

BUILT TO FAIL: THE INHERENT FRAGILITY OF ALGORITHMIC STABLECOINS

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Algorithmic stablecoins are inherently fragile. These uncollateralized digital assets, which attempt to peg the price of a reference asset using financial engineering, algorithms, and market incentives, are not stable at all but exist in a state of perpetual vulnerability. Iterations to date have struggled to maintain a stable peg, and some have failed catastrophically. This Article argues that algorithmic stablecoins are fundamentally flawed because they rely on three factors which history has shown to be impossible to control. First, they require a support level of demand for operational stability. Second, they rely on independent actors with market incentives to perform price-stabilizing arbitrage. Finally, they require reliable price information at all times. None of these factors are certain, and all of them have proven to be historically tenuous in the context of financial crises or periods of extreme volatility. Regulatory guidelines are needed for all stablecoin forms, including issuer registration requirements, a defined taxonomy clarifying forms, prudential, collateral custody, and transparency safeguards, and risk disclosure and containment measures. A strong regulatory framework, with risk disclosure and containment safeguards, is particularly needed for algorithmic stablecoins, which currently serve only speculative DeFi trading applications and have very little, if any, societal or financial inclusionary value.

INTRODUCTION

Financial product innovation is not always a good thing, and certain innovations are designed in a way to make them inherently unstable. In 2008, the entire financial system nearly collapsed due to a dizzying array of complex securitization-driven, derivatives-enhanced financial product innovations, which emanated from home

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loans.¹ Now, a new, increasingly popular,² poorly-designed³ and inherently fragile⁴ financial product has recently emerged, that needs to be appropriately regulated—the algorithmic stablecoin.

An algorithmic stablecoin is a contradiction of terms.⁵ The market iterations of the algorithmic stablecoin to date have revealed a total lack of stability.⁶ It is an unregulated, uncollateralized digital asset that operates in a perpetually vulnerable state.⁷ An algorithmic stablecoin has no true peg,⁸ but rather derives value solely from what the crypto-asset task force of the European Central Bank calls, “the expectation of its future market value.”⁹ As a result, it is an incredibly tenuous payment mechanism. Algorithmic stablecoins are heralded by some as a more “capital efficient”¹⁰ antidote to the wild daily price volatility of popular cryptocurrencies like Bitcoin and

1. See *Crash Course*, THE ECONOMIST (Sept. 7, 2013), <https://www.economist.com/schools-brief/2013/09/07/crash-course>.

2. See Brady Dale, *The Quest for a Truly Decentralized Stablecoin*, COINDESK, <https://www.coindesk.com/tech/2021/07/06/the-quest-for-a-truly-decentralized-stablecoin/> (last updated Sept. 14, 2021, 9:21 AM).

3. See Patrick Tan, *TITANic Crash—How Algorithmic Stablecoins Fall Short Fast*, DATA DRIVEN INV. (June 19, 2021), <https://medium.datadriveninvestor.com/titanic-crash-how-algorithmic-stablecoins-fall-short-fast-a1147a721207>.

4. See Carlo R.W. De Meijer, *Stablecoins Are Not That Stable: What Regulatory Approach?*, FINEXTRA (July 30, 2021), <https://www.finextra.com/blogposting/20690/stablecoins-are-not-that-stable-what-regulatory-approach>; J.P. Koning, *Algorithmic Stablecoins*, AM. INST. ECON. RSCH. (Feb. 1, 2021), <https://www.aier.org/article/algorithmic-stablecoins/>; Robbie Liu, *Algorithmic Stablecoins’ Performance Suggests They Have Yet to Justify Their Models*, OKEX (Jan. 25, 2021), <https://www.okex.com/academy/en/algorithmic-stablecoins-performance-suggests-they-have-yet-to-justify-their-models>; Andrey Shevchenko, *Algorithmic Stablecoins Aren’t Really Stable, but Can the Concept Redeem Itself?*, COINTELEGRAPH (Feb. 18, 2021), <https://cointelegraph.com/news/algorithmic-stablecoins-aren-t-really-stable-but-can-the-concept-redeem-itself>.

5. See Andrey Shevchenko, *Finance Redefined: The Curious Implications of Algorithmic Stablecoins*, Dec. 2–9, COINTELEGRAPH (Dec. 10, 2020), <https://cointelegraph.com/news/finance-redefined-the-curious-implications-of-algorithmic-stablecoins-dec-2-9>.

6. See Shevchenko, *supra* note 4.

7. See *id.*

8. See Shevchenko, *supra* note 5. A “peg” is defined as “a specific price for the rate of exchange between two assets.” Sam Kazemian, *Peg*, ALEXANDRIA, <https://coinmarketcap.com/alexandria/glossary/peg> (last visited Oct. 14, 2021).

9. ECB CRYPTO-ASSETS TASK FORCE, EUROPEAN CENT. BANK, STABLECOINS: IMPLICATIONS FOR MONETARY POLICY, FINANCIAL STABILITY, MARKET INFRASTRUCTURE AND PAYMENTS, AND BANKING SUPERVISION IN THE EURO AREA 8 (2020), <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op247~fe3df92991.en.pdf>.

10. See Koning, *supra* note 4.

Ether,¹¹ which limits their functionality as a money substitute for consumer transactions, wages, or deferred debt payments.¹² Others have claimed that algorithmic stablecoins are “recreating traditional banking” as a decentralized finance (“DeFi”) fractional reserve system.¹³ Both comparisons miss the mark, and the proclaimed utility of algorithmic stablecoins is vastly overstated and misleading because of three lessons from history that make them inherently fragile.

