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Review

A Systematic Literature Review of Empirical Research on Stablecoins

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Abstract: This study reviews the current state of empirical literature on stablecoins. Based on a sample of 22 peer-reviewed articles, we analyze statistical approaches, data sources, variables, and metrics, as well as stablecoin types investigated and future research avenues. The analysis reveals three major clusters: (1) studies on the stability or volatility of different stablecoins, their designs, and safe-haven-properties, (2) the interrelations of stablecoins with other crypto assets and markets, specifically Bitcoin, and (3) the relationship of stablecoins with (non-crypto) macroeconomic factors. Based on our analysis, we note future research should explore diverse methodological approaches, data sources, different stablecoins, or more granular datasets and identify five topics we consider most significant and promising: (1) the use of stablecoins in emerging markets, (2) the effect of stablecoins on the stability of currencies, (3) analyses of stablecoin users, (4) adoption and use cases of stablecoins outside of crypto markets, and (5) algorithmic stablecoins.

Keywords: stable coin; stablecoin; tether; bitcoin; cryptocurrency; cash

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1. Introduction and Background

Stablecoins are digital currencies that peg their value to other assets, most often the U.S. dollar but also other fiat currencies or physical assets, such as gold [1]. By mid-2022, two of the four largest crypto assets based on market capitalization were stablecoins. Tether USD (USDT) is the largest stablecoin and is also the crypto asset with the highest average daily trading volume—even higher than Bitcoin [2]. Accordingly, stablecoins exhibit a significant importance in cryptocurrency markets and sparked the interests of researchers across disciplines [3].

While the first stablecoins were launched in 2014, their actual adoption and market relevance only began in 2017 with the rise of USDT. By that time, cryptocurrency exchanges faced significant challenges in providing banking services, i.e., fiat currency deposits and withdrawals, which led to a high level of uncertainty on the customer side [4]. Consequently, USDT was introduced as an equivalent to the U.S. dollar, facilitating a fiat-currency substitute with the properties of cryptocurrency. The stablecoin gained noticeable traction by allowing cryptocurrency users to easily transfer USDT between exchanges, administer quasi-fiat funds in their own wallets, and circumvent the necessity of keeping U.S. dollar funds on exchanges. Within a short time, all major exchanges were implementing the use of USDT and adding USDT-based trading pairs. Inspired by the success of USDT, numerous stablecoins, e.g., Circle's USD Coin (USDC) or Binance USD (BUSD), entered the market. Since major stablecoins are managed by single entities and in light of different viable approaches to managing the peg of stablecoins to its derivative asset, discussions were sparked about their underlying collateral, the risks of centralized management, and in the case of USDT, if the stablecoin could be used to manipulate the Bitcoin price [5].

Three basic forms of stablecoins can be distinguished, which include (1) traditional asset-backed stablecoins, (2) crypto-collateralized stablecoins, and (3) algorithmic stablecoins (with or without seigniorage shares). In the first and most prominent form, the common approach is for the issuer to collect, for example, U.S. dollar deposits and subsequently issue digital tokens establishing a direct link to the U.S. dollars in custody. This form of stablecoin is used by the most prominent stablecoin providers (e.g., USDT, USDC, BUSD), exists for a variety of fiat currencies (e.g., USD, EUR, MXN, or CNY and other assets, such as gold (e.g., Tether Gold, XAUT, or Paxos Gold, PAXG). Crypto-collateralized stablecoins basically apply the same approach, except crypto assets, such as Ether (ETH), are used as underlying collateral. In the case of MakerDAO's DAI, for example, ETH but also other stablecoins, are applied in a system where the value for DAI is pegged to one U.S. dollar [6,7] and secured by an overcollateralized basket of underlying cryptocurrency. In the case of non-fiat-pegged stablecoins or so-called "reserve currencies", such as Olympus DAO (OHM), the token represents the underlying collateral basket without being pegged to a single asset's value. Finally, algorithmic stablecoins are crypto assets whose peg, e.g., to the U.S. dollar, is managed by algorithms via smart contracts on blockchains that dynamically minimize the price volatility of the token based on predefined expirations. Meanwhile, hybrid forms, such as fractional algorithmic stablecoins that employ both (fractional) collateralization and algorithmic volatility reduction, emerged. Examples include Frax (FRAX) or Terra USD (UST). The latter, after an interim market capitalization of over USD 17.5 billion, lost its price peg to the U.S. dollar and is currently trading as a rebranded TerraClassicUSD (USTC) at a price of a few cents, evaporating billions of investments [8,9]. The case of Terra illustrates the risks and challenges to stablecoin designs applying algorithms and raises the question if algorithmic stablecoins should be categorized as stablecoins at all.

The volume of literature covering the topic of stablecoins does not reflect its economic importance, which suggests many literature gaps and opportunities for future research. In response, we aim to examine the current stand of the literature by systematically identifying, processing, and analyzing the empirical literature on stablecoins. By focusing on empirical studies, we ensure the analysis relies on objective data. We conduct a systematic literature review (SLR) based on Webster and Watson [10] and vom Brocke et al. [11]. First, we want to identify which empirical research on stablecoins already exists and to what extent thematic clusters can be formed. Second, we want to identify the studies' aims, focus, and methods. For this purpose, existing studies are identified, consolidated, and classified based on various characteristics (i.e., methods, data, sources, recommendations for future research, etc.).

