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Mechanisms and Challenges of Price Stability in Stablecoins: A Systematic Literature Review

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Abstract

Stablecoin price stability is inherently linked to the underlying operations of crypto asset trading, decentralized finance, and cross-border payments as a bridge between fiat currencies and crypto assets. Nevertheless, the failure of TerraUSD in 2022 and its cascades of depegging episodes suggest that price stability is not a property of stablecoins by default, and the internal connection between the processes of stability achievement and the processes of instability is not yet systematically analyzed. Literature exists along two lines- mechanism design and risk problems but it is comparatively disjoint. Mechanism design literature addresses institutional structure and does not explain well what happens to particular mechanisms during a shock, whereas risk research literature addresses crisis description without comparing differences across mechanisms systematically. With stablecoin price stability as its theme, this paper will perform a systematic literature review. The starting point is the typology that explains the operational logic behind four stabilization mechanism types: fiat-collateralized, basket-collateralized, crypto-asset-collateralized, and algorithmic. By using both theoretical explanations and common examples of depegging, it discloses the failure pathways and the causes behind reserve trust crises, price manipulation and systemic risk contagion. Through the comparison of various mechanisms and challenges, it can infer the policy implications with respect to the regulation of reserves, the warning of early depegging, and cross-border cooperation. This paper brings mechanism design and risk issues together in a single analytical framework to correct the weakness of the current literature that has concentrated on one dimension, and establishes a literature base enabling regulators to understand the chain of transmission of stablecoin risks and develop differentiated regulatory instruments.

Keywords

stablecoins, price stability, stabilization mechanisms, depegging risk, regulatory framework

1. Introduction

The main value of stablecoins as a critical link between fiat currencies and crypto assets is their ability to retain 1:1 price stability in relation to the anchored asset. The stablecoin market has been growing since the introduction of USDT in 2014, and has been integrated into various aspects of life including crypto asset trading, decentralized finance (DeFi), cross-border payments and others acting as a stabilizing mechanism in the crypto ecosystem. Nevertheless, the failure of TerraUSD (UST) in 2022 and its later waves of short depegging episodes of stablecoins suggest that price stability is not a natural property of stablecoins but is determined by their structure and regulation. Can price stability be obtained? How it can be obtained and why

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it keeps failing are now central concerns of shared interest in monetary economics studies, financial regulation studies, and crypto finance research.

In connection with the problem of stablecoin price stability, the available literature can be roughly divided into two streams. The first stream deals with the manner through which price stability is attained that is, the mechanism design and the typological analysis of stablecoins. According to the BIS, stablecoins may be defined as crypto assets backed by fiat currency or other assets and designed to maintain value stability. [1] notes that the emergence of such assets is a fundamental example of the use of distributed ledger technology within the monetary and payments sectors. The IMF divides stablecoins into two categories: electronic money type and investment token type depending on the origin of value on the liability side. The electronic money type is fully reserved and has low volatility; the investment token type is volatile depending on underlying assets and has investment features. The two have fundamental differences in their stability foundations [2].

The internal logic of the different stabilization mechanisms is different depending on related studies. Full reserve-backed stablecoins are based on high-quality liquid assets as redemption guarantees, and their credibility depends on reserve transparency and the governance structure [3]. Basket-collateralized stablecoins spread the risk of one currency across a multi-currency portfolio, which has a global demand influence due to the supply of reserve currencies and changes in exchange rates [4]. The crypto-asset-collateralized stablecoins depend on overcollateralization and forced liquidation. The algorithmic stablecoins utilize seigniorage-based arbitrage and elastic supply mechanisms, and they are very sensitive to the self-fulfillment of market expectations [5].

The second thread deals with the reasons why the concept of price stability does not work, i.e., the difficulties of stablecoins and their underlying causes. [6] Tests on popular stablecoins demonstrate that in extreme market conditions, most stablecoins experience heavy depegging and their stability is systematically overestimated in empirical terms. [7] reviewed 68 stablecoins and determined that the ability of each sample to maintain parity with the underlying asset, or the ability of issuers to redeem them fully at any given time, is not guaranteed. Concerning the theoretical basis, [8] referring to the historical experience of the U.S. Free Banking Era states that private money has a natural trust problem of being accepted at par without reason, and is extremely vulnerable to runs. [9] highlights that the lack of sensitivity of the debt contract to information is a promise of the stability of the money market. After negative information shocks happen to the reserve information, sensitive information-based private money like stablecoins will quickly initiate runs and death spirals. Empirically speaking, [10] has employed blockchain data analysis to establish that the release of USDT in the bull market in 2017 was strongly correlated with the increase in Bitcoin prices, indicating the possibility of inadequate reserves and manipulation of prices in some stablecoins; [5] presents the micro-level analysis of the two crashes of Iron Finance and TerraUSD which directly shows the entire sequence of bank-style runs in algorithmic stablecoins during confidence deterioration and indicates that retail investors suffered disproportionately.