First, algorithmic stablecoins require a support level of demand for the entire ecosystem to operate.¹⁴ If demand falls below a threshold level, the entire system will fail.¹⁵ History shows that base or floor levels of support for financial products is not guaranteed—especially in a crisis.¹⁶ Second, algorithmic stablecoins rely on independent actors with market incentives to perform price-stabilizing arbitrage to maintain a so-called “stable” ecosystem.¹⁷ History again reveals that reliance on independent, market-driven actors, without legal obligations, to perform price-stabilizing discretionary arbitrage is also fragile.¹⁸ Finally, history has proven that in a crisis, information becomes opaque, noise crowds signal, prices and counterparties become uncertain, and cascades and herds easily form.¹⁹ Informational opacity undermines the token “economics” and incentive structures of algorithmic stablecoins.²⁰

If the “tokenomic” incentive structure in any algorithmic stablecoin ecosystem breaks down, the entire ecosystem fails without

11. See Christian Catalini & Jai Massari, *Stablecoins and the Future of Money*, HARV. BUS. REV. (Aug. 10, 2021), <https://hbr.org/2021/08/stablecoins-and-the-future-of-money>.

12. See Steve Walters, *Terra (LUNA) Review: Programmable Money Protocol*, COINBUREAU (Feb. 19, 2021), <https://www.coinbureau.com/review/terra-luna/>; Adrian Whelan, *Regulators Dive Deep into Stablecoin*, FINREG ALERT (Oct. 7, 2019), <http://www.finregalert.com/regulators-dive-deep-into-stablecoin/>.

13. See David Z. Morris, *Paying the IRON Price: Fractional Reserve Banking on a Blockchain*, COINDESK (Sept. 14, 2021, 9:13 AM), <https://www.coindesk.com/policy/2021/06/17/paying-the-iron-price-fractional-reserve-banking-on-a-blockchain/>.

14. See MakerDAO, *Stablecoins: Collateralization Types*, MEDIUM (Dec. 12, 2018), <https://medium.com/@MakerDAO/stablecoins-collateralization-types-2a860624dcd3>.

15. See Jamie Redman, *VC Backed Billion-Dollar Stablecoin Project Fei Protocol Falls Below the USD Peg*, BITCOIN.COM (Apr. 8, 2021), <https://news.bitcoin.com/billion-dollar-stablecoin-project-fei-protocol-falls-below-usd-peg/>.

16. See *infra* Part III.

17. See *infra* Part III; Koning, *supra* note 4; Liu, *supra* note 4; Tan, *supra* note 3.

18. See *infra* Part III.

19. See *id.*

20. See Amani Moin & Kevin Sekniqi, *On Stablecoins and Beauty Pageants*, HACKING, DISTRIBUTED (May 7, 2019, 9:30 AM), <https://hackingdistributed.com/2019/05/07/stablecoins-and-beauty-pageants/>.

a backstop or depositary insurance safety net.²¹ Algorithmic stablecoins exist in a system that will be prone to runs, destabilization, and failure when reality deviates from the assumptions underlying the embedded incentive structure.²² Multiple iterations of algorithmic stablecoins have already catastrophically failed.²³

There is a need for regulatory safeguards for all stablecoin types including issuer registration requirements, a defined taxonomy clarifying stablecoin forms, prudential rules, collateral custodial safeguards, as well as reporting transparency, risk disclosure, and containment measures.²⁴ Risk transparency, disclosure, and containment measures are particularly relevant for algorithmic stablecoins, which currently serve only to power speculative DeFi trading applications.²⁵

I. THE VARIETIES OF STABLECOIN EXPERIENCE

Stablecoins are crypto-assets that attempt to peg their value to another asset (or basket of assets including reserve currencies or highly-liquid government bonds).²⁶ To date, stablecoins have no universal definition²⁷—perhaps one of the reasons why regulatory

21. See Serg (@elagai), *Tokenomics of Difference Stablecoins*, HACKERNOON (Apr. 24, 2021), <https://hackernoon.com/tokenomics-of-different-stablecoins-ttg33ut>.

22. See *id.*

23. Redman, *supra* note 15; Nivesh Rustgi, *Algorithmic Stablecoin Crashes 50% as Devs Scramble for a Fix*, CRYPTO BRIEFING (Apr. 7, 2021), <https://cryptobriefing.com/algorithmic-stablecoin-crashes-50-devs-scramble-fix/>; Sebastian Sinclair, *Iron Finance's Titan Token Falls to Near Zero in DeFi Panic Selling*, COINDESK, <https://www.coindesk.com/markets/2021/06/17/iron-finance-titan-token-falls-to-near-zero-in-defi-panic-selling/> (last updated Sept. 14, 2021, 9:12 AM).

24. See De Meijer, *supra* note 4.

25. See Shevchenko, *supra* note 5.

26. See DAVID GOGEL ET AL., WHARTON BLOCKCHAIN & DIGIT. ASSET PROJECT, THE WHARTON SCHOOL, UNIV. OF PA., *DEFI BEYOND THE HYPE: THE EMERGING WORLD OF DECENTRALIZED FINANCE* 9–10 (2021), <https://wifpr.wharton.upenn.edu/wp-content/uploads/2021/05/DeFi-Beyond-the-Hype.pdf>.

