
0xa2c8728269438aeb28…	Add_liquidity	14744979	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0619882
0x66e9ac63f2316ccda34…	Transfer Tokens	14744921	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Wormhole: Token Bridge	0 Ether	0.0219326
0x5817dd3f3b94fa50626…	Remove_liquidity...	14744902	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.038996
0x75db9497fd75d9a881…	Add_liquidity	14744895	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.111268819
0x7abbd0a4b23c6fc1ba…	Remove_liquidity...	14744877	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0467952
0x6c152556202e4317a8…	Add_liquidity	14744870	3 days 22 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0619882
0x337331a17a44545ba0…	Remove_liquidity...	14743761	4 days 3 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0313648
0xb572114fd99746f4e1b…	Remove_liquidity...	14743749	4 days 3 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.0313648
0xf7593b17763f8eb2f75…	Remove_liquidity...	14743716	4 days 3 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.023034614916
0xe077379289e18f3012…	Add_liquidity	14743711	4 days 3 hrs ago	0x59964a45f2efbb00185…	OUT	Curve Finance: 3Pool De…	0 Ether	0.034379197247

The Curve 3 + UST Pool Seemed to Have Normal Activity:

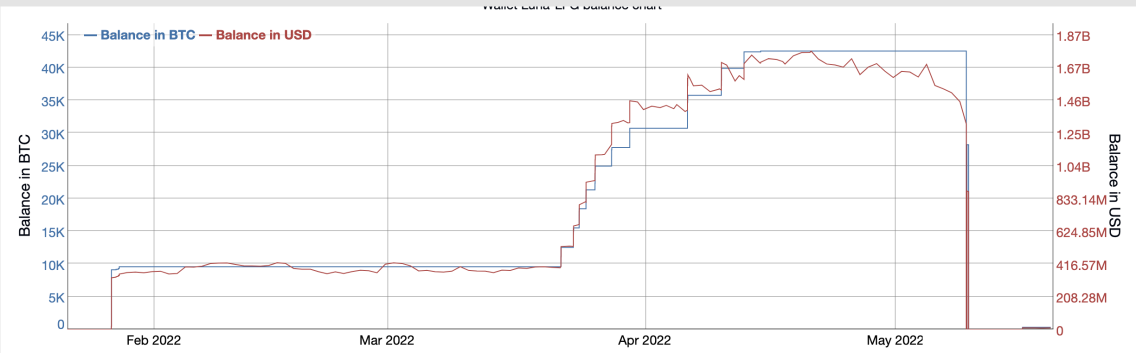
The users moving large amounts of capital during May 9th were also moving similar amounts of capital in both directions in the weeks and months leading up to the initial Terra depeg. Our hypothesis is that these users simply continued business as usual, perhaps through automation, without realizing that the curve 3pool + UST had experienced a liquidity drain as LFG moved the capital to the 4pool.

The Only Anomalous User Actually Attempted to Secure the Peg:

Address 0x59964a45f2efbb001859ab57e3e4cdcfb7f3d2c0 seems to be the only anomalous address, appearing for the first time that day and trading hundreds of millions of dollars. However, they acted to support the peg by buying UST and transferring it to Terra to exchange for Luna. This user, or more likely bot, seems to just be taking advantage of the arbitrage opportunity when Terra broke the peg.

However, once Terra depegged, it was likely to enter into a terminal “death spiral”. In a vain attempt to stop the spiral, LFG “loaned” nearly all of their BTC reserves to halt the dynamic.

