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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 stablecoins 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 that future research should explore diverse methodological approaches, data sources, different stablecoins or more granular datasets, and arrive at four significant topics that 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 and (4) adoption and use cases of stablecoins outside of crypto markets.

Keywords: Stable coin, Stablecoin, Tether, Bitcoin, Cryptocurrency, Cash

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 (Ante et al., 2021a). By mid-2022, two of the four largest crypto assets based on market capitalization were stablecoins. *Tether USD* (USDT) is the largest stablecoin and also the crypto asset with the highest average daily trading volume—even higher than Bitcoin (Coingecko, 2022). Accordingly, stablecoins exhibit a significant importance in cryptocurrency markets and sparked the interest of researchers across disciplines (Fiedler and Ante, 2023).

While the first stablecoins launched in 2014, their actual adoption and market relevance only began in 2017 with the rise of USDT. By the 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 (Bitfinex, 2017). In consequence, 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 (Griffin and Shams, 2020).

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 that 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 (Brennecke et al., 2022; MakerDAO, 2020) and secured by 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 also 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 $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 (Briola et al., 2022; Uhlig, 2022). The case of Terra illustrates the risks and challenges to stablecoin designs applying algorithms and raises the question, if algorithmic stablecoins at all should be categorized as *stablecoins*.

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 that the analysis relies on objective data. We conduct a *systematic literature review (SLR)* based on Webster and Watson (2002) and vom Brocke et al. (2015). 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 on the basis of 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 (3.1), an analysis of statistical approaches applied by researchers (3.2), the analyses of variables, data and sources (3.3) as well as future research questions raised in the studies under consideration (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 a 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 (Kitchenham, 2004).

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.

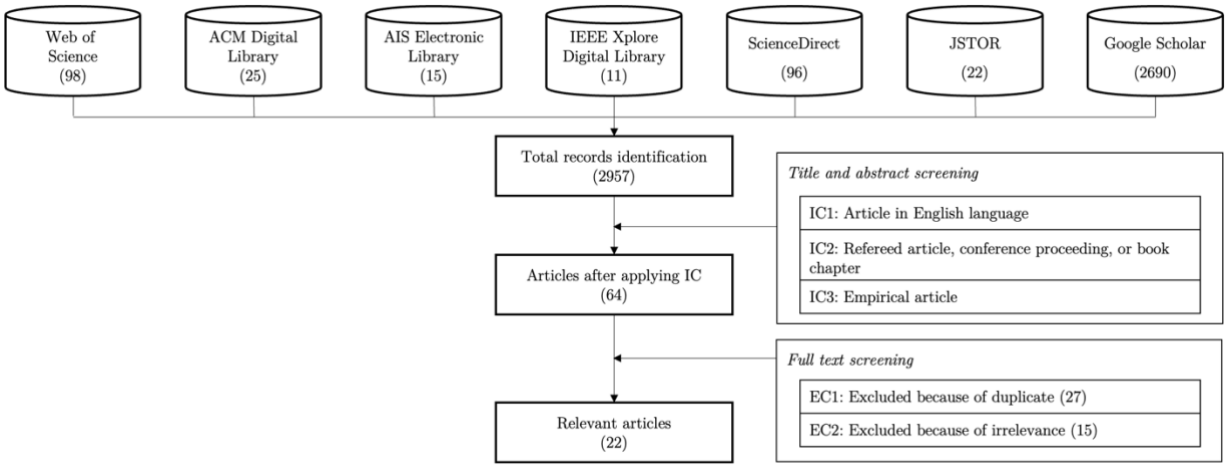

Figure 1. Sample identification process

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 (Webster and Watson, 2002). Based on a screening of title and abstract, we only include articles in English language (*inclusion criteria*, IC1), peer-reviewed literature in 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 remove duplicates (exclusion criteria, EC1) and irrelevant, i.e., non-empirical, literature (EC2), arriving at a total of 22 relevant articles.

3 Results

Table 1 provides an overview of the peer-reviewed articles resulting 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 overall scope is briefly described. 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 1. Identified literature.