27. See, e.g., Adam Hayes, *Stablecoin*, INVESTOPEDIA, <https://www.investopedia.com/terms/s/stablecoin.asp> (last updated Oct. 8, 2021) (“A stablecoin is a new class of cryptocurrencies that attempts to offer price stability and are backed by a reserve asset.”); Alyssa Hertig, *What Is a Stablecoin?*, COINDESK (Dec. 29, 2020), <https://www.coindesk.com/learn/what-is-a-stablecoin/> (“A stablecoin is a type of cryptocurrency whose value is tied to an outside asset, such as the U.S. dollar or gold, to stabilize the price.”); Paulina Likos, *What Are Stablecoins and How Can I Invest in Them?*, U.S. NEWS & WORLD REP.: MONEY (May 21, 2021, 3:09 PM), <https://money.usnews.com/investing/cryptocurrency/articles/what-are-stablecoins-and-how-can-i-invest-in-them> (“Stablecoins are cryptocurrencies that are backed by an asset, most often a fiat currency.”).

structures have been so slow to materialize. The International Organization of Securities Commissions (“IOSCO”) has suggested that stablecoins come in many different varieties and forms.²⁸

The most popular form is an “off-chain” custodial stablecoin, like Circle and Coinbase’s widely circulated USD Coin (“USDC”),²⁹ or Facebook’s proposed Diem,³⁰ both of which use “holdings of fiat currency or high-quality liquid assets as a reserve.”³¹ Or Tether, which claims to be collateralized with vast holdings of commercial paper.³² Other stablecoins are either fully collateralized, or “over-collateralized.”³³ Over-collateralized means that more than 100 percent of the value of the stablecoin is held “on-chain,” using another crypto-asset to serve the collateral function—like MakerDAO’s ERC20 Dai (“DAI”) token.³⁴ Using another crypto-asset in this manner, DAI collateralizes a variety of crypto-assets, with collateral ratios adjusted for the particular locked-up token.³⁵

The most unstable and fragile variety of stablecoins are “algorithmic,” which are not fully collateralized and use market incentives, arbitrage opportunities, automated smart contracts, and reserve token adjustments to attempt to maintain a stable peg.³⁶ These kinds of stablecoins have been described as an algorithmic “Central Bank.”³⁷ The size of the stablecoin market has skyrocketed to over \$119 billion in 2021,³⁸ and algorithmic varieties are a significant and growing portion of this market.³⁹

28. IOSCO, GLOBAL STABLECOIN INITIATIVES 3–4 (2020), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD650.pdf> [hereinafter IOSCO].

29. See *USDC: The World’s Leading Digital Dollar Stablecoin*, CIRCLE, <https://www.circle.com/en/usdc> (last visited Oct. 14, 2021).

30. See *Welcome to the Diem Project*, DIEM ASS’N, <https://www.diem.com/en-us/> (last visited Oct. 14, 2021); IOSCO, *supra* note 28, at 3.

31. GOGEL ET AL., *supra* note 26, at 9.

32. Siddharth Venkataramakrishnan & Joe Rennison, *Tether’s Commercial Paper Disclosure Places It Among Global Giants*, FIN. TIMES (June 10, 2021), <https://www.ft.com/content/342966af-98dc-4b48-b997-38c00804270a>.

33. Hayes, *supra* note 27.

34. See *A Better, Smarter Currency*, MAKERDAO, <https://makerdao.com/en/> (last visited Oct. 14, 2021).

35. See *A Guide to DAI Stats*, MAKERDAO: MAKER BLOG (Dec. 15, 2020), <https://blog.makerdao.com/a-guide-to-dai-stats/>; Ki Chong Tran & Adriana Hamacher, *How to Use DAI Stablecoin: Beginner’s Guide (2021)*, DECRYPT (Jan. 18, 2021), <https://decrypt.co/resources/dai-explained-guide-ethereum-stablecoin>.

36. GOGEL ET AL., *supra* note 26, at 9.

37. See De Meijer, *supra* note 4.

38. See Jane Thomason, *Stablecoin Adoption and the Future of Financial Inclusion*, COINTELEGRAPH (Aug. 19, 2021), <https://cointelegraph.com/news/stablecoin-adoption-and-the-future-of-financial-inclusion>.

39. See Muyao Shen, *Terra’s 25-Fold Price Jump This Year Shows Growing Bet on Algorithmic Stablecoins*, YAHOO! (May 14, 2021), <https://www.yahoo.com/now/terra-25-fold-price-jump-172547273.html>.

Despite the spectacular failure of Iron Finance in June 2021,⁴⁰ algorithmic stablecoins have the purported benefit of automated operation and the ability to scale without requiring corresponding reserves.⁴¹ In basic terms, the protocol underpinning an algorithmic stablecoin attempts to operate as a central bank, with “less than one-to-one backing”⁴² by manipulating the number of tokens in “circulation” in response to changes in their value.⁴³

There are a variety of algorithmic stablecoin models, as well as contentions on their exact definition.⁴⁴ They generally look to combine monetary supply with embedded economic incentives to artificially control the price of the stablecoin.⁴⁵ For example, if a stablecoin was trading below \$1, an algorithmic system may offer some other type of digital asset, digital “bond,” “coupon,” or issued “share” for less than \$1, with the new capital used to maintain the

40. See Sinclair, *supra* note 23; see *infra* Part II.

41. See Cheyenne Ligon, *Terra Attracts \$150M for DeFi Ecosystem Fund*, YAHOO! (July 16, 2021), <https://www.yahoo.com/entertainment/terra-attracts-150m-defi-ecosystem-160105012.html>.