All BTC assets were deployed by 05/09/2022 21:20 UTC



Block	Time	Amount	Balance	Balance, USD
736950	2022-05-18 13:44:58	+0.00016913 BTC (4.91 USD)	313.00006913 BTC	$9,086,204 @ $29,029.4
736621	2022-05-16 08:39:47	+312.9999 BTC (9,359,448.87 USD)	312.9999 BTC	$9,359,449 @ $29,902.4
735694	2022-05-09 21:20:26	-28,205.54636042 BTC (876,765,949.09 USD)	0 BTC	$0 @ $31,084.88
735662	2022-05-09 16:34:20	+28,205.54636042 BTC (881,080,227.58 USD)	28,205.54636042 BTC	$881,080,228 @ $31,237.84
735648	2022-05-09 14:34:13	-42,530.82827771 BTC (1,307,701,285.72 USD)	0 BTC	$0 @ $30,747.14
732795	2022-04-20 23:21:06	+0.001 BTC (41.66 USD)	42,530.82827771 BTC	$1,771,704,730 @ $41,656.95
732308	2022-04-17 13:15:50	+0.00000621 BTC (0.25 USD)	42,530.82727771 BTC	$1,704,905,833 @ $40,086.35
732048	2022-04-15 18:46:43	+0.00000534 BTC (0.22 USD)	42,530.8272715 BTC	$1,721,728,264 @ $40,481.89
731907	2022-04-14 21:55:42	+123.89917 BTC (4,954,226.2 USD)	42,530.82726616 BTC	$1,700,635,594 @ $39,985.95
731635	2022-04-12 21:55:59	+2,508.946366 BTC (100,036,153.22 USD)	42,406.92809616 BTC	$1,690,839,635 @ $39,871.78
731545	2022-04-12 08:12:43	+0.001 BTC (40.48 USD)	39,897.98173016 BTC	$1,615,061,907 @ $40,479.79
731243	2022-04-10 04:49:14	+2,647.99 BTC (112,778,089.54 USD)	39,897.98073016 BTC	$1,699,257,944 @ $42,590.07

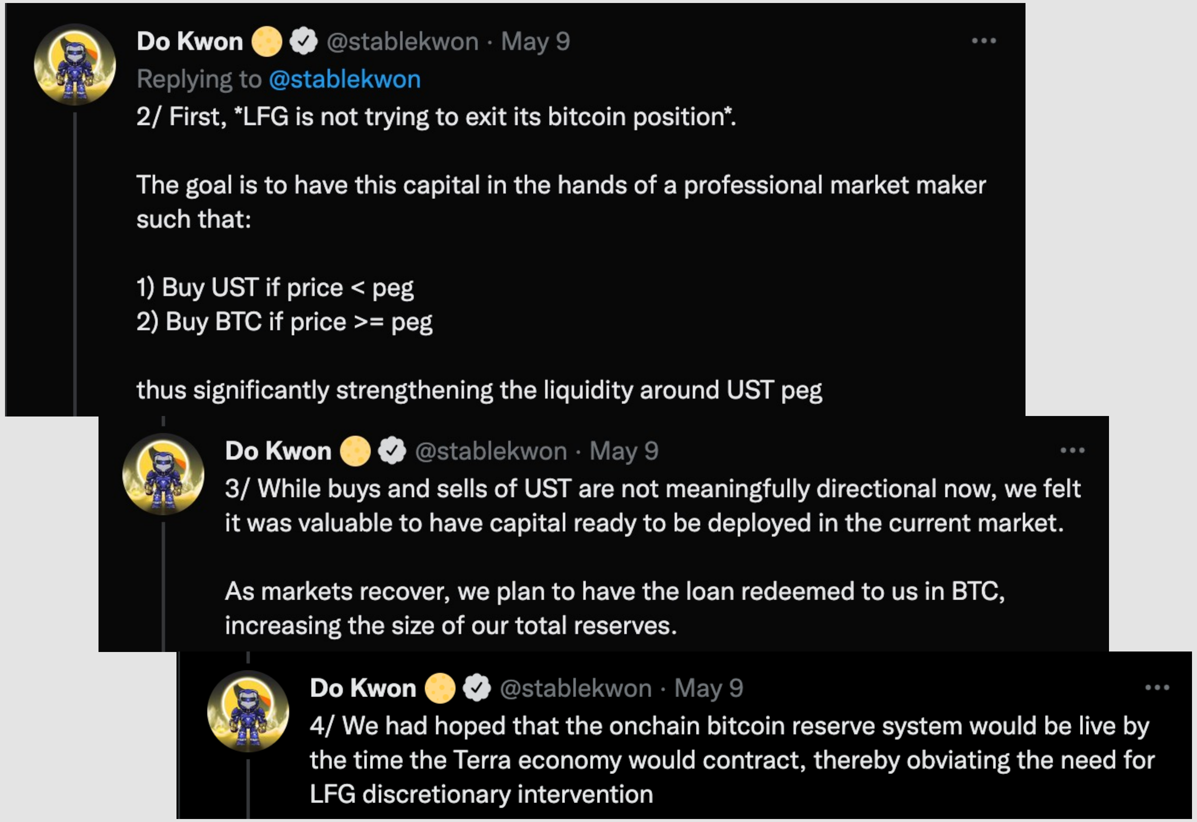
LFG deployed their entire reserve, $1.5B to manage the losses of Terra and stabilize the peg. Ultimately, these efforts were unsuccessful and did not arrest the spiraling decline in prices for Luna and Terra.