This article proceeds as follows: Section 2 provides a description of the methodology, data collection and processing, whereas in Section 3, results of the SLR are presented. This includes a generalized overview of the studies and thematic clusters (Section 3.1), an analysis of statistical approaches applied by researchers (Section 3.2), the analyses of variables, data, and sources (Section 3.3), as well as future research questions raised in the studies under consideration (Section 3.4). Section 4 provides a discussion of the results and future research recommendations based on this study's findings. Lastly, Section 5 concludes.

2. Methodology

To identify and analyze all empirical findings on stablecoins, we employ the approach of an SLR. SLRs aim to systematically identify, evaluate, and interpret the academic literature on a topic in light of specific research questions. The existing evidence related to a topic is analyzed to identify fundamental and specific research gaps and to derive practical and theoretical recommendations for action [12].

As outlined in Figure 1, we utilize seven scientific databases, namely, Web of Science, ACM Digital Library, AIS Electronic Library, IEEE Xplore Digital Library, ScienceDirect, JSTOR, and Google Scholar for our literature selection process. We iteratively searched these databases to gather all relevant literature until May 2022. The search term(s) used

for the literature search in title and abstracts are mainly "stablecoin*". We validate the queries by additionally searching for studies containing the terms "stable coin*", "tether*", "libra*" or "diem*". In the case of Google Scholar, only the first 100 results (10 pages) are considered, justified by the argument that thematical relevance deteriorates.

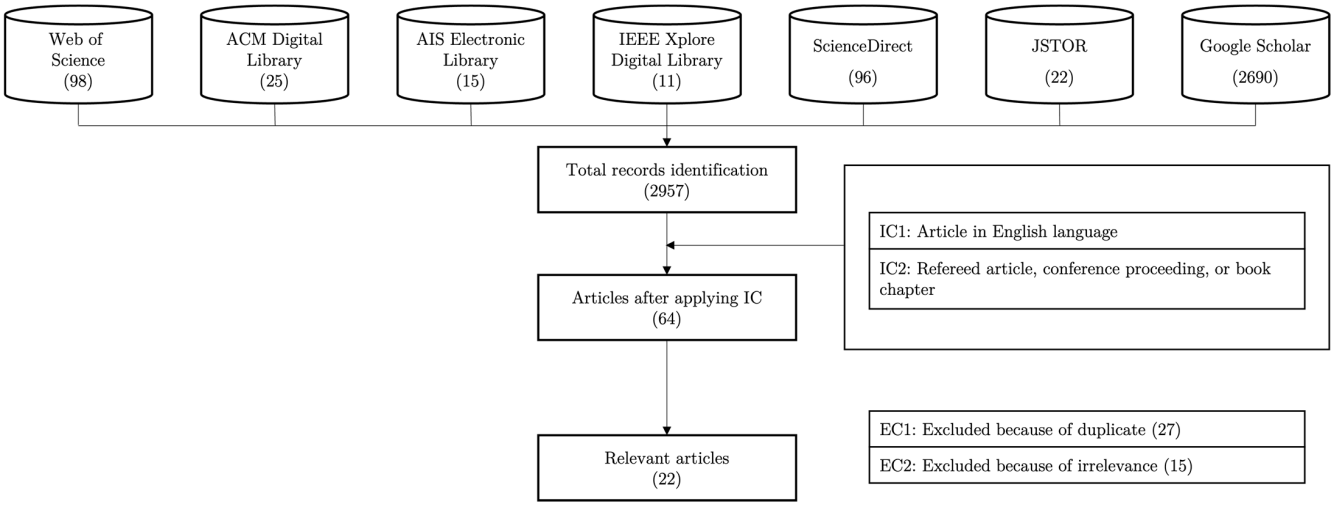

Figure 1. Sample identification process.

After identifying a total of 2,957 records, we employ inclusion criteria to filter for relevant articles and exclusion criteria to define the final set of articles [10]. Based on a screening of title and abstract, we only include articles in the English language (inclusion criteria, IC1), peer-reviewed literature in the form of research articles, conference proceedings or book chapters (IC2), and articles with an empirical approach (IC3), resulting in a set of 64 articles. Based on full-text analysis, we first remove 27 duplicates (exclusion criteria, EC1), resulting in 37 articles of which we remove 15 irrelevant, i.e., non-empirical and non-fitting, literature (EC2), arriving at a total of 22 relevant articles that constitute our final sample.

3. Results

Table 1 provides an overview of the peer-reviewed articles resulting from the literature search strategy of the SLR. In the table, each publication is assigned an identifier for subsequent tables, and its title, academic outlet, and a brief description of the overall scope are provided. With a relative share of 64 percent (14), the majority of the studies were published in 2021. Before that, only two articles were published in 2020 and one in 2018. With four more articles published in 2022, the topic of (empirical) research into stablecoins is seemingly gaining momentum. The journal *Finance Research Letters* published the most empirical publications on the topic of stablecoins.