42. See Morris, *supra* note 13.

43. See Whelan, *supra* note 12.

44. For a fuller explanation of this process, see Shevchenko, *supra* note 4, who explains:

While these tokens are commonly considered algorithmic stablecoins, the teams involved have their own definitions. For MakerDAO, an algorithmic stablecoin is one that uses total supply manipulations to maintain a peg. The founders of Empty Set Dollar and Neutrino, a Waves-backed stablecoin project, believe Dai is also an algorithmic stablecoin due to its programmatic mint-and-burn mechanics. Ampleforth’s team, on the other hand, rejects the notion that its token is a stablecoin.

In addition to the “two-coin” model described in the body of the Article, there is also a less popular “rebase model” which has shown difficulty retaining its peg due to volatility and market fluctuations. For a discussion of this alternate model, see Liu, *supra* note 4, who explains:

[B]y adjusting token balances in user wallets, rebase stablecoins ensure that holders always retain the same percentage share of the entire market capitalization. Ampleforth (AMPL) is a good example of such a stablecoin, especially since there are no other notable projects using this model. YAM Finance, a DeFi project that was once extremely popular, also recently disabled its rebase feature.

Id.; see also Shevchenko, *supra* note 4 (providing an additional description of the rebase model).

45. See @MakerDAO, *Stablecoins: Collateralization Types*, MEDIUM (Dec. 12, 2018), <https://medium.com/@MakerDAO/stablecoins-collateralization-types-2a860624dcd3>.

peg.⁴⁶ A common algorithmic stablecoin structure is a “two-coin” system, where one coin is used to maintain the peg, and the other is used to “absorb” market volatility.⁴⁷ This latter token is usually called a “share” or “balancer” token,⁴⁸ and often trades on secondary DeFi exchanges like Uniswap.⁴⁹ Two-coin systems are often combined with partial collateralization dynamics,⁵⁰ such as those described in the next Part with Iron Finance’s IRON algorithmic stablecoin.

II. THE IRON FINANCE FAILURE IS A BIG RED FLAG FOR THE PRODUCT CLASS

Iron Finance describes itself exotically as a “multi-chain, decentralized, non-custodial ecosystem of DeFi products, protocols, and use cases.”⁵¹ Their original system was a two-coin structure which attempted to create an algorithmic stablecoin called “IRON.”⁵² IRON was pegged to \$1, without having the actual backing of \$1.⁵³ A reboot—“v2”—was recently announced for an “over-collateralized and soft-pegged” stablecoin.⁵⁴ Prior to its nearly \$2 billion failure, each IRON stablecoin was “minted” through a process that locked 75 percent of its value in collateralized USDC (a fully reserved, fiat-backed stablecoin⁵⁵), and 25 percent of its value through locked-in “TITAN”—Iron Finance’s own, unlimited supply, internal governance token.⁵⁶

TITAN was backed by nothing, and its value was solely determined in the secondary DeFi market.⁵⁷ The original protocol relied on a market-driven “arbitrage” opportunity between the IRON

46. *Id.* (“Essentially, speculators are offered a small portion of future growth in the stablecoin’s market cap in exchange for providing the capital to peg the currency.”); see Koning, *supra* note 4 (“A coupon, in short, can be thought of as a promise to pay even more ESD stablecoins in the future, conditional on locking up one’s ESD stablecoins now, but only if and when the \$1 peg has been restored. The further that the price of ESD stablecoins falls below \$1, the more enticing the system-set conversion rate into coupons gets.”).

47. Redman, *supra* note 15.

48. See Morris, *supra* note 13.

49. UNISWAP, <https://uniswap.org/> (last visited Oct. 14, 2021).

50. See Liu, *supra* note 4.

51. See IRON FINANCE, <https://iron.finance/> (last visited Oct. 14, 2021).

52. See Sinclair, *supra* note 23.

53. See *id.*; Morris, *supra* note 13.

54. See *IRON Stablecoin v2 Design*, IRON FINANCE (Aug. 10, 2021), <https://ironfinance.medium.com/iron-stablecoin-v2-design-44a006b5b8b>.

55. See CIRCLE, *USDC: the Worlds Leading Digital Dollar Stablecoin*, <https://www.circle.com/en/usdc> (last visited Oct. 14, 2021); see also *supra* note 29 and accompanying text.