These assets were claimed to be a “loan”

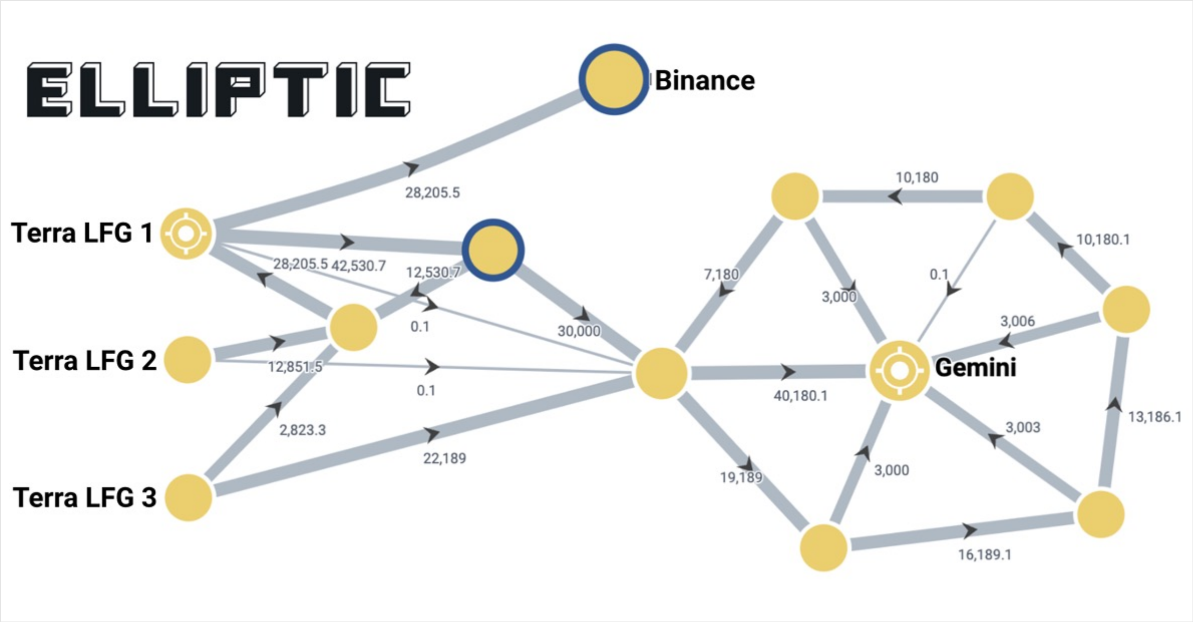
Both LFG and Do Kwon himself referred to the deployment of these assets as a “loan” in both BTC and UST. The UST, which subsequently slipped the peg was never ‘loaned’ to accumulate BTC, but the entirety of the BTC reserve was liquidated.

It is now known that it wasn’t a ‘loan’ at all, rather these assets were sold directly to Binance and Gemini. 28,205 BTC to the former and 52,189 BTC to the latter.

Do Kwon in a latter tweet provided the details of the “loan”



These BTC ultimately were sold to major exchanges



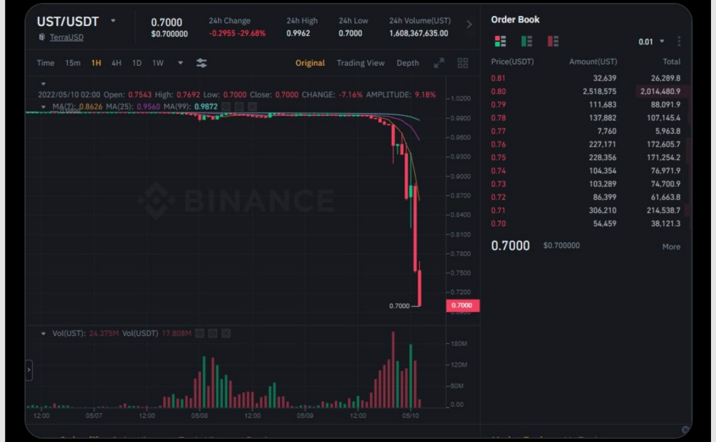
As is evident now, this wasn’t really a “loan” but rather a liquidation. All of the BTC tokens were sold to Gemini and Binance in order to arrest the falling prices of Terra and Luna. Ultimately to no avail, as the nearly $20B in UST could not be guaranteed by the $1.5B in BTC deployed by LFG.

