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Indicators for Predicting Company Crashes in the Cryptocurrency Market

***Abstract*—We study recent crypto collapses and discuss how indicators we identify could have been used to predict them. In particular, we study the collapse of companies such as Terra, BlockFi and Voyager, Celsius and FTX. We discuss categories for analyzing the operations of a company and delve into key indicators that can shed light on financial health and stability. To overcome access challenges to such data, we propose a score to further foresee crashes. This score is based on publicly available data and traditional company metrics.**

I. Introduction

The last few years have proved to be tough for the cryptocurrency industry, with several major players experiencing significant setbacks, including crashes and failures. Among these, prominent entities are FTX, Terra Luna, Voyager, Celsius, and others [1]. Additionally, the cryptocurrency market as a whole has seen a sharp decline from its 2020 peak till late in 2022 [2]. These developments have highlighted the need for a deeper understanding of the underlying causes of these crashes, as well as methods for categorizing and predicting them. One major factor contributing to these crashes is the heavy reliance of many cryptocurrency projects on loans and external dependencies. In an industry that is largely unregulated and decentralized, companies may take on significant amounts of debt or rely heavily on third-party providers, exposing them to a range of financial and operational risks. This can lead to instability and vulnerability to sudden market shifts or other unexpected events.

This study explores reasons behind some of the significant recent crypto crashes, classifies them into categories, and offers a framework for anticipating the likelihood of future crashes. Through careful analysis, we hope to provide valuable insights into the dynamics of the crypto market and inform decision-making for investors and industry participants alike.

II. Analyzing Notable Crypto Crashes

A. The Terra Collapse (May 2022)

Overview. Towards understanding the collapse of Terra first we explain the notion of stablecoins [3]. Stablecoins refer to cryptocurrencies that aim to tie their value to an external asset such as USD, gold or oil using algorithms in order to maintain a stable price. The link is determined by the exchange rate between the currency and the asset in a way that the value of the cryptocurrency fluctuates the same as the asset to which it is pegged. An example for such cryptocurrencies are Binance USD, Euro Coin and Tether.

Unlike other mentioned cryptocurrencies, Terra's stablecoins ensure seamless transaction and stability of flat currencies, the Terra crypto network was not directly backed by reserves [4]. Instead, it used its native LUNA currency as a utility and governance coin to operate the collateralizing mechanisms that back and secure the price stability of the Terra network's stablecoins. In that manner, the LUNA coins had an elastic supply that fluctuated according to the needs of Terra's collateralization mechanism. To summarize, Terra and Luna were supposed to act as a balancing mechanism where one is automatically created or destroyed based on the supply and demand of the other - if UST ever fell below the value of USD, arbitrages would buy UST and then buy LUNA at a discount which would prop up the price of UST and the same happens for the opposite direction. In practice, the algorithm heavily relied on consistent demand for the stablecoin. In order to reach such demand, the company designed the Anchor Protocol, a DeFi protocol that is built within the Terra ecosystem and offers investors up to 20 percent of annual return on their investment.

What went wrong? First, the 20 percent annual return rate is quite high, letting people calling it a Ponzi scheme where money from later investors was paid to earlier investors as interest. Before the LUNA crash, 2 billion USD worth of UST was unstaked from the Anchor Protocol and hundreds of millions of it were then immediately sold, some suspect that it was a form of a malicious attack on the Terra ecosystem but it is still unknown exactly why someone carried out this action. At the same time the overall crypto market was experiencing a major crash which led to the price of LUNA crashing - in one week LUNA went down from 80 USD for a token to less than 1 USD a token. This was a problem because the UST was algorithmically linked to LUNA for stabilization and as a result the UST got de-pegged since the total value of UST could not be redeemed against LUNA. This motivated people to lose confidence in the UST and sell it off, leading to the crash of the value of LUNA till it was worthless.

Key points that caused the collapse:

- The stablecoin relied on a native cryptocurrency not backed by reserves.
- The algorithm was prone to malicious attacks and was not stress tested.
- The algorithm relied on external interference (without demand the value would not go back).
- The demand was artificially built using the Anchor Protocol.
- The entire crypto market crashed including the LUNA cryptocurrency.