When examining the available literature in general, the two kinds of research are more fragmented but focus on different issues: the mechanism design literature focuses on the institutional arrangements at the normative level, but fails to explain the path of failure of particular mechanisms to shocks; the risk research literature focuses on the characterization of crises at the positive level but does not systematize the comparison of mechanism differences. The natural connection between the mechanism logic of stablecoin price stability and the underlying reasons of the issues has not been completely systematically reviewed. This is why this paper performs a systematic literature review of the topic related to stablecoin price stability mechanisms and challenges, namely three objectives are achieved: firstly, overviewing the mechanisms of the realization of the stablecoin price stability, and elucidating the operation logic of the different stabilization mechanisms beginning with typology; secondly, exploring the issues that have been encountered by the stablecoin price stability, and exposing their failure paths and underlying causes through both theoretical analysis and examples of typical depegging; thirdly, extracting regulatory implications based on contrary mechanisms and challenges, which may serve as a reference in improving the regulation of stablecoins.

The marginal contributions of this paper can be observed through two features. Theoretically, this paper integrates mechanism design and risk challenges within one analytical model, which gives an overall picture of the process of stablecoins' stability and the way they approach failure, thus addressing the shortcomings of the current literature that does not address only one dimension. In practice, the review presented in this paper

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offers a literature foundation for regulators to comprehend the transmission channel of stablecoin risks and create different regulatory instruments, as well as offer a reference point for market users to learn the limits of vulnerabilities of stablecoins.

2. Pricing and Development of Stablecoins

2.1 Definition and Pricing Basis of Stablecoins

The current literature mostly describes stablecoins under two viewpoints, namely the reserve side, and the liability side, and builds several classification systems on this basis. [2] separates them on the basis of the source of the value on the liability side. [11] divides stablecoins by reserve type into four types (tokenized funds, off-chain asset collateral, on-chain asset collateral, and algorithmic) and notes that the quality of reserves and the right of redemption are two important factors to evaluate stability properties. [12] does not use one dimension anymore but divides stablecoins into three combinable design elements, such as collateral, stabilization mechanism, and governance. [13] studies 24 stablecoin projects and uses stabilisation devices in the context of monetary policy literature to create an interdisciplinary classification system. They note that more than 91 percent of projects promise to provide 1:1 anchoring to external assets, but monetary policy literature states that smoothing short-term fluctuations tends to be a more sustainable objective; another 38 percent of projects use exchange rate targets and stabilisation technology packages that make them vulnerable to speculative attack. [14] offers a functional classification depending on risk, with current economic models and computer science models mapped to different custody frameworks. All these works indicate the same inference: stability is not a natural property of stablecoins but a consequence of a combination of design decisions. The importance of classification schemes stems from the breakdown of stability issues into parts that can be tested individually, which allows for further comparison of the four types of mechanisms.

One-price principle and arbitrage constraint form the basis of pricing stablecoins. [15] notes that three designs (reserve composition, stabilization mechanism, and legal claim rights) jointly define the stable price range, with legal claim rights defining whether or not there is a chance of getting the repayment in case of extreme situations. [16] compares the question of why stablecoins are stable with the question of why fixed exchange rates can be sustained, and addresses it with tools of exchange rate economics. By analyzing directional transaction data and order book data of several exchanges, they conclude that issuance by issuers-the instrument most similar to central bank intervention-contributes little to stability and anchoring is mostly preserved by demand-side arbitrage forces. Following the integration of USDT into the Ethereum platform in 2019, more opportunities were provided to investors to engage in arbitrage and the spread of arbitrage shrank down to 70 basis points to 30 basis points. Sources of deviation on either side are also identified: premiums arise due to the safe-haven functionality of stablecoins, whose premiums used to be over 100 basis points in the course of the market stress period in March 2020; discounts are caused by liquidity effects and doubt about collateral. [17] provides another dimension: there are few institutional arbitrageurs who control the redemption channels in the primary market. This type of centralization of arbitrage reduces the size of deviations under normal conditions but increases them during periods of stress. It is evident that the stablecoin price is not dictated directly by the issuer anchoring commitment, but rather relies upon the costs of arbitrage and capital constraints of arbitrageurs.