ID	Reference	Title	Journal / Conference	Topic
1	Hoang and Baur (2021)	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. (2021a)	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. (2021b)	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 (2021)	Does the Design of Stablecoins Impact Their Volatility?	Journal of Risk and Financial Management	Average volatility of different stablecoin designs
5	Pernice (2021)	On Stablecoin Price Processes and Arbitrage	Financial Cryptography and Data Security	Analysis of arbitrage processes and price determination
6	Zhao et al. (2021)	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. (2022)	Are the stabilities of stablecoins connected?	Journal of Industrial and Business Economics	Connections between stability of different stablecoins
8	Jalan et al. (2021)	"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 (2020)	Is Bitcoin Really Un-Tethered?	The Journal of Finance	Influence of stablecoin Tether on the prices of Bitcoin in 2017
10	Wei (2018)	The impact of Tether grants on Bitcoin	Economics Letters	Impact of Tether issuances on the price and trading volume of Bitcoin
11	Kristoufek (2021)	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., (2020)	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. (2021)	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 (2021)	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. (2021)	On the stability of stablecoins	Journal of Empirical Finance	Stablecoin volatility and connection to Bitcoin volatility
16	Wasiuzzaman and Haji Abdul Rahman (2021)	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)
17	Aloui et al. (2021)	Are Islamic gold-backed cryptocurrencies different?	Finance Research Letters	Comparison of Islamic gold-backed stablecoins and conventional ones
18	Baur and Hoang (2021)	A crypto safe haven against Bitcoin	Finance Research Letters	Analysis if stablecoins as a safe haven for crypto investors
19	Wang et al. (2020)	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. (2022)	Stablecoins versus traditional cryptocurrencies in response to interbank rates	Finance Research Letters	The impacts of the United States (US) federal funds rate and Chinese interbank rate on the behaviors of stablecoins and traditional cryptocurrencies
21	Bojaj et al. (2022)	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 (2022)	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 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 by 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.

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, 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. (2021) analyze the resilience of this particular decentralized system during market crisis.

***Cluster 1*: The stability and volatility of stablecoins.** Jarno and Kołodziejczyk (2021) find that the stability of stablecoins differs based on the underlying design choice (e.g., fiat collateralized, algorithmic, etc.). Similarly, Jeger et al. (2020) review stability mechanisms of stablecoins and

find that 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. (2021) discuss how stablecoin design choices relate to volatility based on a systematic empirical analysis of volatility of algorithmic stablecoin *Basis Cash.*

Table 2. Largest 20 stablecoins, their characteristics and prevalence in the empirical literature.

Stablecoin		**Stablecoin characteristics**				**Prevalence in the empirical literature**		
		Ticker	**Mcap ($m)**	**Peg**	**Collateral / type**	**#**	**%**	**IDs**
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	6,476	USD	Cryptocurrency incl. stablecoins	9	41	[3-5,7,11-13, 15,17]
5	Frax	FRAX	1,368	USD	Algorithmic	0	0	-
6	TrueUSD	TUSD	1,220	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	-
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 obtained via coingecko.com on July 9, 2022.

Hoang and Baur (2021) 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 (Baur and Hoang, 2021), even if the measure of suitability changes depending on market conditions (Wang et al., 2020). Gold-backed stablecoins—other than their underlying asset—would not necessarily offer safe-haven properties during financial crisis but show increased volatility risk (Jalan et al., 2021; Wasiuzzaman and Haji Abdul Rahman, 2021). This goes hand in hand with the results of another study showing that Bitcoin volatility has a significant impact on the volatility of stablecoins (Grobys et al., 2021). As expected, Islamic gold-backed stablecoins do

show positive correlations to gold, other than their non-Islamic counterparts (Aloui et al., 2021). Analyzing the interconnection of major stablecoins, Thanh et al. (2022) 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 (2021) 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. (2021a) investigate the effects of stablecoin transfers with a value of $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. (2021b) analyze the influence of stablecoin issuances of $1 million or more on the return of four major cryptocurrencies, i.e., Bitcoin, Ethereum, Ripple, and Litecoin. The authors identify positive abnormal returns following stablecoin issuances, which differ across individual stablecoins, but also note that the issuance size does not significantly impact the effect.