TABLE I
PLATFORMS COMMON TRAITS

CharacteristicPlatform	**Terra**	**BlockFi/Voyager**	**Celsius**	**FTX**
Lower reserves or collateral than customers assets	Yes	Yes	Yes	Yes
Small liquidity assets	Yes	No	Yes	Yes
High holder of the native token	Yes	No	Yes	Yes
Low decentralization of users or business partners	Yes Yes	Yes Yes	No No	No No
Incentives account for most of the use	Yes	No	Yes	Yes
Technical Audit of smart contracts	No	No	No	No

B. BlockFi and Voyager collapse (July 2022)

Overview. Both Voyager and BlockFi are crypto lending companies.The idea is that Investors can deposit their crypto assets in their Accounts, where in turn the lending company takes that money and loans it to other traders or institutions. Investment firms and hedge funds can rely on these loans to make big trades, and invest the money in usually rather risky ventures such as investing in early-stage companies. If it goes well, the returns can be substantial with profit coming from the interest on these loans.

What went wrong? Both companies gave loans amounting to hundreds of millions of USD to Three Arrow Capital, with no real collateral for their loans. When Terra crashed, Three Arrows Capital also crashed from overexposure as a result, and therefore could not pay back its lenders. Having lost a significant part of its assets as a result, with no collateral to compensate, both Voyager and Blockfi went on a downward spiral following these events.

Key points that caused the collapse:

- Risky business plan – lending large amounts of money to companies that are involved in risky ventures themselves.
- No significant collateral – By giving hundreds of millions of USD in loans without a significant collateral, both companies were exposed to huge risks.

C. Celsius collapse (July 2022)

Overview. Celsius is a decentralized finance company that works similarly to how a typical bank functions. The only difference is that Celsius Network deals in cryptocurrencies rather than fiat money. All Celsius users can deposit their cryptocurrencies on the network and earn interest in return. Moreover, users can also choose to take out loans in the form of cryptocurrency.

What went wrong? As we already discussed, in 2022 The cryptocurrency market has been extremely volatile and unstable due to major financial issues like inflation, a weak stock market, and increased interest rates by the Federal Reserve System in the US. Which resulted in a pool of people asking to pull out their crypto from Celsius. On 12 June 2022, Celsius posted a memo indicating they paused withdrawals resulting in locking their users out of their money.

In the aftermath of Celsius Network's announcement to suspend all withdrawals, a rapid and drastic depreciation of approximately 70% unfolded in the value of the Celsius cryptocurrency. This downward spiral persisted throughout the subsequent days, further eroding the price of the Celsius token. Concurrently, the broader cryptocurrency market experienced a substantial sell-off, driven by pronounced volatility and a widespread decline in the value of numerous prominent cryptocurrencies. Ultimately, on July 13, 2022, Celsius Network took a significant step by initiating legal proceedings and filing for Chapter 11 bankruptcy protection in the esteemed U.S. Bankruptcy Court in New York.

Key points that caused the collapse:

- Market volatility had a direct negative effect on Celius.
- Missing procedures regarding customer funds keeping and usage.
- Bad loan behaviors and investments.

D. FTX collapse (November 2022)

Overview. FTX Trading Limited, an enterprise established in 2017, emerged as a prominent player in the cryptocurrency derivatives exchange and trading realm. FTX secured 400 million USD in a funding round in January 2021. A comprehensive overview on FTX was presented by KPMG [5].

The exceptional liquidity offered by FTX stemmed, in part, from its unique liquidation engine. This engine effectively acquired assets from sellers during significant liquidation events, thereby averting price collapses. Notably, Alameda served as the safeguard for this liquidation engine. In March, FTX's native token, FTT, garnered a market capitalization of 14 billion USD.

FTT, a native utility token developed by FTX, granted holders a variety of benefits, including trading fee discounts and OTC rebates. FTX further demonstrated its commitment to enhancing token value by repurchasing and "burning" FTT tokens based on the profitability of the platform, consequently reducing the token supply and potentially increasing its price. It is crucial to acknowledge that utility tokens, such as FTT, differ from security tokens in that they are not primarily intended for investment purposes. Instead, their value derives exclusively from their utility within the associated platform.

What went wrong? On 2 November 2022, media outlet CoinDesk first raised concerns regarding the long-term viability of FTX, along with its affiliated trading firm, Alameda Research. The article triggered apprehension resulting in a rush to withdraw funds from FTX. It was revealed that FTX had extended loans exceeding 10 billion USD, including customer deposits, to Alameda, thereby amplifying the magnitude of withdrawal requests. The cryptocurrency exchange subsequently filed for Chapter 11 bankruptcy protection in the United States. In an FTX balance sheet reported by the Financial Times, a significant discrepancy of approximately 8 billion USD was identified between liabilities and assets, leading to a pause in trading and withdrawals.