Theoretical pricing frameworks disagree on whether reserves have to be full. [18] provides a unified theoretical structure of stable assets and demonstrates that when there is inadequate collateral, the incentives of the issuer and the anchoring promise would be contradictory. Mechanisms of algorithmic support can be maintained within the model but are much more vulnerable compared to full collateralization. [19] comes up with another conclusion: they demonstrate that using smart contracts, a redemption policy with reserves less than 100 and dynamic changes in response to demand may remove speculative attacks. [20] develops a stochastic model of non-custodial stablecoins to show that their stability is limited by collateral ratio and liquidation threshold, and that when the price of collateral drops sharply, it starts a deleveraging process. [21] sees the issuance of stablecoins as a form of money creation as an internal process of crypto asset demand, which is procyclical and therefore shadow banking in the crypto sphere. [22] judges from the perspective of private money history that whether stablecoins can be universally accepted depends on whether unconditional redemption trust similar to banknotes and positive network externalities can be established. The differentiation between these models is based on the reserve level, whereas the agreement is based on credibility: the range

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of the anchoring interval is set both by the credibility of the commitment of the issuer and the volatility of the collateral.

2.2 The Practical Evolution of Foreign Stablecoins and Changes in Research Focus

Initial implementations of stablecoins focused on the off-chain fiat reserve model, approximately between 2014 and 2018. USDT was introduced in 2014 with off-chain US dollar reserves, but it took a long time before the makeup of the reserve could be revealed. In 2017, DAI was introduced by MakerDAO using overcollateralization with on-chain crypto assets, enabling the validation of reserve status directly on-chain. Issuance schemes based on regulated trust companies as vehicles started to be implemented around 2018, trying to substitute self-declarations of issuers with external audits and licenses. The study in this phase was mostly descriptive and classificatory; the above taxonomic literature is an exact compilation of early practice. At the time, there had been only limited availability of price series data, and so statistical tests based on anchoring deviations had not been widely used.

The years 2019-2021 were a period of simultaneous scaling and regulation. The suggestions of stablecoins by big platform companies led international organisations to consider the dangers in an organized manner. A final report on the regulation and monitoring of global stablecoin systems was published in [23], which included ten high-level recommendations, as well as three priorities - reserve management, redemption rights, and cross-border coordination. Decentralized finance growth saw stablecoins become both major trading pairs and major collateral assets, and price effects became an area of focus. [24] analyzed 565 issuance events of seven stablecoins and discovered that issuance announcement had a short-term positive impact on mainstream crypto asset returns. The diversification and safe-haven properties of stablecoins were investigated by [25] and [26], which suggested that these two properties were valid only at certain times and with particular coins. [27] reported that stablecoins have inverse relationship with Bitcoin and positive correlation with other tokens, and their primary purpose is money and short term safe haven asset.

As of 2022, the topics in research were directed towards stability testing and survival analysis. In May 2022, UST and LUNA dropped their peg in just a few days, and [5] has characterized their run chain using micro data. On 23 March 2023, USDC temporarily depegged as some of its reserves were kept in an unreliable bank, which suggests that the custody link of off-chain reserves is also one of the sources of risks. [28] separates the concept of absolute stability and relative stability and concludes that most stablecoins experience continuous divergences compared to the US dollar. [29] tests five popular stablecoins using hourly frequency data and determines that there is strong persistence of deviations in all of them. Starting with market microstructure, [30] finds that cash-collateralized types are indeed more stable, but the overall failure rate is comparable to that of types not intended to be stable; USDT, USDC, and DAI represent the highest shares on Ethereum, and the average circulation velocity is nearly three times that of M1; four of the top ten tokens have concentration indicators above those of the US banking sector. The findings can be reconciled with the findings of Grobys et al. (2021) and Kosse et al. (2023) that the empirical stability of stablecoins is systematically overestimated.

The most important jurisdictions have since 2023 incorporated reserve and redemption restrictions in legislation, and research attention has been directed towards the impact of regulations. The Markets in Crypto-Assets Regulation, Regulation (EU) 2023/1114, EU [31] came into effect in June 2023, although the asset-referenced token and e-money token provisions only became effective on June 30, 2024. In 2022, Japan revised its Funds Settlement Act, which becomes effective on June 1, 2023, and places stablecoins under the category of electronic payment instruments and restricts the list of persons who can issue them. On July 18, 2025, the United States signed the Guiding and Establishing National Innovation of U.S. Stablecoins Act [32], which requires issuers to hold 100 percent quality liquid asset reserves, separate custody, and redeem at par. Hong Kong, China has had its Stablecoins Ordinance [33] in effect since August 1, 2025, which requires fiat stablecoin issuance to be placed under licensing management and demands that reserve assets be not less than 100 percent of the circulating par value and redeemable at any time. All these rules have the same direction, which is to convert reserve adequacy and redemption rights as a market commitment into statutory obligations. This also leads to new research problems, such as how varying levels of regulation intensity influence issuance activity and market architecture.