Griffin and Shams (2020), Wei et al. (2018) and Grobys and Huynh (2021) all primarily research the connection between Tether, the company operating USDT, and Bitcoin, or rather, the influence Tether has on Bitcoin. Griffin and Shams (2020) 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 (2021) encounter negative price changes of Bitcoin as a reaction to USDT jumps—a statistically relevant price deviation in a one-day-period.

Finally, Kristoufek (2021) 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 that 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. (2022) 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 that regular cryptocurrencies are rather speculative and volatile assets (e.g., Corbet et al., 2018; Fry and Cheah, 2016), whereas stablecoins *can* serve as a safe haven (Wang et al., 2020; Baur and Hoang, 2021). Additionally, Yousaf and Yarovaya (2022) find varying return and volatility spillovers between gold-backed stablecoins and equities in pre-COVID and COVID periods.

Bojaj et al. (2022) 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 that 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 have chosen 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) (Hoang and Baur, 2021; Jarno and Kołodziejczyk, 2021; Pernice, 2021; Jeger et al., 2020). In addition, descriptive statistics and approaches have been applied and evaluated to gain further insight into the stability/volatility of stablecoins (Jalan et al., 2021; Grobys and Huynh, 2021; Wasiuzzaman and Haji Abdul Rahman, 2021; Aloui et al, 2021; Baur and Hoang, 2021; Wang et al., 2020). In terms of statistical methods, studies predominantly apply (auto-)regression, including OLS, VAR, and different GARCH models (Pernice, 2021; Thanh et al, 2021; Hoang and Baur, 2021; Wasiuzzaman and Haji Abdul Rahman, 2021; Aloui et al., 2021; Wang et al., 2020).

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, Q^2 or LiMak, for their analysis (e.g., Grobys and Huynh, 2021). 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 (Ante et al., 2021a, 2021b; Griffin and Shams, 2020; Kristoufek, 2021; Wei, 2018). Ante et al. (2021a, 2021b) employ event study methodology, t-tests and non-parametric Wilcoxon sign rank tests, whereas Grobys and Huynh (2021) use Barndorff-Nielsen and Shephard (2006)'s 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 (Griffin and Shams, 2020; Wei, 2018; Kristoufek, 2021). 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 (Nguyen et al., 2022) and spillover connectedness (Bojaj et al., 2022), employing regression models (GARCH, EGARCH, SVAR, VAR-BEKK-AGARCH) as well as Fixed Effect models, variance decomposition or a Keynesian macroeconomic model (Bojaj et al., 2022; Nguyen et al., 2022; Yousaf and Yarovaya, 2022).

3.3 Variables, data and data sources

Figure 1 visualizes the timeframes analyzed in the literature grouped into the three described clusters presenting a cumulative overview over the number of studies covering each timeframe. The observation period starts in January 2015 with three studies and ends with 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.