Table 2 shows the market capitalization, price peg, and type/collateral of major stablecoins with the studies analyzed based on the SLR, showing absolute and relative prevalence of studies, as well as the individual IDs of the studies. With 16 studies (73%), USDT is the most studied stablecoin, followed by USDC with 11 (50%). As the third largest stablecoin based on market capitalization, BUSD was the major subject in only 23% of the studies, while other stablecoins, such as DAI, USDP (both 41%), TUSD (36%), and GUSD, (32%) were studied proportionally more often. Without checking for duplicates, a total of 119 stablecoins are considered in the literature, resulting in an average of 5.41 stablecoins examined per study. Removing duplicates results in a total of 45 unique stablecoins analyzed.

Table 1. Identified literature.

ID	Reference	Title	Journal/Conference	Topic
1	Hoang and Baur [13]	How stable are stablecoins?	The European Journal of Finance	Stability of stablecoins and proposal of a framework to test for absolute and relative stability
2	Ante et al. [14]	The impact of transparent money flows: Effects of stablecoin transfers on the returns and trading volume of Bitcoin	Technological Forecasting and Social Change	Effect of large stablecoin transfers and their effect on Bitcoin returns and trading volume
3	Ante et al. [1]	The Influence of Stablecoin Issuances on Cryptocurrency Markets	Finance Research Letters	Influence of large stablecoin issuances on the return of major cryptocurrencies
4	Jarno and Kołodziejczyk [15]	Does the Design of Stablecoins Impact Their Volatility?	Journal of Risk and Financial Management	Average volatility of different stablecoin designs
5	Pernice [16]	On Stablecoin Price Processes and Arbitrage	Financial Cryptography and Data Security	Analysis of arbitrage processes and price determination
6	Zhao et al. [17]	Understand Volatility of Algorithmic Stablecoin: Modeling, Verification and Empirical Analysis	International Conference on Financial Cryptography and Data Security	Key design of three algorithmic stablecoin designs, volatile by design in theory and/or in practice?
7	Thanh et al. [18]	Are the stabilities of stablecoins connected?	Journal of Industrial and Business Economics	Connections between stability of different stablecoins
8	Jalan et al. [19]	"Shiny" crypto assets: A systemic look at gold-backed cryptocurrencies during the COVID-19 pandemic	International Review of Financial Analysis	Performance of gold-backed stablecoins during the COVID-19 pandemic; compared to gold
9	Griffin and Shams [5]	Is Bitcoin Really Un-Tethered?	The Journal of Finance	Influence of stablecoin Tether on the prices of Bitcoin in 2017
10	Wei [20]	The impact of Tether grants on Bitcoin	Economics Letters	Impact of Tether issuances on the price and trading volume of Bitcoin
11	Kristoufek [21]	Tethered, or Untethered? On the interplay between stablecoins and major cryptoassets	Finance Research Letters	Connection between stablecoin issuances and the price of other cryptocurrencies
12	Jeger et al. [22]	Analysis of Stablecoins during the Global COVID-19 Pandemic	Procedia Computer Science	Different stablecoin stability mechanics and their performance during the 2020 crisis
13	Kjäer et al. [23]	Empirical Evaluation of MakerDAO's Resilience	Blockchain, Robotics and AI for Networking Security Conference (BRAINS)	MakerDAO's resilience during first year from November 2019 to 2020
14	Grobys and Huynh [24]	When Tether says "JUMP!" Bitcoin asks "How low?"	Finance Research Letters	Impact of high fluctuation in Tether price (jump) on Bitcoin price
15	Grobys et al. [25]	On the stability of stablecoins	Journal of Empirical Finance	Stablecoin volatility and connection to Bitcoin volatility
16	Wasiuzzaman and Haji Abdul Rahman [26]	Performance of gold-backed cryptocurrencies during the COVID-19 crisis	Finance Research Letters	Performance of gold-backed stablecoins during COVID-19 crisis, especially in 2020 (bear market)

Table 1. *Cont.*

ID	Reference	Title	Journal/Conference	Topic
17	Aloui et al. [27]	Are Islamic gold-backed cryptocurrencies different?	Finance Research Letters	Comparison of Islamic gold-backed stablecoins and conventional ones
18	Baur and Hoang [28]	A crypto safe haven against Bitcoin	Finance Research Letters	Analysis of stablecoins as a safe haven for crypto investors
19	Wang et al. [29]	Are stablecoins truly diversifiers, hedges, or safe havens against traditional cryptocurrencies as their name suggests?	Research in International Business and Finance	Diversifier, hedge, and save haven properties of different stablecoins against conventional cryptocurrencies
20	Nguyen et al. [30]	Stablecoins versus traditional cryptocurrencies in response to interbank rates	Finance Research Letters	The impacts of the United States (U.S.) federal funds rate and Chinese interbank rate on the behaviors of stablecoins and traditional cryptocurrencies
21	Bojaj et al. [31]	Forecasting macroeconomic effects of stablecoin adoption: A Bayesian approach	Economic Modelling	Effect of stablecoin adoption on key macroeconomic factors in Montenegro.
22	Yousaf and Yarovaya [32]	Spillovers between the Islamic gold-backed cryptocurrencies and equity markets during the COVID-19: A sectorial analysis	Pacific-Basis Finance Journal	Return and volatility transmission between the Islamic gold-backed cryptocurrencies and global Islamic equities.