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2.3 Domestic Policy Environment and Research Progress

The regulations of Mainland China on virtual currency-related businesses are very stringent, and this policy environment strongly impacts the nature of the issues in the domestic research. On December 2013, the People's Bank of China with five other departments released the Notice on Prevention of Bitcoin Risks [34], which made it clear that Bitcoin is not a monetary value and cannot be traded in the market as a currency. On September 2017, the People s Bank of China and seven other departments released the Announcement on Stopping the Activities of Token Issuance Financing and Related Exchange Business [35], which stopped various types of token issuance financing activities and related exchange businesses. On September 2021, the People s Bank of China and ten other departments released the Notice on Further Prevention and Control of the Risk of Virtual Currency Transactions and Speculations [36], confirming that the business activity related to virtual currencies was an illegal financial activity and that foreign trading platforms that provided services to residents of China were also illegal. Alongside the restrictive actions goes the development of the digital renminbi. It was reported in the white paper of the People s Bank of China [37] that the digital renminbi, like cash, is issued by the central bank, and is a cash-like payment mechanism, i.e. M0, is legal tender, and is fundamentally different than crypto assets. In this setting, the domestic research is less often considered to be a direct object of market pricing of stablecoins but rather considers their influence on monetary sovereignty, the payment system, and financial stability.

The initial thread of domestic literature covers institutional positions and macroeconomic consequences. [38] has previously examined the classification and stabilization schemes of digital stable tokens and remarked that they rely on the mechanisms of reserves and redemptions, and addressed the implications of the central bank payment and settlement systems. [39] separates digital currency into private digital currency and a central bank digital currency, systematically examines the possible consequences of stablecoins, including the effect of central banco digital currencies on financial intermediation, welfare, privacy and financial stability, and mentions that reserve transparency and compliance risks are the focus of controversy. [40] presents the view of the sphere of money circulation, considering it in three aspects: space, institution, and function, how US dollar stablecoins introduce US dollar credit to on-chain pricing and settlement, and what influence they have on the international monetary system. [41] gives a scale assessment in a report, stating that the market value of stablecoins is about USD 266.5 billion, or around 7 percent of the overall market value of crypto assets, and the daily trading volume is about USD 169.5 billion. This strand of literature is primarily concerned with substitution effects and cross-border transmission, with a shorter discussion of the pricing mechanism.

The legal features and regulatory structures are the topic of discussion in the second strand. [42] states that although stablecoins are less volatile in terms of prices, they are more prone to credit risk and trust risk, and that off-chain collateralized and algorithmic variants cannot be directly subjected to the conventional licensing and information disclosure mechanisms. [43] goes on to note that stablecoin-related payment arrangements are systematically important financial infrastructure, and supports the idea of governance using reserve requirements, node management, and filing of issuances. [44] suggests a method that involves both functional regulation and look-through regulation, where payment-type stablecoins should be integrated into the current regulatory framework using an analogy with non-bank payment enterprises. Institutional identification and tool adaptation is the contribution made by this strand of literature, where it starts analyzing legal relationships instead of the price formation process.

Domestic literature combined with foreign literature shows that research labor division is relatively distinct. Foreign literature has gathered more on the subject of arbitrage pricing, collateral pricing, and empirical tests of anchoring deviations but pays less attention to variance in redemption rights and reserve regulations across jurisdictions. Domestic literature has gathered more on institutional characterization and macroeconomic effects but uses less on-chain high-frequency data to examine the size and duration of anchoring deviations. The overlap between them is poor. The given trend suggests that there is still room to conduct a comparative analysis that puts the mechanism design and failure routes into the same category. Two subsequent chapters follow this direction: Chapter 3 discusses the process logic of all four stabilization mechanisms, and Chapter 4 discusses the mechanisms and the underlying reasons behind the failure of price stability.

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3. Typology and Mechanism Design of Stablecoin Price Stability

3.1 Fiat-Collateralized and Basket-Collateralized: Reserve Anchoring Mechanisms

The value anchor of basket-collateralized stablecoins is multi-currency portfolios, and the design rationale is theoretically homologous to the development of effective exchange rate indices and stable currency baskets. The concept of a stable aggregate currency, which constructs a minimum-variance currency basket using an equal-weighted geometric mean, is proposed by [45]; it is stated by [46] that this basket can be effectively treated as an equal-weighted geometric mean effective exchange rate index, and its mathematical construction is formally equivalent to the trade-weighted effective exchange rate indices specified by [47] and [48]. Nevertheless, the criticism of [46] shows that despite the fact that a basket formed through an equal-weighted geometric mean has extremely low variance and correlation in-sample, its economic significance is unclear since equal weighting does not have any economic foundations that would reflect the trade significance of every country. Likewise, when a basket-collateralized stablecoin uses equal weights or a simple geometric mean to determine the proportions of each currency, there is also the issue of the explanatory power of the anchoring logic economics. It implies that basket-collateralized stablecoins have a loose association with stable aggregate currencies in the economic rationalization of weights.