56. Tan, *supra* note 3.

57. *Id.*

stablecoin and the TITAN governance token.⁵⁸ If IRON lost its peg and traded below \$1, an arbitrageur could purchase it on the secondary market and redeem it for \$1 of combined USDC and TITAN.⁵⁹ Correspondingly, if IRON traded higher than \$1, market actors could mint new IRON by locking in \$1 of combined USDC and TITAN and then sell the new IRON on the market for a profit.⁶⁰ The system also burned the TITAN portion of collateral when IRON was minted, and minted new TITAN when IRON was redeemed.⁶¹ The system and its assumptions failed, however, in catastrophic fashion.⁶²

Iron Finance unraveled when the value of its unlimited supply governance token, TITAN, fell precipitously in the DeFi secondary market.⁶³ Iron Finance reported that there was significant selling by certain “whale” holders.⁶⁴ The market for TITAN was already thin,⁶⁵ and this large-value sale triggered a cascade selloff of TITAN and an IRON redemption “negative feedback loop.”⁶⁶ This caused the IRON token to lose its peg, which in turn “triggered” the algorithmic minting mechanism for TITAN and an arbitrage opportunity in a resulting “death spiral.”⁶⁷

The net impact was a flood of TITAN supply on the secondary market.⁶⁸ At some point, the price of TITAN was basically zero, and Iron Finance halted redemptions of the IRON stablecoin—they only had 75 percent collateralized USDC coverage to begin with.⁶⁹ The moment the price of TITAN destabilized in the secondary trading market, the entire house of cards that was the IRON stablecoin came down, with nothing to backstop the run.⁷⁰

58. See Jakub, *Bank Run in DeFi – Iron Finance Fiasco Explained*, FINEMATICS (June 24, 2021), <https://finematics.com/bank-run-in-defi-iron-finance-explained/>.

59. *Id.*

60. *Id.*

61. See Jakub, *supra* note 58; Tan, *supra* note 3.

62. Jakub, *supra* note 58.

63. See *Iron Finance Post-Mortem*, IRON FINANCE (June 17, 2021), <https://ironfinance.medium.com/iron-finance-post-mortem-17-june-2021-6a4e9ccf23f5>.

64. *Id.*

65. See Tan, *supra* note 3.

66. See IRON FINANCE, *supra* note 63.

67. See Tan, *supra* note 3 (“The speed at which TITAN started to fall caused IRON to lose its peg, allowing traders to redeem IRON which was priced at US\$0.90 as the peg started to slip, for US\$0.75 in stablecoin and US\$0.25 in TITAN.”).

68. See *id.*

69. See IRON FINANCE, *supra* note 63; Tan, *supra* note 3 (“IRON purports to be a stablecoin, receiving its collateral backing from TITAN and users mint new stablecoins through a mechanism on Iron Finance by locking up 25% in TITAN and 75% in USDC, a regulated dollar-backed stablecoin issued by Circle.”).

70. See Tan, *supra* note 3.

The idea has been advanced that algorithmic stablecoins are an early iteration of DeFi fractional reserve banking.⁷¹ Iron Finance—while interpreting the failure of its so-called stablecoin, IRON—called it “the world’s first large-scale crypto bank run” in a “post-mortem” report.⁷² This analogy is significantly flawed, and the Iron Finance operating structure was tremendously fragile from inception.

It sought to create a dollar from seventy-five cents, under the inaccurate assumption that its secondary-traded governance token, TITAN, would not fall below a market-determined price floor. It was designed on the assumption that TITAN itself would remain stable—or even better, that it would increase in price. Banks also create money through fractional reserves and lending.⁷³ Yet banks are backstopped by government depositary insurance—and they pay mightily for it in the form of premium payments and being subject to extensive supervision and examination.⁷⁴

III. THREE LESSONS FROM FINANCIAL MARKET HISTORY

Three lessons from financial market history impact the viability of algorithmic stablecoins. First, any financial product that needs a support, or base level, of demand for the product class as a whole to operate as intended (and assumed) will be prone to failure if demand dries up.⁷⁵ Demand is impossible to predict and impacts the price of all securities.⁷⁶ If a minimum level of demand is necessary for a product to even function, however, this product is inherently fragile.⁷⁷

As identified in prior work, requiring (but not getting) a support level of backstopping demand from major financial institutions was a significant factor underpinning the failure of the auction rate securities market.⁷⁸ Reliance on a base level of support is perhaps the biggest problem with an uncollateralized algorithmic stablecoin two-coin structure.⁷⁹ The volatility absorbing coin must maintain a

71. Morris, *supra* note 13.

72. See IRON FINANCE, *supra* note 63.

73. See *How Is Money Created?*, BANK OF ENG., <https://www.bankofengland.co.uk/knowledgebank/how-is-money-created> (last visited Oct. 14, 2021).

74. See *What We Do*, FED. DEPOSIT INS. CORP., <https://www.fdic.gov/about/what-we-do/index.html> (last updated May 15, 2020).

75. See Tan, *supra* note 3.

76. See *id.*; see also *How Does the Law of Supply and Demand Affect the Stock Market*, INVESTOPEDIA, <https://www.investopedia.com/ask/answers/040215/how-does-law-supply-and-demand-affect-stock-market.asp> (last updated Oct. 5, 2021).

77. See Tan, *supra* note 3 (using the example of the Bank of England’s losing billions of pounds in 1992 to support its currency after it was forced to up interest rates after demand for marks grew as an illustration of this principle).

78. See Ryan Clements, *New Funds, Familiar Fears: Do Exchange Traded Funds Make Markets Less Stable? Part I, Liquidity Illusions*, 20 HOU. BUS. & TAX L.J. 14, 49–51 (2020).