Table 2. Twenty largest stablecoins, their characteristics, and prevalence in the empirical literature.

Stablecoin		Stablecoin Characteristics				Prevalence in the Empirical Literature		
		Ticker	Mcap (USD m)	Peg	Collateral/Type	#	%	IDs (cf. Table 1)
1	Tether	USDT	66,077	USD	Cash and cash equivalents	16	73	1–5,7–12,14,15,18–20
2	USD Coin	USDC	55,531	USD	Cash and cash equivalents	11	50	1–5,7,11,12,15,18,20
3	Binance USD	BUSD	17,878	USD	Cash	5	23	2,3,5,11,15
4	Dai	DAI	6476	USD	Cryptocurrency incl. stablecoins	9	41	3–5,7,11–13,15,17
5	Frax	FRAX	1368	USD	Algorithmic	0	0	-
6	TrueUSD	TUSD	1220	USD	Cash	8	36	1,4,7,11,15,17–19
7	Paxos Dollar	USDP	853	USD	Cash	9	41	1–5,7,11,17,19
8	Neutrino USD	USDN	750	USD	Algorithmic	0	0	-
9	USDD	USDD	721	USD	Algorithmic	0	0	-
10	Paxos Gold	PAXG	587	XAU	Gold	2	9	8,12
11	TerraClassic USD	USTC	481	USD	Algorithmic	0	0	-
12	Tether Gold	XAUT	428	XAU	Gold	1	5	8
13	Fei USD	FEI	358	USD	Algorithmic	0	0	-
14	Euro Tether	EURT	210	EUR	Cash	0	0	-
15	Magic Internet Money	MIM	196	USD	Cryptocurrency incl. stablecoins	0	0	-

Table 2. *Cont.*

Stablecoin		Stablecoin Characteristics				Prevalence in the Empirical Literature		
		Ticker	Mcap (USD m)	Peg	Collateral/Type	#	%	IDs (cf. Table 1)
16	Gemini Dollar	GUSD	186	USD	Cash	7	32	1–5,11,17
17	Alchemix USD	ALUSD	186	USD	Stablecoins (DAI)	0	0	-
18	Liquity USD	LUSD	173	USD	Cryptocurrency	0	0	-
19	STASIS EURO	EURS	126	EUR	Cash	3	14	1,4,19
20	HUSD	HUSD	110	USD	Cash	4	18	2,3,5,11

Market data was collected on 7 November 2022 from coingecko.com.

3.1. Thematic Clusters of Stablecoin Research

Based on the full text assessment of all articles, three main thematic clusters were derived. Studies in the first cluster focus on the topic of stability/volatility of different stablecoins, their design approaches, and safe-haven properties (55% of the studies). Articles in the second cluster put stablecoins into macroeconomic perspectives, assessing their roles in the cryptocurrency ecosystem and how the issuance of new stablecoins relates to the price of Bitcoin and other cryptocurrencies (27% of the studies). Third, a share of 14% of the studies deals with the relationship between stablecoins and non-cryptocurrency-related ecosystems, factors, and markets (e.g., equities, federal funds rate, etc.). Finally, one study does not fit any of the three clusters, as it represents more of a case study of a specific stablecoin's design and efficiency: Focusing on the empirical analysis of a single stablecoin's underlying design (MakerDAO's DAI), Kjäer et al. [23] analyze the resilience of this particular decentralized system during market crisis.

Cluster 1: The stability and volatility of stablecoins. Jarno and Kołodziejczyk [15] find the stability of stablecoins differs based on the underlying design choice (e.g., fiat-collateralized, algorithmic, etc.). Similarly, Jeger et al. [22] review stability mechanisms of stablecoins and find the performance of different stablecoins during the COVID-19-related financial crisis relates to design aspects of stablecoins. Focusing solely on algorithmic stablecoins, Zhao et al. [17] discuss how stablecoin design choices relate to volatility based on a systematic empirical analysis of volatility of algorithmic stablecoin Basis Cash.

Hoang and Baur [13] use high-frequency data of six major stablecoins to study their returns, volatility, and volume, identifying that stablecoins are not stable "enough", i.e., too volatile. Although they are not always stable, stablecoins offer a safe haven for Bitcoin investors [28], even if the measure of suitability changes depending on market conditions [29]. Gold-backed stablecoins—other than their underlying asset—would not necessarily offer safe-haven properties during a financial crisis but show increased volatility risk [19,26]. This goes hand in hand with the results of another study showing Bitcoin volatility has a significant impact on the volatility of stablecoins [25]. As expected, Islamic gold-backed stablecoins do show positive correlations to gold [27]. Analyzing the interconnection of major stablecoins, Thanh et al. [18] identify that volatility varies across different stablecoins; the instabilities of major stablecoins, such as USDT and USDC, drive comparatively smaller stablecoins, and USDT-pricing affects the pricing of other stablecoins. Pernice [16] models how the prices of fully collateralized stablecoins change due to traders' behaviors on the interplay of trend following and peg deviations, i.e., the role of arbitrage in keeping stablecoins "stable".