Fiat-collateralized stablecoins are based on one fiat currency as an anchor, and their stabilization mechanism is similar to the fixed exchange rate anchoring in a parallel currency framework rather than to the basket strategy. [49] presents a model of currency competition with a floating exchange rate showing how the freedom of exchange rates restrains the inflationary motives of the currency issuers; [50] and [51] suggest exit and voice mechanisms to lower inflation in the context of currency competition; [52] investigates the relationship between currency competition, inflation, and Gresham's Law. It is shown in the model of [49] that even a parallel currency system can restrict excessive money issuance by the issuer in the case of floating exchange rates by applying market selection mechanisms. Nevertheless, fiat-collateralized stablecoins lack this market discipline since their anchoring is directional: the stablecoin issuer will exchange at a fixed ratio with fiat currency without reaching self-control via market floating of exchange rates. This implies that the stability of fiat-collateralized stablecoins entirely depends on whether the issuer has sufficient reserves and whether the redemption promise can be trusted. Thus, fiat-collateralized stablecoins have a higher similarity to a fixed exchange rate system in a parallel currency structure than to the competitive equilibrium with floating exchange rates.

Regardless of the type of mechanism (basket-type or single-fiat-anchored), the great in-sample performance of reserve anchoring mechanisms cannot be automatically extended to out-of-sample robustness; it is an empirical weakness shared by both types of mechanisms. [46] reproduces the constant aggregate currency of [45] and shows that the out-of-sample correlations increase substantially, and the in-sample optimized weights are no longer low-correlated out-of-sample; [53] notes that variance and covariance estimates calculated using level values have spurious correlation difficulties due to the non-stationarity of nominal exchange rates. [46] continues to implement the construction approach of the stable aggregate currency into stock price data, revealing that even though the standardized value indicator has a very low volatility, the portfolio value measured in US dollars is unstable. The result is directly alarming to basket-collateralized stablecoins: a stable basket of currencies created with a geometric or equal-weight average may seem stable statistically, but does not necessarily ensure real purchasing power. Fiat-collateralized stablecoins suffer the same issue: the stability of book value of reserve assets is not the same as the stability of real value at redemption. Both types of reserve anchoring mechanisms have a shared weakness, i.e., their stability indicators are determined more by the construction procedure than by the economic reality and the out-of-sample behavior can be quite different than in-sample behavior.

3.2 Crypto-Asset-Collateralized and Algorithmic: On-Chain Stabilization Mechanisms

Crypto-asset-collateralized stablecoins depend on overcollateralization and forced liquidation schemes to ensure a peg, and they operate in a structurally similar environment to the existence of two competing fiat currencies in a parallel currency scheme. [54] describes the impact of network externalities and switching costs in currency competition on multi-currency equilibria; [55] develops a search model to determine the circumstances of successful issuance of a new fiat currency in a parallel currency situation; [56] applies an adaptive learning model to show how network effects play a critical part in the predominance of government-

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backed fiat currencies. According to the model of [54], a single-currency equilibrium is socially optimal in most cases when there are large switching costs and network externalities. This result has two consequences concerning crypto-asset-collateralized stablecoins: first, to compete with fiat currencies, they have to overcome the switching costs of users and the network effects of existing currencies; second, if they exist alongside fiat currencies as parallel currencies, their market share is determined by the liquidity of collateral assets and the expectations of the users about the stability of the coins. Crypto-asset-collateralized stablecoins' position in a parallel currency scheme will depend on whether they are able to create sustainable market demand within the confines of switching costs and network effects.

Algorithmic stablecoins have elastic supply rules to keep their peg, and by design, their logic is theoretically connected to the discussion of Gresham's Law and reverse Gresham's Law in the literature on currency competition. [57] reinterprets Gresha's Law, differentiating between currency expulsion mechanisms in the case of overvaluation and undervaluation of legal exchange rates, and notes that the law applies only at fixed exchange rates and when the government compulsorily overvalues a particular currency; in the absence of fixed exchange rates, inferior currency will be expelled by the market. [58] discusses the abuse of Gresham's Law in monetary history. [52] examines the dynamic process by which inflationary currency is forced out of the market due to currency competition. Reverse Gresha's Law is an implicit part of the design of an algorithmic stablecoin. Should algorithmic rules lead to a persistent deviation of values from the peg, the market will expel it using arbitrage mechanisms. The model of [49] indicates that in a very turbulent macroeconomic environment, even with floating exchange rates, too much expansion by the issuer can still lead to rapid elimination of the currency in the market. In other words, in the case of irrational expectations or severe shocks, the elastic supply mechanism of algorithmic stablecoins may also break down. The overall supply-demand adjustment mechanism of algorithmic stablecoins theoretically follows reversed Gresham's law, but its practical effectiveness depends on the stability of market expectations and the level of macroeconomic instability.