79. See @MakerDAO, *supra* note 45.

certain support level of demand—and not fall below a price threshold—otherwise the entire ecosystem fails.⁸⁰ Non-collateralized tokens that purport to be “stable” require a consistent, if not increasing, level of demand, and once this stops, the peg fails.⁸¹

The second lesson from history that makes algorithmic stablecoins inherently fragile and unstable is that they often rely on independent actors, with market incentives, to perform a price stabilizing arbitrage function.⁸² Arbitrageurs must step in and exploit profit opportunities to maintain price stability through minting or redemption activities.⁸³ The performance of discretionary, price-stabilizing arbitrage is historically fragile in a crisis, and as previously identified in prior work on exchange-traded funds, “market discipline can fail when it is most needed.”⁸⁴

Arbitrageurs stepped back from buying up undervalued assets during the 1987 portfolio insurance failure.⁸⁵ More recently, arbitrageurs stepped back from arbitraging away price dislocations between secondary market prices of fixed-income exchange traded funds (and their underlying net asset values) when the market moved swiftly to price in March 2020 during the fallout of the coronavirus pandemic.⁸⁶

The third lesson from history that casts doubt on the long-term viability of algorithmic stablecoins is that during periods of heightened volatility, panics, or crises, there is widespread informational opacity.⁸⁷ Effectively incorporating price information is a problem that “plagues” many algorithmic stablecoins.⁸⁸ Price “oracles” (external price feeds) cannot always be trusted, and there are “misaligned” incentive problems when token holders vote on which potential price feeds (from a pool of them) to adopt.⁸⁹ Price uncertainty in the TITAN token, as a result of delays in an automated

80. See Redman, *supra* note 15.

81. See @MakerDAO, *supra* note 45.

82. See Koning, *supra* note 4; Liu, *supra* note 4.

83. See Koning, *supra* note 4; Liu, *supra* note 4; Tan, *supra* note 3.

84. Clements, *supra* note 78, at 49.

85. *Id.* at 45–49.

86. See Ryan Clements, *Exchange-Traded Confusion: How Industry Practices Undermine Product Comparisons in Exchange Traded Funds*, 15 VA. L. & BUS. REV. 125, 136–138 (2021).

87. See Ryan Clements, *New Funds, Familiar Fears: Are Exchange Traded Funds Making Markets Less Stable? Part II – Interaction Risks*, 21 HOU. BUS. & TAX L.J. 1, 7–11 (2020).

88. See Moin & Sekniqi, *supra* note 20.

89. *Id.* (“Suppose the price of the currency is trading above \$1. Participants could dutifully report the truth, and trigger the mechanism that dilutes the coin to reduce its price. But this would result in a net loss for them. Instead, they have an incentive to report a price that is lower than the truth, so there is less of the currency put into circulation. It is in the best interest of the participants to falsely claim that the price is still \$1, or even lower.”)

“oracle” information feed, contributed to Iron Finance’s June 2021 failure.⁹⁰

When information is uncertain, cascades and investor herds form, and perceived unsafe assets are quickly sold off in fire sales—a phenomenon evident in the 2008 global financial crisis, even for certain financial assets like commercial paper and money market mutual funds that were perceived as stable before the crisis.⁹¹ Informational opacity also affects the ability of market participants to perform price-stabilizing arbitrage, as was the case with the failure of portfolio insurance in 1987.⁹²

IV. STABLECOINS AS STANDING DOMINOS IN BUDDING ALGORITHMIC ECOSYSTEMS

Perhaps the most popular algorithmic stablecoin platform right now is Terra.⁹³ The creator of Terra, Terraform Labs, has received significant recent venture capital backing and investor interest as a “stablecoin for e-commerce creator.”⁹⁴ Terra mints U.S. dollar- and Korean won-pegged algorithmic stablecoins (among others), using a governance balancing token (known as LUNA), with built-in monetary supply and economic incentives including fees and arbitrage opportunities.⁹⁵

90. See Jakub, *supra* note 58 (“Because of the extremely quick and sharp drop in the TITAN price, the time-weighted price oracle used for reporting TITAN prices started reporting stale prices that were still higher than the actual market price of TITAN. This created a negative feedback loop as the price oracle was used to determine the number of TITAN tokens that have to be printed while redeeming IRON.”).

91. See Clements, *supra* note 87, at 7–11.

92. Clements, *supra* note 78, at 49–51; Mark Carlson, *A Brief History of the 1987 Stock Market Crash with a Discussion of the Federal Reserve Response* 11, 17 (Fed. Rsv. Bd., Working Paper No. 2007-13, 2006); Floyd Norris, *A Computer Lesson Still Unlearned*, N.Y. TIMES (Oct. 18, 2012), <https://www.nytimes.com/2012/10/19/business/a-computer-lesson-from-1987-still-unlearned-by-wall-street.html>.

93. See Benjamin Hor, *Unearthing the Biggest Algorithmic Stablecoin: UST by Terra*, COINGECKO (June 10, 2021), <https://www.coingecko.com/buzz/unearthing-the-biggest-algorithmic-stablecoin-ust-by-terra>.

94. See Brady Dale, *Galaxy, Coinbase Bet \$25M on DeFi Using Terra Stablecoins*, COINDESK, <https://www.coindesk.com/business/2021/01/26/galaxy-coinbase-bet-25m-on-defi-using-terra-stablecoins/> (last updated Sept. 14, 2021, 7:01 AM); see also Ligon, *supra* note 41.