Shortly after receiving the BTC, Binance unilaterally halted trading on its exchange below $0.70 for Terra and suspended any withdrawals at 2:20 UTC on May 10th.

Several users were reporting that Binance simply wouldn't accept any orders either selling or buying UST under 0.70.

Hasu⚡ @hasufl

Binance book is empty. Never seen that before



8:08 PM · May 9, 2022 · Twitter Web App

647 Retweets **169** Quote Tweets **4,964** Likes

Hasu⚡ @hasufl · May 9
Replying to @hasufl
It's not for a lack of demand to bid below $.70. It's simply not possible to submit orders via frontend/API. Dunno what's going on

12 16 413

Binance furthermore officially suspended all withdrawals "due to high volume of pending transactions"

Withdrawals on Terra (LUNA) Network Temporarily Suspended

2022-05-09 23:35

Fellow Binancians,

Withdrawals for **LUNA** and **UST** tokens on the Terra (LUNA) network were temporarily suspended on 2022-05-10 at 02:20 AM (UTC) due to a high volume of pending withdrawal transactions. This is caused by network slowness and congestion.

Binance will reopen withdrawals for these tokens once we deem the network to be stable and the volume of pending withdrawals has reduced. We will not notify users in a further announcement.

We apologize for any inconvenience.

Risk warning: Cryptocurrency trading is subject to high market risk. Please make your trades cautiously. You are advised that Binance is not responsible for your trading losses.

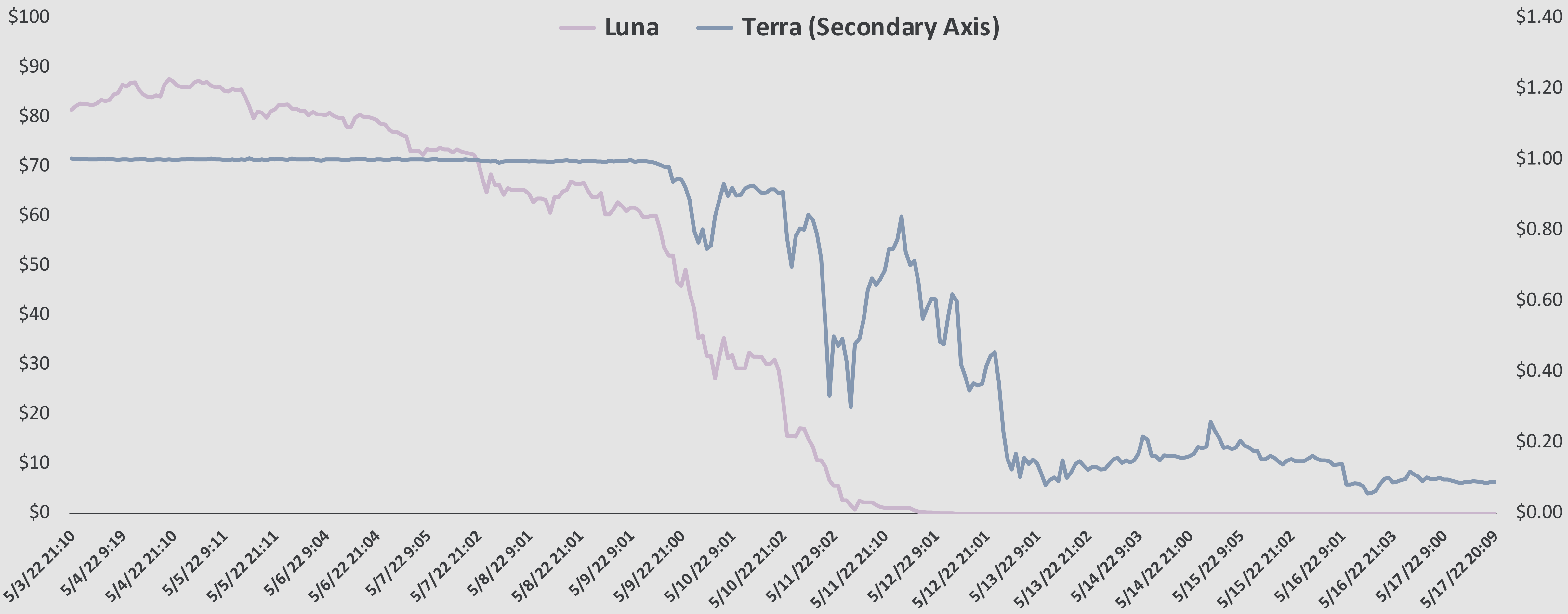
Thanks for your support!