All crypto-asset-collateralized and algorithmic stablecoins are privately issued substitutes of currency, and their credibility issues are directly connected to the discussion in the literature on currency competition about whether private money can attain price stability. [59] suggests the idea of the denationalization of money, which states that through market selection, poor-quality currencies can be removed by competition between private currencies to get to lower inflation. [60] disagrees with this view, stating that private money does not have institutional assurances of price stability. Following this discrepancy, [61] and [62] elaborate new empirical and theoretical talks. The model developed by [63] demonstrates that currency competition can reach an equilibrium of price stability under certain policy rules. [61] also notes that in reality, because of switching costs and network effects, people are frequently unable to switch quickly to a more stable currency, and this observation undermines the general applicability of the Hayek proposition. The model of [63] also reveals that a price stability equilibrium is present only when the country issuing the national currency implements explicit policy rules in order to preserve values. With algorithmic stablecoins, this implies that the stability of their prices cannot be guaranteed simply by algorithmic design; rather, there needs to be a broad consensus among market participants in the algorithmic regulations. Both crypto-asset-collateralized and algorithmic stablecoins' final price stabilities rely on the level of trust in their issuers or algorithmic rules, a fact that goes in line with the main thesis of the theory of currency competition on the issue of institutional credibility.

4. Challenges to Stablecoin Price Stability and the Regulatory Framework

4.1 Reserve Trust Crisis and "Death Spiral" Transmission

The reliability of privately issued money is finally based on the verifiability of its anchored assets or reserve system. As soon as the issue of reserve adequacy is put into doubt, an avalanche of confidence will quickly lead to a rapid decline in value. [52] Studies on the background of currency competition reveal that most currency crises can be traced back to systematic discrepancies between the anchoring mechanism promised by the issuer and the real reserves. [57] The re-interpretation of Gresham's Law also indicates that the definition of bad money is not dependent on the physical characteristics of the currency but rather on the expectations of the population about the reserve position of the issuer when currency issuance has no credible institutional constraints. [58] The analysis of the conditions under which Gresham's Law can be applied in the history of money reveals that when information is opaque, market participants are unable to clearly determine the

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underlying strength of the reserve of various currencies, and this information asymmetry is also prone to speeding up the spread of distrust. The aforementioned reasoning is very coherent with the reserve trust crisis of modern fiat-collateralized stablecoins: upon audit reports of discrepancies between reserve composition and disclosure, holder redemption will surge in a concentrated manner in the near future, placing run pressure on the reserve pool.

Parallel currency regime: When one of the two currencies is seen to be depreciating, the switch behavior of the holders hastens the reduction of liquidity in that currency to create a reinforcing circle of depreciation. [64] Fiscal analysis of a dual-currency arrangement demonstrates that, in the case two currencies are co-existing, the tax base of the weaker currency is slowly eroded since economic agents would rather use the depreciating currency to meet their payment obligations but keep the strong currency. [65] An empirical analysis of the secondary currency in Argentina describes a similar process of crowding out: with the ongoing depreciation of the peso, dollarization increased, and the role of the peso as a medium of exchange quickly decreased. [66] The theoretical model also establishes that in a currency competition setting, inflation differences cause arbitrage-induced switching by holders, which subsequently magnifies the initial currency imbalance. This is digitally replicated in the death spiral of algorithmic stablecoins: whenever the token price drops below the anchoring level, the selling behavior of arbitrageurs and redemption requests of holders feed into each other, eventually causing systemic failure due to lack of liquidity.

There are some currency baskets or indices that can have high stability in the sample time, but when they are introduced into an out-of-sample setting, it is frequently hard to keep their stability hypothesis. [46] critically assesses the Stable Aggregate Currency (SAC) put forward by [45]. These findings indicate that SAC has low variance and covariance in-sample, but decreases severely out-of-sample, and portfolio weights calculated on in-sample data cannot ensure that there will be out-of-sample performance. [53] Studies of the non-stationary nature of nominal exchange rates also suggest that, statistically speaking, measures of stability which rely on past variances and covariances have inherent flaws. It implies that when unprecedented liquidity shocks occur, the protection line of any reserve anchoring mechanism using historical information could break down. In the stablecoin market, this result has an immediate warning value. Extreme market conditions may render the collateral ratios or liquidation thresholds established on historical volatility inadequate to handle shocks and cause chain forced liquidations to occur.

4.2 Price Manipulation and Systemic Risk Contagion

The worth of money is not only based on its inherent stability, but is greatly influenced by network externalities and switching costs. These aspects can lock the market in a sub-optimal equilibrium and enhance the systemic effects of price manipulation. [54] The conventional analysis indicates that network externalities in currency competition imply that a currency becomes valuable as the user base grows. It is a positive feedback effect, which makes the incentive to switch lower and extends the possible range of influence of one-point manipulation. [67] A particular research of network effects in cryptocurrencies proves that even though the virtual world eliminates certain switching costs, new switching costs including wallet ecosystems and exchange liquidity remain. [55] The conceptualization of the new currency issuance suggests that in a market where there are network effects, issuers have the opportunity to make excess profits through strategic pricing and that offers the theoretical opportunity of price manipulation. This network lock-in effect in the stablecoin market implies that when a major stablecoin fails, the extent of contagion will be much more than the single asset alone.