95. Terra incentivizes the long-term holding of LUNA through applications on its decentralized ecosystem. See Jonathan Vanian, *What Is Terra? Your Guide to the Hot Cryptocurrency*, FORTUNE (July 16, 2021, 12:00 PM), <https://fortune.com/2021/07/16/what-is-terra-cryptocurrency-crypto-guide-stablecoin-luna/> (“Each time someone buys something—like an ice cream—using UST, that transaction generates a fee, similar to a credit card transaction. That fee is then distributed to people who own L[UNA] tokens, similar to a stock dividend.”). The Terra protocol also creates arbitrage opportunities to purchase

These stablecoins are then used as payment mechanisms in an ever-expanding Terraform Labs financial “ecosystem,” which also includes a protocol (“Mirror”) to create synthesized assets that track the performance of U.S. stocks, futures, and exchange-traded funds;⁹⁶ a lending and savings platform (“Anchor”);⁹⁷ and a partner payments platform (“Chai”).⁹⁸ Terra also has anticipated plans to add DeFi asset management, additional lending protocols, and decentralized levered insurance protocol to this budding ecosystem.⁹⁹

Terra stablecoins are the “centerpiece” that interconnect a burgeoning financial “infrastructure” that includes the aforementioned e-commerce payments, synthetic stocks, exchange-traded funds, derivatives, and other financial assets, savings, borrowing, and lending applications.¹⁰⁰ The operation of Terra, as a protocol, incentivizes independent traders to purchase its stablecoins in exchange for LUNA if a stablecoin drops below its peg.¹⁰¹ The stability of Terra stablecoins transcends DeFi speculation. Given their many applications within its “Terra economy,” these algorithmic stablecoins also directly impacts the economic prospects of a host of businesses and consumers.¹⁰²

In order for this ecosystem to be continually viable, there must be a perpetual baseline level of demand in the Terra stablecoins and also the governance token, LUNA.¹⁰³ In other words, there must be sufficient arbitrage activity between the two tokens,¹⁰⁴ as well as sufficient transactional fees in the Terra ecosystem and mining demand in the network.¹⁰⁵ The founders of Terra have asserted that mainstream adoption of their stablecoins as transactional currencies,

the LUNA token as a price stabilizing measure for the terra stablecoins whenever it loses its peg. See Hor, *supra* note 93 (“This system offers arbitrage opportunities whenever a Terra stablecoin is trading off the peg; arbitrageurs are thus incentivized to ensure the price returns to its peg. LUNA’s burning mechanism further complements this—a portion of LUNA is burned during expansion and algorithmically adjusted until UST is restored to \$1. In other words, the price volatility of Terra stablecoins are effectively transferred onto LUNA’s fluctuating supply.”); see Walters, *supra* note 12.

96. See *Terra Launches Mirror Protocol, the First Synthetic Asset Protocol That Can Grant Global Access to \$36.3 Trillion-Dollar US Equities Market*, YAHOO! FINANCE (Dec. 3, 2020), <https://finance.yahoo.com/news/terra-launches-mirror-protocol-first-200000652.html>.

97. See Shen, *supra* note 39.

98. See Danny Nelson, ‘Clicks and Bricks’ Strategy to Drive Korean Users to Terra’s Blockchain, COINDESK, <https://old.coindesk.com/clicks-and-bricks-strategy-to-drive-korean-users-to-terras-blockchain> (last updated Oct. 30, 2019, 11:26 AM).

99. See Hor, *supra* note 93.

100. Dale, *supra* note 94.

101. Ligon, *supra* note 41.

102. See Vanian, *supra* note 95; Walters, *supra* note 12.

103. See Walters, *supra* note 12.

104. See Hor, *supra* note 93.

105. See Walters, *supra* note 12.

and the ability to “stake” them and earn rewards, creates “network effects” and long-term incentives to hold and maintain the ecosystem.¹⁰⁶

Thus, Terra is betting that use on their “network” of financial applications that utilize the stablecoins (and LUNA) will drive perpetual demand.¹⁰⁷ This assumption is not certain,¹⁰⁸ and Terra stablecoins have deviated from their peg in the past.¹⁰⁹ In many ways, a developing DeFi financial ecosystem that is backed by an algorithmic stablecoin with no real collateral or government guarantee, but instead relying on perpetual interest of individually motivated market actors for sustainability, looks like standing dominos—once the first falls, all of the others could be affected.

CONCLUSION

Despite the “quest” for a conceptual model of sustainable price stability,¹¹⁰ algorithmic stablecoins have shown an utter lack of stability to date, and are thus unsuitable as a money substitute.¹¹¹ Unlike their collateralized cousins, algorithmic stablecoin varieties seem “destined to fail.”¹¹² Financial writer J.P. Koning has argued that they are “prone to permanent breakage” because of their fragile reliance on a “circular relationship” between divergent actors—those who crave “stability” on the one hand and those who alternatively seek “high-return opportunities.”¹¹³ Algorithmic stablecoins are unlikely to serve any true long-term, consumer welfare-enhancing, or financial inclusionary function other than short-term DeFi speculation,¹¹⁴ which yields very little inclusionary or system-wide benefits. As others have noted, their “instability threatens their usefulness.”¹¹⁵

Like other stablecoin varieties, the algorithmic form currently lacks transparency, prudential safeguards, and supervisory

106. *Id.*; see Dale, *supra* note 94.

107. See Hor, *supra* note 93.

108. *Id.*

109. See Dale, *supra* note 2.

110. *Id.*

111. Interestingly, some of the issuers of these so-called “stablecoins” have openly admitted that they are “unstable” and prone to volatility. See Shevchenko, *supra* note 4 (“In a conversation with Cointelegraph, Manny Rincon-Cruz, advisor to Ampleforth and co-author of its whitepaper, fully accepted the fact that Ampleforth is unstable: ‘Ampleforth holders can experience gains and losses much in the same way that Bitcoin or Ethereum holders can. Thus, it is a speculative investment asset where the probability of gain and the probability of loss are both greater than zero.’”).