Binance Team

2022-05-10

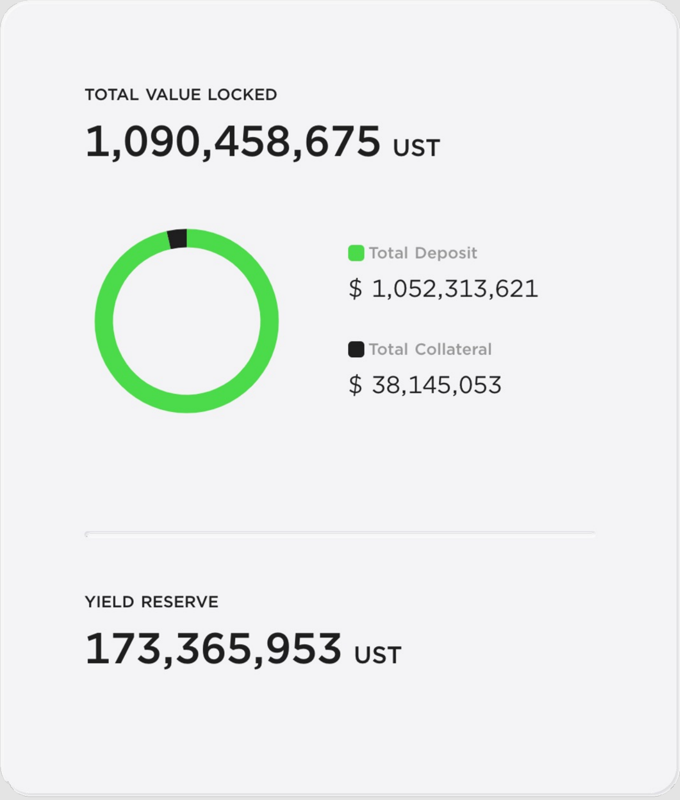
However these actions did little to stem the depeg for more than a few hours. The price of Luna continued its collapse as a result of the run and Terra quickly followed to around 10 cents.

The price of Luna had completely collapsed 64 hours after the initial depeg with UST hovering around 10 cents.

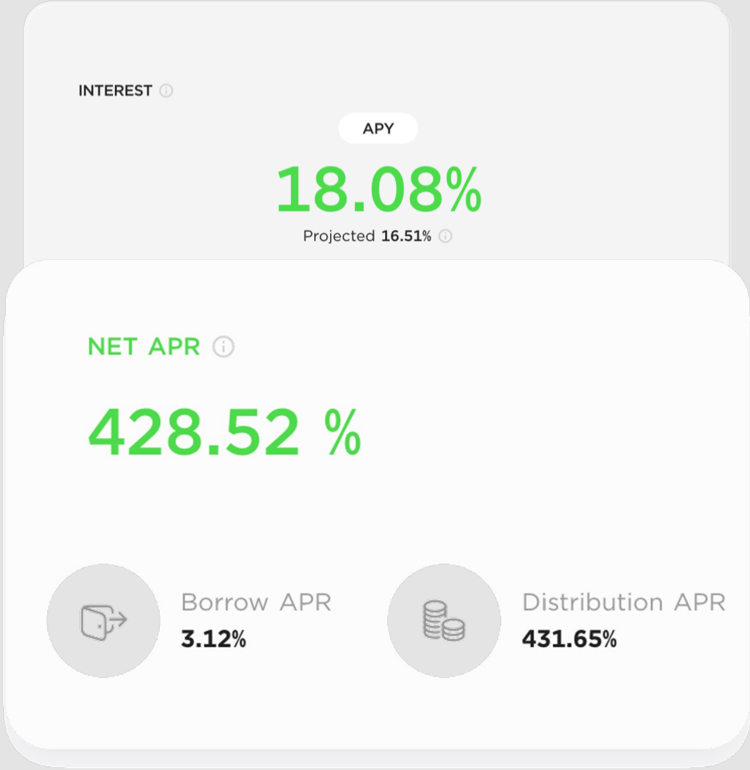


The price of Terra hasn't completely collapsed as 1B+ UST tokens are still in Anchor, generating interest from the yield reserve even though there is no borrowing demand.