Successful currency competition involves market players being able to correctly evaluate the stability features of various currencies. Nonetheless, the market discipline effect of private issuers is reduced since information asymmetry and assessment costs are widespread. [61] revisits the discussion of private money between Friedman and Hayek, noting that Hayek was overly optimistic in his view that people would opt to use stable currencies, neglecting the fact that switching and information acquisition costs constrained the behavior of people in their choices. [62] remarks that Hayek is better suited to the case of capital and saving transactions, as opposed to day-to-day small transactions, which means that he significantly overstates the intensity of market discipline depending on the usage cases. [63] The formal model also shows that if an economy has information frictions, issuers have reasons to hide risk exposure by making products complex, and this can cause currency competition not to converge to a desirable equilibrium. There is also a similar

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problem of information asymmetry in the stablecoin market. The challenge of reserve auditing and the messiness of on-chain data complicate the ability of ordinary users to carry out effective supervision.

The rapid transmission of the value fluctuations of one currency to the entire system in a highly interconnected monetary system occurs through channels including the payment networks, collateral chains, and liquidity pools, which create cross-market and cross-border systematic risks. [68] The parallel currency proposal analysis of Asian monetary integration highlights the fact that, in the case of several currencies, which are highly correlated with each other in a particular region, a crisis in any given currency will easily be transmitted to other currencies along the trade and capital movement channels. [69] A consideration of post-COVID-19 parallel currency proposals in the euro area highlights that adding another parallel currency to an already very integrated financial market can increase systemic risk instead of reducing it unless prudential regulation limits are absent. [70] The examination of the Greek sovereign debt crisis reveals that cross-border capital controls and liquidity freezes become the immediate results of chain reactions as the country experiences run pressure on its currency. The role of stablecoins in the DeFi ecosystem is dual, as the core asset of trading pairs and as collateral, and thus they play an important role in the transmission of systemic risk.

4.3 Regulatory Framework and Policy Implications

When institutional arrangements permit the existence of parallel currencies or private money alongside legal tender, the main aim of the regulatory structure is to define the limits of competition and ensure that the weakness of other currencies cannot spill over into the legal tender system. [50] Preliminary ideas about a European parallel currency approach and [51] detailed examination of the currency competition and European monetary integration offer an initial conceptual backdrop to the formulation of a parallel currency system, whose essence is to separate contagion risk amongst various currencies by way of the use of floating exchange rates as the instruments of choice. [71] discusses the Russian currency board reform. The evaluation indicates that if private money or alternative currencies are linked to legal tender, explicit redemption undertakings and a non-governmental reserve administration organization are institutional requirements to ensure trust. [72] contrasts the historical development of the hard ECU and the euro and goes on to identify institutionalized reserve disclosure and independent audit systems as central variables in the success and failure of parallel currency schemes. These historical lessons can be related directly to reserve transparency specifications and independent custody provisions in stablecoin regulation.

In case of an emergency with a parallel currency or private money, regulators have to find a middle ground between providing liquidity assistance and avoiding the risk of moral hazard by developing orderly exit plans to ensure the stability of the system. [73] Euro crisis proposals indicate that liquidity support on a temporary basis should come with stringent adjustment conditions in order to avoid the effects of bailouts on market discipline. [74] is a proposal of a market approach to the orderly exit of Greece, supporting the creation of a new dual-currency mechanism and supervision of capital flows over a transitional period to lower the costs of exit and preserve the soundness of the financial system. [75] The research on the legislative background of parallel currencies within the euro zone shows that it is necessary to clearly establish the legal position relationship between parallel currencies and legal tender, particularly the sequence of payment implementation and debt repayment. Stablecoin regulation also requires the same mix of crisis response tools to be pre-set, such as trigger factors to inject liquidity and limits to suspend the redeemability of stablecoins.

The lessons learned by various economies during the process of currency substitution and parallel currency systems indicate that successful stablecoin regulation must strike a pragmatic compromise between national sovereignty and cross-border cooperation. [76] reviews systematically the local currency system of Argentina. The findings reveal that under macroeconomic instability, local supplementary currency can help reduce liquidity shortages in the short term; however, their longevity is dependent on how the central government perceives the situation and the macroeconomic policy regime stability. [65] The empirical literature covers regulatory arbitrage in the informal dollarization process. Where regulated through formal channels, alternative currency arrangements quickly increase in the shadow system. [77] The official report on the parallel currency system in Peru is somewhat positive. The country permits free competition between the US dollar and the sol, instead of enforcing substitution, which preserves the effectiveness of monetary policy and lowers the influence of exchange rate volatility on real economic activity. Those different country experiences demonstrate that stablecoin regulation would not aim at a one-size-fits-all worldwide standardized approach,

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but could leave room for countries, on the basis of minimum information disclosure and anti-money laundering requirements, to tailor it to their own financial systems.