Cluster 2: The interrelation of stablecoins and crypto markets. Ante et al. [14] investigate the effects of stablecoin transfers with a value of USD 1 million or more on Bitcoin returns and trading volume, finding a (highly) significant increase in both trading volume and returns. Subsequently, Ante et al. [1] analyze the influence of stablecoin

issuances of USD 1 million or more on the return of four major cryptocurrencies, i.e., Bitcoin, Ether, XRP, and Litecoin. The authors identify positive abnormal returns following stablecoin issuances, which differ across individual stablecoins but also note the issuance size does not significantly impact the effect.

Griffin and Shams [5], Wei et al. [20], and Grobys and Huynh [24] all primarily research the connection between Tether, the company operating USDT, and Bitcoin–more precisely the influence Tether has on Bitcoin. Griffin and Shams [5] find significant increases in Bitcoin prices during the 2017 'crypto boom', following purchases with USDT, which they observe to be occurring following market downturns. Conversely, Wei et al. (2018), employing a VAR model, find no impact of USDT issuances on subsequent Bitcoin returns but observe an impact on the traded volumes of Bitcoin. Moreover, Grobys and Huynh [24] encounter negative price changes of Bitcoin as a reaction to USDT jumps—a statistically relevant price deviation in a one-day-period.

Finally, Kristoufek [21] employs a VAR model to analyze directional spillovers between stablecoins and other crypto assets. The author finds no evidence that stablecoins positively influence the price of other crypto assets, but rather, an increase in stablecoin issuances follows other crypto asset price increases, which is interpreted as a reflection of increased demand.

Cluster 3: The relationship of stablecoins with (non-crypto) macroeconomic factors. Nguyen et al. [30] employ GARCH, EGARCH, and fixed effects models to determine the effect of the United States federal funds rate and the Chinese interbank rate on both stablecoins and 'regular' cryptocurrencies. Both rates have a similar impact, where a higher rate increases both price and price volatility for standard cryptocurrencies, while having a decreasing price effect on stablecoins. These findings are in line with other studies, suggesting regular cryptocurrencies are rather speculative and volatile assets [33,34], whereas stablecoins can serve as a safe haven [28,29]. Additionally, Yousaf and Yarovaya [32] find varying return and volatility spillovers between gold-backed stablecoins and equities in pre-COVID and COVID periods.

Bojaj et al. [31] investigate the potential impacts of cryptocurrency shocks on the Montenegrin economy. For this purpose, they use a Bayesian SVAR model to forecast economic effects based on economic data, including Bitcoin and stablecoin prices, between January 2012 to December 2018. They find various types of shocks result in an unpredictable volatility of Bitcoin and further, stablecoins being unable to maintain their peg.

3.2. Statistical Approaches

The regarded literature employs a variety of methods and metrics, some of which are overlapping regardless of the clusters. However, especially with regard to the examined metrics, the differences between the clusters are quite apparent, which is why we chose to keep the cluster-based differentiation to provide a better overview.

Studies on the stability and volatility of stablecoins (cluster 1) mainly examine measures of stability and volatility, i.e., standard deviation of daily log returns, price-peg deviations, and log returns via exponentially weighted moving average (EWMA) [13,15,16,22]. In addition, descriptive statistics and approaches have been applied and evaluated to gain further insight into the stability/volatility of stablecoins [19,25–29]. In terms of statistical methods, studies predominantly apply (auto-)regression, including OLS, VAR, and different GARCH models [13,16,18,26,27,29].

Similar to the first cluster, most studies on the interrelation of stablecoins and crypto markets (cluster 2) also consider descriptive approaches, such as the analyses of mean, variance, skewness, kurtosis, JB, ERS, Q2, or LiMak, for their analysis (e.g., Grobys and Huynh [24]). For the purpose of examining the interrelation between stablecoins and crypto markets, studies in this cluster utilize (log) returns, trading volumes, and further price correlation, global connectedness, or spillover indices, including directional spillovers [1,5,14,20,21]. Ante et al. [1,14] employ event study methodology, t-tests, and non-parametric Wilcoxon sign rank tests, whereas Grobys and Huynh [24] use Barndorff-

Nielsen and Shephard's [35] methodology for testing for jumps in financial markets using bipower variation, threshold, and logistic regression models. Other works use a variety of regression-based models, including autoregressive distributed lag (ADL), VAR models, and regression of return on lagged stablecoin flows [5,20,21]. In addition, Kristoufek (2021) employs logarithmic transformations and the Akaike information criterion (AIC).

In the third cluster (the relationship of stablecoins with (non-crypto) macroeconomic factors), studies utilize metrics already seen in both other clusters, focusing on price volatility and trading value [30] and spillover connectedness [32], employing regression models (GARCH, EGARCH, SVAR, VAR-BEKK-AGARCH), as well as fixed effect models, variance decomposition, or a Keynesian macroeconomic model [30–32].