112. See Koning, *supra* note 4.

113. *Id.*

114. See Shevchenko, *supra* note 5.

115. UC Hope, *Algorithmic Stablecoins’ Instability Threatens Their Usefulness*, CRYPTOPOLITAN (Feb. 18, 2021), <https://www.cryptopolitan.com/algorithmic-stablecoins-instability/>.

oversight. As this Article identifies, they are also built on a fragile foundation of relying on uncertain historical variables: they need a support level of baseline demand, they need participation of willing arbitrageurs, and they need an environment of informational efficiency.¹¹⁶ None of these factors are certain, and all of them have proven to be highly tenuous in the context of financial crises or periods of extreme volatility.¹¹⁷ History reveals they are likely prone to instability and failure,¹¹⁸ and they should be regulated to provide full transparency, with enhanced consumer protection and risk containment measures, so that they do not interconnect the larger financial system.

Current U.S. financial regulation around stablecoins is fragmented, inefficient, and in many cases, overlapping.¹¹⁹ Clarity around the scope of the “regulatory perimeter” for stablecoins has yet to be settled.¹²⁰ They are subject to federal Financial Crimes Enforcement Network (“FinCEN”) oversight as well as state money transmission and virtual currency licensing.¹²¹ They also give rise to “bank like risks”—particularly shadow deposits like money market mutual funds, and their monetary policy implications implicate the Federal Reserve.¹²² Their systemic risk considerations harken the Treasury-led Financial Stability Oversight Counsel with support from the President’s Working Group on Financial Markets.¹²³ They also have potential jurisdictional implications for the Consumer Financial Protection Bureau (“CFPB”),¹²⁴ the Office of the Comptroller of the Currency (“OCC”), the Commodity Futures

116. *See supra* Part III.

117. *Id.*

118. *Id.*

119. *See* SUSAN GAULT-BROWN & ADAM FLEISHER, STABLECOIN REGULATION IN THE UNITED STATES 3 (2020), <https://www.legal500.com/guides/hot-topic/stablecoin-regulation-in-the-united-states/?export-pdf>.

120. Howell E. Jackson & Morgan Ricks, *Locating Stablecoins within the Regulatory Perimeter*, HARVARD L. SCH. F. ON CORP. GOVERNANCE (Aug. 5, 2021), <https://corpgov.law.harvard.edu/2021/08/05/locating-stablecoins-within-the-regulatory-perimeter/>.

121. GAULT-BROWN & FLEISHER, *supra* note 119, at 3.

122. Financial Times Editorial Board, *Stablecoins Come with Bank-Like Risks*, FIN. TIMES (July 25, 2021), <https://www.ft.com/content/096b9080-cbcc-413d-8053-3d9964db8c5e>.

123. *See* Robert Schmidt & Benjamin Bain, *New SEC Boss Wants More Crypto Oversight To Protect Investors*, BLOOMBERG (Aug. 3, 2021), <https://www.bloomberg.com/news/articles/2021-08-03/will-government-regulate-crypto-sec-chair-gary-gensler-on-bitcoin-and-oversight>.

124. Kate Berry, *Complaints About Crypto Are Soaring. Is CFPB Crackdown Imminent?*, AM. BANKER (Aug. 6, 2021, 12:34 PM), <https://www.americanbanker.com/news/complaints-about-crypto-are-soaring-is-a-cfpb-crackdown-imminent>.

Trading Commission (“CFTC”), and the Security and Exchange Commission (“SEC”).¹²⁵

There is a need for an integrated approach to regulating stablecoins that transcends agency divides. Ideally, a regulatory framework for all stablecoins will include issuer registration requirements, prudential measures, collateral custodial safeguards, and reporting transparency, a defined taxonomy clarifying stablecoin forms (and distinguishing algorithmic varieties from other types), and risk disclosure and containment measures.¹²⁶

Such a framework may require what newly appointed SEC Chair Gary Gensler has described as “plenary authority” for a particular agency over crypto-trading,¹²⁷ albeit, adapted and applied for stablecoins. Some fully collateralized stablecoins may have financial inclusionary benefits such as faster and cheaper global remittance, real-time payments, application in fiscal stimulus efforts, and the ability to serve as a transaction proxy for thin credit files and the underbanked.¹²⁸ Thus, an innovation-supportive regulatory framework, which still creates transparency, risk containment, and consumer protection safeguards, is warranted.¹²⁹

125. GAULT-BROWN & FLEISHER, *supra* note 119, at 3.

126. *See generally* De Meijer, *supra* note 4 (explaining the regulatory gaps that currently plague the stablecoin market).

127. *See* Gary Gensler, *Remarks Before the Aspen Security Forum*, U.S. SEC (Aug. 3, 2021), <https://www.sec.gov/news/public-statement/gensler-aspen-security-forum-2021-08-03>.

128. *See* Thomason, *supra* note 38.

129. *See* Michael J. Casey, *Money Reimagined: Regulate Stablecoins, Don't Smother Them*, COINDESK, <https://www.coindesk.com/money-reimagined-regulating-stablecoins> (last updated Sept. 14, 2021, 9:30 AM).