5. Conclusions and Prospects

The present paper performs a systematic literature review of the mechanisms and challenges of stablecoin price stability, explains the workings of four types of stabilization mechanisms beginning with typology, identifies the paths of failure of reserve trust crises, price manipulation, and systemic risk contagion, and summarizes the regulatory implications on the basis of contrasting mechanisms and challenges. [1] and [2] provide the classification framework and functional positioning of stablecoins as seen in terms of institutions, which allows conducting the typological analysis presented in the paper. [3] and [4] explain the logic of reserve anchoring of fully reserve-backed and basket-collateralized stablecoins respectively and [5] discloses the mechanism at a micro-level through which algorithmic stablecoins are susceptible to bank-like runs during confidence erosion. Empirical analyses by [6] and [7] demonstrate that the price stability of stablecoins cannot be maintained in extreme market conditions and most stablecoins fail the stability test when subjected to stress testing. [78], having examined the evolutionary history of monetary systems, suggests that the institutional system but not the technical level is the source of the core credibility of private money, and that the viability of private money over time is determined by whether the trust contract established between issuers and users will survive the test of the economic cycles. When combined with the available research findings, price stability of stablecoins depends on the interaction of the mechanism design, market discipline, and regulatory environment, and no single technical design or institutional arrangement can be used to attain it.

To date, the academic body has developed quite advanced research findings in the area of stablecoin mechanism classification and risk identification, however, there are some research gaps, which can be found in the areas of dynamical mechanism modeling, empirical examination of cross-market risk contagion, and quantitative evaluation of regulatory impact. [10] performs a micro-analysis of Tether issuance behavior and Bitcoin price volatility association, statistically confirming the possibility of market manipulation, however, due to data availability and endogeneity treatment issues, this conclusion is not yet a full causality mechanism level evidence. [8] and [9] provide elementary theory to the phenomenon of run behavior in private money, however, the current literature has not properly described the dynamic properties of runs, including the triggering thresholds, the rate of risk transmission, and market repair processes, and the theory models could be further developed.

The [79] is optimizing a sparse stable algorithm to work with portfolios, which offers a quantitative analysis tool to manage stablecoin reserve assets, although it has not been determined whether this method can be adapted to the stablecoin market conditions using out-of-sample data. [46] performs critical studies on the out-of-sample performance of stable currency baskets and states that stability measurement systems built on the basis of historical data are vulnerable to systemic failures in case of drastic changes in market structure. [53] There is also empirical evidence that supports this position on the non-stationarity of nominal exchange rates: historical variance and covariance cannot be used to offer adequate protection against extreme market shocks. Such research limitations result in poor predictability of the current literature concerning the behavior of the stablecoin market during extreme stress conditions and also outline areas of optimization in future research.

In light of the gaps in the current body of knowledge, further studies may go into the depth of three important directions that are construction of real-time reserve audit mechanisms, examination of micro-level operating mechanisms of algorithmic stablecoins, and development of cross-border regulatory coordination systems. [63] and [67] present a systematic discussion of network effects and information frictions in currency competition, which forms a theoretical base for micro-level behavioral modeling of algorithmic stablecoins. On these grounds, subsequent research can bring in high-frequency on-chain transaction data to accurately identify the distinct behavioral features of retail investors and arbitrage traders at stablecoin depegging events.

The research at the regulatory research level, i.e., [50, 51] the study of the design of the European parallel currency system and [71] the outcomes of currency board reform evaluations, may serve as a historical reference to the formation of the independent custody of stablecoin reserves and redemption guarantee systems. [73] The idea of liquidity support constraint model used in the euro crisis may be applied in practice to the creation of crisis response programs in the stablecoin market. [68] and [69] Cross-country studies on the systemic risk contagion of parallel currencies also clearly demonstrate the significant role of cross-border

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regulatory coordination in the governance system of the stablecoin. The future research can continue to quantify the real influence of various regulatory intensities on stablecoin issuance choices and the general market structure.

Since the level of penetration of stablecoins into the global payment system keeps increasing, the problem of price stability of stablecoins is one of the central themes of scholarly work and regulation. Further exploring the logic behind the operation mechanism and the reasons for risk formation of stablecoins may offer useful assistance in theoretical iterations and enhancement of regulatory frameworks in this area.

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Conflicts of Interest

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