3.3. Variables, Data, and Data Sources

Figure 2 visualizes the timeframes analyzed in the literature grouped into the three described clusters presenting a cumulative overview of the number of studies covering each timeframe. The observation period starts in January 2015 with three studies and ends in August 2021 with one study analyzing this timeframe. Forming a visual peak, a total of 11 studies included data from November 2019 into their analysis.

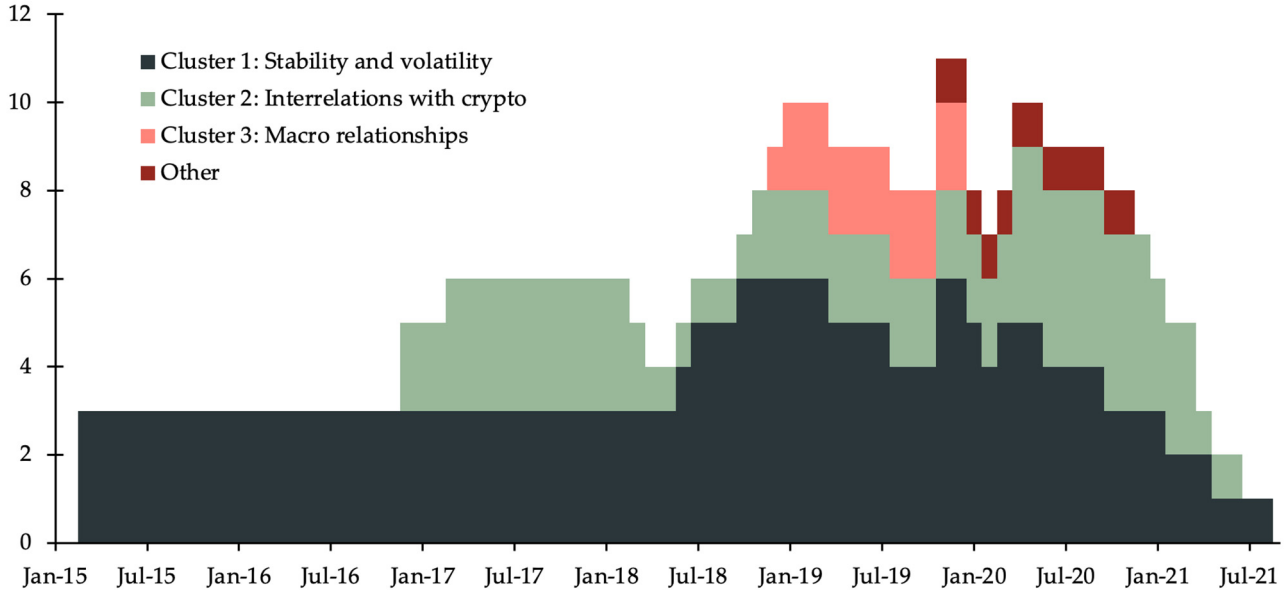

Figure 2. Monthly time frames analyzed by the empirical literature on stablecoins by cluster.

Cluster 1 shows an increase in the number of studies examining a particular timeframe starting in June 2018 (3 → 4), peaking between September 2018 and February 2019 with six studies including the timeframe, before dropping and peaking again in November 2019. This observation can potentially be explained with the rising interest (in the analysis) of stablecoins and their safe-haven properties during the (beginning of the) COVID-19 pandemic/economic crisis. The peak of Cluster 2 is much later in April 2020, with four studies including this timeframe. Only two studies include the timeframe from November 2018 until the peak, which seems odd considering three studies build on data between March 2017 to January 2018. A possible explanation is that the crypto (mostly Bitcoin) rise and subsequent fall in 2017 attracted more attention, in particular when considering the interrelations between standard crypto assets and stablecoins. The comparably limited timeframes used in the studies from Cluster 3 can be explained by their primary focus on the COVID-19 crisis (e.g., Nguyen et al. [30]).

Table 3 provides an overview of the time interval and data source(s) of the studies in relation to the main stablecoin metrics considered. Most works use daily (N = 9) or hourly (N = 5) data derived from market data aggregators (N = 12). Market data aggregators

include, for example, Coinmarketcap (N = 12), CoinGecko, investing.com (each N = 2), Coinmetrics, Anyblock, and Coinmarket, WorldCoinIndex.com (each N = 1). Two works use hourly data from the Bitfinex API. Only Hoang and Baur [13] use 5-min intraday prices from Coinmarketcap. Blockchain explorers, such as Etherscan, Tronscan, or Omniexplorer (each N = 1), are employed to gather data on market capitalization, the supply of stablecoins and/or non-stablecoins cryptocurrencies (N = 2), as well as blockchain transactions (N = 4). Additionally, Kjäer et al. [23] use Ethereum blocks as time intervals, gathered through the OpenEthereum client. Grobys et al. [25] further collect data on the rank of stablecoins, i.e., the overall market rank based on the reported market capitalization.