The collapse of FTX can be attributed to several key factors:

- Utilization of FTT coins as collateral: Alameda employed FTT tokens as collateral for leveraged trading. Given the direct correlation between the value of FTT and FTX, the decline in FTT's price below 22 USD triggered the

liquidation of Alameda's loans due to their inability to repay the debt.

- Token concentration: FTX's balance sheet revealed a significant holdings concentration, valued at approximately 5.4 billion USD, in low float, high fully diluted value (FDV) tokens, with FTT and Serum. Fair values of these tokens in a liquidation scenario were notably lower than reported values.
- Inappropriate and unethical utilization of customer funds: FTX appears to have lent billions of dollars in customer funds to Alameda Research. Furthermore, FTX commingled customer funds with counterparties and engaged in unauthorized trading activities—a clear violation of US securities law.
- Lack of comprehensive reports: FTX lacked a robust financial reporting system, resulting in the absence of reliable financial information. Incomplete records were found to payments, employee salaries, and asset acquisitions.

III. Critical Parameters for Predicting Financial Stability and Company Crashes

A. Background and Model

Taken together, the key points presented suggest significant issues with the stability and regulation of the cryptocurrency market, as well as the ethics and financial management practices of companies operating within it. From the creation of unstable and potentially fraudulent stablecoins to the lending of large amounts of money without significant collateral, to the misuse of customer funds, all of which have the potential to result in a collapse.

In this section, we explore some parameters that can help predict company crashes. By identifying these factors, businesses and investors can take proactive measures to mitigate the risks and prevent exposure to a potential collapse. We will examine some of the key indicators that have been shown to be reliable predictors of a company's financial health and stability. Additionally, we will discuss how investors can leverage these parameters to safeguard their investments and avoid the devastating consequences of a collapse, using an index we will provide that relies on the following predictors. Let's dive in and explore these critical parameters for predicting company crashes.

To effectively analyze and address the various aspects of company operations, we divide the points of consideration to three categories. For each category we provide an Indicator with a score that ranges from 1 to 100. Using these indicators we provide an indicator aiming to predict a company's tendency to crash.

B. Corporate Governance

The category refers to (i) Appropriate governance arrangements; (ii) Proper and transparent financial management for the public; (iii) Segregation of customer funds and company funds; (iv) Effective cash management processes.

One commonly used indicator of a company's corporate governance is the Corporate Governance Quotient (CGQ) score provided by Institutional Shareholder Services (ISS). The CGQ score is a rating system that ranges from 1 to 10, with 10 being the best possible score. The CGQ score is based on a comprehensive analysis of a range of governance factors, including board structure, shareholder rights, executive compensation, audit, risk oversight, and social and environmental responsibility. A score of 80 or above is generally considered to be a strong indication of good corporate governance practices, while a score below 60 is considered to be a warning sign. So to accommodate the CGQ to our 1 - 100 indicator, we use the formula $(11 - CGQ(score)) \cdot 10$.

C. Security and Risk Management

The category refers to (i) Applied Security measures protocols and enforcement; (ii) Cyber security employee training.

We suggest the Cybersecurity Readiness Score, calculated using three factors: security posture, incident response capability, and employee training. To calculate the security posture score, we average scores from the Identify, Protect, Detect, Respond, and Recover functions of the NIST Cybersecurity Framework. For the incident response capability score, we average the Mean Time to Detect (MTTD) and Mean Time to Respond (MTTR) metrics. The employee training score is calculated as the percentage of employees who completed cybersecurity training in the past year. The score ranges from 1 to 100 for simplicity.

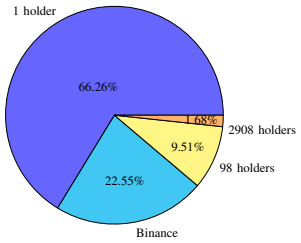
D. Financial Analysis

For this category we suggest the average of two indicators:

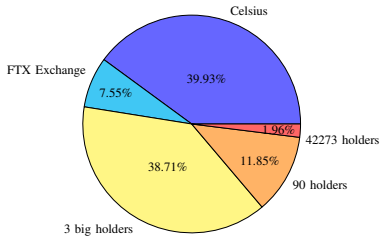
Reserve Adequacy Score. The Reserve Adequacy Score can be calculated by comparing the total amount of the company's crypto coin in circulation with the value of their actual real money reserves. The score can be calculated as follows: Reserve Adequacy Score = (Crypto Coin Market Cap / Actual Real Money Reserves) x 100. If the Reserve Adequacy Score is high, it indicates that the company has a low level of reserves compared to the value of their crypto coin. This is a red flag for investors, as it suggests that the company may not be able to meet the demand for its coin if investors decide to sell en masse. Conversely, a low Reserve Adequacy Score suggests that the company has adequate reserves to back its crypto coin, which is a positive indicator for investors.