The price of Luna had completely collapsed 64 hours after the initial depeg with UST hovering around 10 cents.



Deposit APR



Collateral APR

Anchor Yield Reserves Still Available:

As the yield reserves are still available, Anchor can continue to pay out 18%+ interest on UST deposits creating some demand. As of May 20th, 1B+ Tokens are still deposited.

Virtually No Borrow Demand:

Due to the collapse of the prices of Luna and Terra, there is virtually no borrowing demand. The only remaining collateral on the platform is $35M of bETH which might just be forgotten capital. As of the collapse of UST there is virtually no borrow demand, and interest received on collateral is over 400%.

ANC Token Price Also Collapsed:

The value of ANC tokens has also collapsed. As of writing it is hovering around 10 cents similar to UST.

The second order effects of the collapse of Terra, a $60B+ ecosystem was very limited. As of writing, there haven't been any notable financial contagion to other asset classes or projects.

Terra Was Too New and Limited.

Terra had only been around for less than year at any meaningful volume before it imploded While its growth to $60B in just 12 months is a tower achievement, the speed of its growth didn't allow for many third party connections or for dependencies to built on the ecosystem.

As a case in point, Terra does not have a vibrant NFT ecosystem, there aren't any major ERC-20 token equivalents on the Terra blockchain, and its only major cross chain connection is the wormhole bridge to Ethereum. As a good example of a well connected project, ThorChain also built on Cosmos, serves as a bridge between several large layer 1 projects.

Killer Apps Were Internal Projects

Third party developers were extremely rare on the Terra ecosystem. The overwhelming value of the network was the first party apps Anchor and the ecosystems tight integration with UST. Over the course of the life of the project, notable attempts were made to included third parties including vendors, payment platforms, Dapps and other projects however none were successful.

Ultimately, Terraform Labs built the network, UST, Anchor and Mirror, all of the major use cases of the ecosystem. At one point, 75% of all UST was on Anchor, and there weren't any real uses for the borrowed UST other than investing it straight back into Anchor. This limited the fallout to Terraform Labs.

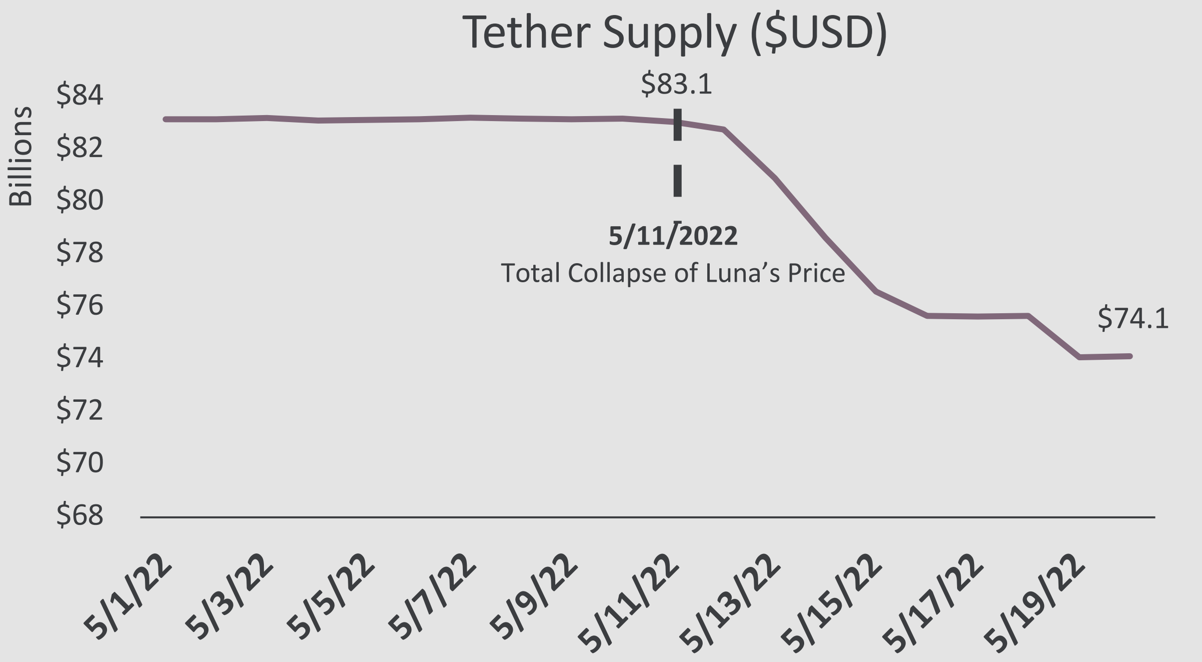
Failure Modes Were Well Known

It is well known that most multi-coin algorithmic stablecoin projects struggle to reduce token supply, especially at the speed at which demand curves can change. Multiple individuals had identified the flaws of this model with just a cursory glance at Terra's stability mechanism and limited their exposure.