Table 3. Concept matrix merging stablecoin metrics considered with data time intervals and sources. The cells of the matrix show the IDs of the academic publications fitting the specific combinations. For an overview of the articles and their IDs, see Table 1.

		Main Stablecoin Metrics Considered			
		Pricing/Returns	**Market Cap/Supply**	**Trading Volume**	**Blockchain Transactions**
Time interval	Minute *	[1]	[1]	[1]	
	Hourly	[5,6,9,14,18]	[9]		[2,3,9]
	Daily	[4,7,8,10,12,16,17,19,20]	[10–12,20]	[10,12]	
	Blocks				[13]
Data source	Market data aggregators	[1,4,5–9,12,16,17,19,20,22]	[1,9,11,12,20]	[1,12]	[9]
	Cryptocurrency exchanges	[14,18]			
	Blockchain explorers		[9,10]		[2,3,9,13]
	Blockchain nodes/clients				[13]

* The study of Hoang and Baur [13] uses 5-min intervals.

3.4. Future Research on Stablecoins Mentioned in the Surveyed Literature

The topics for future research on stablecoins outlined in the surveyed literature are described by the identified clusters in the following.

Studies in the Cluster 1 suggest to further investigate how the design, life cycle (i.e., time) or maturity of stablecoins relates or affects their stability, factoring in newer, potentially improved generations of stablecoins [13,17,28]. Further, studies call for research with regards to the question to what extent stablecoins fulfill the promises of a financial safe haven and how such suitability relates to design choices, such as different pegs [19,27–29]. Finally, Grobys et al. [25] suggest the relationship between the volatility of stablecoins and cryptocurrencies (in this case, the negative relationship between the lagged volatility of bitcoin and stablecoin volatility) should be studied more closely—a study that would be thematically assigned to Cluster 2.

In Cluster 2, most studies refrain from detailed suggestions for future research. Grobys and Huynh [24] encourage identifying "jumps" in other stablecoins and analyzing their effects. Ante et al. [14] put forward quite a few suggestions for future work, mainly focusing on improving upon their study by considering cumulative transactions, using a more granular clustering of blockchain addresses, or dividing them into more categories. Further, they propose to analyze 'relationships, cointegration, and differences between various cryptocurrency markets' [14] or to employ shorter or different time intervals. Ante et al. [1] pose the questions whether stablecoin issuances influence Ethereum prices directly or indirectly through Bitcoin prices, i.e., the research question to which degree abnormal effects may be explained by other market factors.

In the third cluster, Nguyen et al. [30] propose expanding their study by including the supply of both stablecoins and traditional cryptocurrencies as potential determinants or variables. Bojaj et al. [31] outline a variety of factors that could be included in future research on stablecoins' effects on macroeconomic factors. These include general economic risks, e.g., illicit finance, fraud, interoperability risks, and (stable)coin-related risks, e.g., scalability, protocol vulnerabilities, or cybersecurity. Yousaf and Yarovaya [32] propose the use of other types of stablecoins for future research and highlight that future studies should analyze the relationships between Islamic cryptocurrencies and other Islamic and conventional markets.

4. Literature Gaps and Open Research Paths

The identified clusters of literature on empirical stablecoin research deal with the most pressing and straightforward questions about stablecoins: their price stability, their effect on crypto markets, and their relation to macroeconomic factors. Price stability is most relevant because fluctuations in value would negate the main proposition of stablecoins. Price effects on crypto markets are most straightforward since the transparency of on-chain transactions allows precise analyses of stablecoin movements and changes in price of cryptocurrencies; if these can be anticipated, it promises a low-risk return for speculators. The relation to macroeconomic factors, especially interest rates, grew in importance with the increased market capitalization of stablecoins and their advanced integration into the traditional financial markets, e.g., by applying traditional financial assets as collateral for stablecoins.

The identified studies are well-designed, and both the methodological approaches as well as the datasets are sufficient to explore these aspects and find reasonable results. Though, such studies are still scarce and more research is needed that:

- Applies different methodological approaches for a range of research topics (e.g., price clustering detection, distributional characteristics, seasonality, intraday market efficiency and mean-reverting behavior, portfolio optimization, or interrelations with other market and assets);
- Includes data from more blockchains (e.g., Tron, Algorand, Solana, Avalanche);
- Includes data from more stablecoins (i.e., not "only" USDT and USDC, cf. Table 2);
- Builds on expanded datasets that are more granular (e.g., minute, tick, or block data), as well as longer time horizons that cover multiple years. Since crypto markets are ever-changing, research should best try to validate or challenge studies that rely on specific time frames since market dynamics may differ, and thus, "older" findings may not be valid anymore.