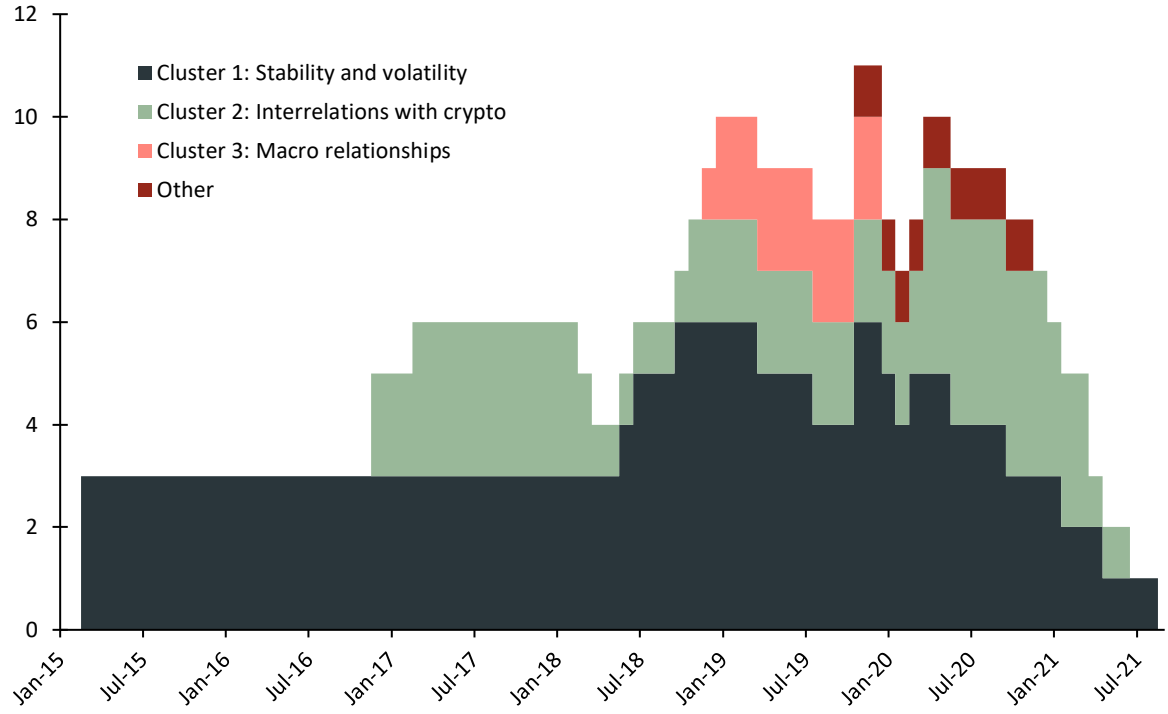

Figure 1. Monthly time frames analyzed by the empirical literature on stablecoins by cluster.

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 seem odd considering that 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 has attracted more attention 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., 2022).

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 that is 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 (2021) use 5-minute 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. (2021) use Ethereum-blocks as time intervals, gathered through the *OpenEthereum* client. Grobys et al.

(2021) further collect data on the rank of stablecoins, i.e., its 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]	[10,11,12,20]	[10,12]	
	Blocks				[13]
Data source	**Market data aggregators**	[1,4,5,6,7,8,9,12, 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 (2021) 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 if newer, potentially improved, generations of stablecoins (Hoang and Baur, 2021; Zhao et al., 2021; Baur and Hoang, 2021). Further, studies call for research with regards to the question to what extent stablecoins fulfill the promises of a financial safe havens and how such suitability relates to design choices, such as different pegs (Jalan et al., 2021; Baur and Hoang, 2021; Aloui et al, 2021; Wang et al., 2020). Finally, Grobys et al. (2021) suggest that 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 (2021) encourage identifying "jumps" in other stablecoins and analyzing their effects. Ante et al. (2021a) 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' (Ante et al., 2021a) or to employ shorter or different time intervals. Ante et al. (2021b) 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. (2022) propose expanding their study by including the supply of both stablecoins and traditional cryptocurrencies as potential determinants or variables. Bojaj et al. (2022) 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 (2022) 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 in 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. Such studies are still scarce, though, and more research is needed that:

a) 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).
b) Includes data from more blockchains (e.g., Tron, Algorand, Solana, Avalanche).
c) Includes data from more stablecoins (i.e., not "only" USDT and USDC, cf. Table 2).
d) 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.

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 that 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 four research topics the most interesting and promising to analyze:

1. **The use of stablecoins in emerging markets:** Emerging markets like 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 like capital controls. However, countries such as Turkey have a comparatively high cryptocurrency adoption rate (e.g., Ante et al., 2022). 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 like the Turkish Lira. A survey would be another option.
2. **The effect of stablecoins on the stability of currencies:** The market capitalization of stablecoins amounts to $150 billion by October 2022 (CoinGecko, 2022). At this size, it becomes possible that stablecoins can have an effect on the stability of currencies in general and those of emerging markets in particular. For example, capital might be channeled from a small domestic currency towards 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 crypto markets**: 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 cryptocurrency markets. For example, they could be feasible for remittances or cross-border payments in general, but they might also be used in specific industries already 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 Conclusion

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 that 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 with the exception of 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. These effects seem to fade out with a growing maturity of markets, though. The third cluster mainly found that 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 casese of stablecoins outside of crypto markets. While the curent 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 counts and tackle more diverse aspects of stablecoins.

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The Blockchain Research Lab promotes independent science and research on blockchain technologies and the publication of the results in the form of scientific papers and contributions to conferences and other media. The BRL is a non-profit organization aiming, on the one hand, to further the general understanding of the blockchain technology and, on the other hand, to analyze the resulting challenges and opportunities as well as their socio-economic consequences.

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