If not for the $500M+ yield reserve, it is unlikely that any fund would have even decided to pursue any exposure of Luna or UST at all. Those that did, such as Selini Capital, likely had sophisticated contingency plans for this eventually limiting the fall out.

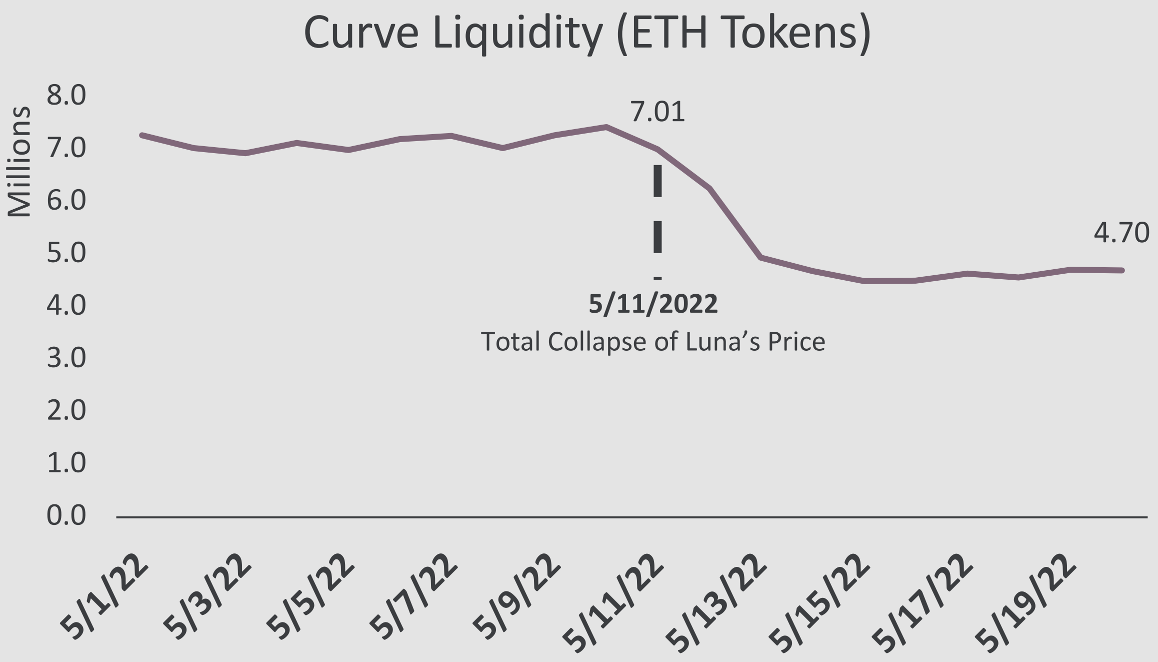
The limited outcomes as of writing are the two traditional impacts of any financial crash; a “bank run” on stable assets and an enduring constrained liquidity environment.

In the wake of the Terra collapse there was a run on Tether’s deposits reducing overall supply by $9B.



One of the most classic results of a financial crash is a run on the banks. Since the Great Depression, the FDIC and other regulators in all countries have stepped in to assure the solvency of banks during crises. In crypto, we saw the equivalent run through a drain on Tether’s supply.

Curve Pools have seen tightened liquidity in the days after the collapse of Terra. (Measured here in ETH tokens)



As is typical, users pull their liquidity out of the market during periods of expected high volatility in order to minimize risks to themselves. As crypto assets lack traditional credit exposure risk, this mostly means reducing the exposure to liquidity pools to avoid risks of impermanent loss.

STARDUST

For any questions, please reach out to us at:

Theresa Garcia (Theresa@stardustfunds.com)
Adit Patel (adit.patel@stardustfunds.com)