Given the novelty of stablecoins, a literature gap in regard to the improvable extent of datasets and additional methodological approaches is hardly surprising. More surprising is the "limited" scope of only three existing research clusters, indicating other important topics have not yet been studied. There are many potentially interesting areas of research. Reflecting on the current state of the literature and stablecoin markets, we find the following five research topics the most interesting and promising to analyze:

1. **The use of stablecoins in emerging markets**: Emerging markets, such as Turkey or Argentina, suffer from high inflation rates, which could lead their citizens to turn their savings into U.S. dollars. At the same time, not all parts of the population have broad access to the banking system, financial markets, or simply U.S. dollar accounts, for example, due to regulations, such as capital controls. However, countries, such as Turkey, have a comparatively high cryptocurrency adoption rate [36]. Stablecoins might provide an option for people in these countries to access capital markets in the first place and obtain U.S. dollars over their domestic currencies in particular. A potential angle to explore this hypothesis are analyses of centralized or peer-to-peer markets of stablecoins against a respective currency, such as the Turkish lira. A survey would be another option. An important dimension should also be the possibility of

regulatory intervention to support local currencies as a potential limitation to growth and adoption of stablecoins in emerging economies.

2. **The effect of stablecoins on the stability of currencies**: The market capitalization of stablecoins amounts to USD 150 billion by October 2022 [37]. At this size, it becomes possible that stablecoins can influence the stability of currencies in general and those of emerging markets in particular. For example, capital might be channeled from a small domestic currency toward the U.S. dollar, causing a drop in the exchange rate between the currency and the U.S. dollar. A possible approach to study this relationship is to triangulate data from foreign exchange (forex) rates with data from stablecoin markets against a specific currency.
3. **Analyses of stablecoin users**: Little is known about stablecoins users and their motivations. Users of stablecoins might be a homogenous group or differ in various respects. One or more (representative) surveys among stablecoin users in general or within specific populations/countries are a promising way to find out about the socioeconomic profiles of stablecoin users and their behavioral intentions and usage patterns of stablecoins. If such analyses are replicated and standardized across countries, it could contribute to understanding socioeconomic or cultural differences in relation to the maturity of domestic banking systems and capital markets in various geographic regions. Another, apparently geographically limiting, option could be to analyze on-chain behavior of wallets.
4. **Adoption and use cases of stablecoins outside of cryptocurrency trading**: While stablecoins were born in cryptocurrency markets to meet the need to move fiat-denominated value between crypto exchanges at a fast pace, they are starting to expand into other areas. Little is known yet about the countries and markets where stablecoins find adoption outside of trading cryptocurrencies. For example, they could be feasible for remittances or cross-border payments in general, but they might also already be used in specific industries that are either prone to experience banking and payment issues (e.g., the cannabis industry) or that are simply attracted by the simplicity and effectiveness of stablecoin transfers. Such questions could potentially be analyzed using qualitative interviews with managers from specific industries, individuals, or companies that issue stablecoins and thus potentially know who their customers are.
5. **Algorithmic stablecoins**. Algorithmic stablecoins represent the "holy grail" of stablecoins, promising capital-efficient, decentralized, and price-stable assets without the risk of an intermediary that necessarily comes with counterparty risk. In the past, various algorithmic stablecoins have failed, as illustrated by the collapse of Terra in 2022 [8,9]. Based on this, one can even ask the research question whether algorithmic stablecoins should actually be called "stablecoins" or if they should represent something of their own. Accordingly, we see a need to better understand, plan, classify and analyze algorithmic stablecoins. The (empirical) academic literature on the topic is still quite scarce [15,17]; however, promising (non-peer reviewed) approaches and foundations for researchers in this area can also be found [38–40].

Of course, research topics 1, 2, and 4 also include overriding questions of the extent to which stablecoins can represent a direct alternative to fiat currencies [41,42] and how stablecoins interact with fiat currencies [43]. In the context of research on crypto asset markets, there are plenty of promising approaches for further investigation. These include, for example, questions about the relevance and significance of stablecoins during different market phases or bubbles [33,34], or questions about how investor sentiment affects the use and relevance of stablecoins [44–46].

5. Conclusions

This study applied a SLR to explore the empirical literature on stablecoins. Based on a sample of 22 peer-reviewed articles, three thematic clusters were derived. They deal with (1) studies on the stability or volatility of different stablecoins and their designs, as

well as safe-haven properties, (2) the relationship of stablecoins to other crypto assets and markets, specifically Bitcoin, and (3) the relationship of stablecoins with (non-crypto) macroeconomic factors.

The studies from the first cluster show price stability and volatility depend on the design of stablecoins with asset-backed stablecoins doing a good job in tracking the currency they are pegged to except for a few short-term deviations on secondary markets. The second cluster of studies finds small but significant price effects of both stablecoin emissions and movements on Bitcoin prices. However, these effects seem to fade out with a growing maturity of markets. The third cluster mainly found the market capitalization of stablecoins correlates negatively to central bank interest rates. This seems reasonable given that stablecoin issuers do not pay interest to stablecoin holders. Apart from these three clusters, many important aspects of stablecoins have not yet been researched. These include the use of stablecoins in emerging markets, the effect of stablecoins on the stability of domestic currencies, analyses of stablecoin users, and the adoption and use cases of stablecoins outside of crypto markets. While the current literature is still narrow in volume and scope, it already provides a robust foundation for additional research. In line with the increased importance of and market for stablecoins, we expect future studies on stablecoins to grow substantially in count and tackle more diverse aspects of stablecoins.

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