Loan management and collateral handling. For this category we provide an indicator utilizing a graph. Let $G = (V, E)$ be a directed graph where the edges represent loan and collateral transactions between companies. Each edge in E is labeled with a weight w, representing the amount of the transaction. Several conclusions can be inferred about the credibility of a company:

- Loan-to-Collateral Ratio - A company with a low loan-to-collateral ratio may be considered more credible, being less likely to default on its obligations.



(a) Voyager - Token holders distribution (as of Oct 26, 2021)



(b) Celsius - Token holders distribution (as of Jan 10, 2022)

Fig. 1. Token holder distribution for Voyager and Celsius (based on [6], [7]).

- Network Structure - A company connected to credible companies may be considered more credible, having relationships with trustworthy companies.
- Types of Transactions - A company that primarily provides loans may be considered less credible following the implied risk.

We can take these parameters and factor them together to create a score to measure how unreliable a company is. As with previous scores, it will range from 1-100, and can be achieved, for example, by averaging the parameters.

IV. Additional metrics

Many of the above metrics rely on open communication or thorough company reports. These are not necessarily available, e.g. in many of the mentioned crashes. We present additional metrics that could help to ascertain the truthfulness of such reports. This metric would serve as an open-access indicator for mitigating companies' fraudulent proposals.

A. Decentralization of the native token

The high concentration of a native token by the platform skews the true price by artificially reducing the supply when investors usually see the price of the native token as a proxy for the company's health. Monitoring the company's addresses should be done. Fig. 1 illustrates how this metric could have served as a worrying sign that the market price was sensitive to token holding by a very small number of users. For Voyager, Binance, or a large investor a ban or mass selling of a coin crashes the price. Celsius held more than 40% of the supply.

B. Recipients of the highest transfers

As highlighted in the case of FTX and Alameda or Voyager and Three Arrow Capital vast sums of money were lent to very few entities. This eventually led to the platform collapse indicating the relevance of tracking huge coin movements.

V. Related Work

Xu and Vadgama presented a global review of lending in blockchain networks [8]. Gonzalez overviewed challenges of decentralized lending systems and the biases in loaning [9]. It serves to show that biases may have led to the devastating loans to Three Arrow Capital for example. Bielinskyi and Serdyuk presented an analysis of crypto market crashes and provided insights as to how to analyze it and heuristics for predicting future ones [10]. Currency prices of the native coin of a network often deeply influence the performance of the various elements composing it. Such prices can serve as safeguards for anticipating future crashes. [11], [12] investigates the Terra Luna crash and the different characteristics prior to it both on Ethereum with UST and the Luna network.

Dai et al. investigate the transmission that is present between cryptocurrency, and equity markets [13]. The transmission of equity markets and cryptocurrency ones could be applied between various blockchains such as the Terra blockchain and the Ethereum blockchain (UST and LUNA coin). Recently, an additional study of connectedness between financial assets such as equities, bonds, or gold and Non-Fungible Tokens (NFT) was presented by Aharon et al. [14].

Previous crash studies and the link between platforms might be used as heuristics for further improving the proposed indicators. To the best of our knowledge, our study is the first to provide an extensive overview of the major 2022 crashes, proposing a score and guidance criteria to predict future crashes.

VI. Conclusions and Future Directions

The cryptocurrency market has significant issues with stability and regulation, as well as the ethics and financial management practices of companies operating within it. We have presented several real-life cases which present many issues such as unstable and potentially fraudulent stablecoins, misuse of customer funds and bad loaning practices, all of which have the potential to result in a company's collapse, and in-turn affect other companies and the crypto market as a whole. In this article, we explored critical indicators for predicting company crashes; from analyzing financial ratios, loan management, collateral handling, corporate governance, transparency and security measures, as well as market stability, we offered a generic formula template to better predict a potential collapse.

With critical indicators discussed in this article, investors and companies can better protect themselves from the potential fallout of a cryptocurrency company crash. Additionally, it is important for regulators to continue to monitor the market and take measures to address issues such as fraudulent activity and unethical business practices. We hope the tools we provided here can help protect companies and investors and assist regulators in monitoring the market.

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