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ARE STABLECOINS SAFE HAVENS FOR TRADITIONAL CRYPTOCURRENCIES? AN EMPIRICAL STUDY DURING THE COVID-19 PANDEMIC

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Abstract

We investigate whether stablecoins are safe havens for traditional cryptocurrencies with fresh evidence from the recent crisis period of the COVID-19 pandemic. Our results support the safe-haven properties of Tether for both before and during the pandemic. For Digix, a gold-backed stablecoin with relatively small market capitalization, we find a change in the characteristics before and during the pandemic, but do not find statistically significant evidence for its safe-haven properties. Furthermore, we document that, when considering the economic benefits and costs of adding safe-haven assets to cryptocurrency portfolios, the one with Tether outperforms both a naked portfolio and a portfolio with traditional safe-haven assets such as gold.

JEL Classification: G11, G15, G19

Keywords: Stablecoins; Safe-Haven Assets; COVID-19 Pandemic

1. Introduction

Innovative technologies such as blockchain have had profound impacts on society, financial markets included. The conceptualization of cryptocurrency and its technological implementations create a class of virtual assets that can bring disruptive developments to financial markets. Bitcoin, the most dominant cryptocurrency, has accumulated $200 billion in market capitalization as of 2020. Other cryptocurrencies have also drawn increasing attention from investors. Stablecoins, for instance, grew their market capitalization from $2.6 billion in 2019 to $20 billion in 2020, making a timely investigation into the characteristics of such an emerging crypto-asset relevant and important.

Stablecoins, backed by either fiat currencies or commodities, are designed to be price-stable cryptocurrencies (Mita et al., 2019; Sidorenko, 2020; Wei, 2018). Take Tether, a stablecoin pegged to USD with an anchor at $1, for example. Investors typically hold Tether to convert into other cryptocurrencies in the future – it currently accounts for more Bitcoin transactions than U.S. dollars (Griffin and Shams, 2020). As a result, it is not surprising to observe increasing interest from investors in stablecoins following the downturns of traditional cryptocurrencies. A stream of literature thus links the role of stablecoins to that of gold as hedges or safe-haven assets in cryptocurrency portfolios (Baur and Hoang, 2020; Wang et al., 2020).

Baur and Lucey (2010) define safe-haven assets as those with little or a negative correlation with other assets during crises. One of the widely recognized safe-haven assets is gold. During the 2007 – 2008 Financial Crisis, gold prices appreciated while other assets stumbled, effectively serving loss-averse investors. Expanding the existing literature on safe-haven assets is important, especially with the ongoing COVID-19 pandemic. With the first cases reported back at the close of 2019, COVID-19 quickly developed from a regional crisis to a global pandemic in early 2020, causing substantial losses in asset markets (Baker et al. 2020). For instance, Bitcoin lost $13 billion in market capitalization during the first quarter of 2020.

Facing such a severe crisis, can stablecoins function as effective and efficient safe-haven assets for traditional cryptocurrencies? Considering the linkage between traditional cryptocurrencies and stablecoins during December 2018 – July 2019, Baur and Hoang (2020) find the strongest safe-haven effects in Tether. Using data up to March 2019, Wang et al. (2020) also document the safe-haven property of stablecoins for traditional cryptocurrencies and note that such characteristics change across different market conditions. However, these empirical tests have been devoid of an essential component – a test during a period of significant turmoil in asset markets such as the recent COVID-19 pandemic.

Our paper fills such a gap by investigating the characteristics of stablecoins, both before and during a severe economic crisis. Our econometric model investigates how stablecoins such as the currency-based Tether and the gold-pegged Digix (DGX) react to extremely negative movements of Bitcoin during the COVID-19 pandemic period. We find that Tether consistently serves as a safe-haven asset for traditional cryptocurrencies, before and during the pandemic, whereas DGX does not. In addition, we analyse the risk-return trade-offs of cryptocurrency portfolios, including and excluding stablecoins. Our portfolio analysis aims to examine the effectiveness and efficiency of using stablecoins as safe-haven assets in traditional cryptocurrency portfolios. This paper adopts three evaluation measures: The Certainty Equivalent Return (Ferreira and Santa-Clara, 2011), the Expected Shortfall (Rockafellar and Uryasev, 2002), and the Economic Value of the Incremental Expected Shortfall (Kang, Ong, and Zhao, 2019). Considering Tether, DGX, and the traditional safe-haven asset of gold, we find that the portfolio with Tether has the highest performance.

Our contributions to the literature are threefold. First, this paper increases our understanding of the characteristics of an emerging financial asset – stablecoins. With a significant share of Bitcoin transactions denominated in Tether, studies on the relationship between traditional cryptocurrencies and stablecoins are increasingly relevant. Our paper builds upon the existing literature by adding an assessment of the safe-haven properties of stablecoins for traditional cryptocurrencies during a period of acute financial losses. Our empirical results show that Tether consistently exhibits safe-haven properties, before and during the COVID-19 pandemic, whereas DGX does not.

Second, our portfolio analysis indicates that adding stablecoins to a cryptocurrency portfolio results in an increased risk-adjusted return, compared to holding Bitcoin alone, with Tether outperforming both DGX and gold. Our findings have significant implications for investors searching for shelter from turbulence in the cryptocurrency markets.

Third, our paper joins and adds to a growing stream of literature investigating the impacts of the COVID-19 pandemic on financial markets. It is worth noting that the Sharpe ratio, arguably the most popular portfolio evaluation measure, does not capture the right preference order if the imputed values are in the negative spectrum[1]. Recognizing this limitation of the Sharpe ratio, we advocate the use of alternative portfolio performance measures during a period of potential acute financial losses such as the COVID-19 pandemic. This is another novelty that this paper introduces to related literature.

The rest of the paper is structured as follows. Section 2 introduces the data and methodology, Section 3 discusses the results, and Section 4 concludes.

[1] When a portfolio mean return is negative, the Sharpe ratio prefers a portfolio with a larger standard deviation to one with a smaller standard deviation. See Subsection 3.2 for details.

2. Data

We collect the prices of Bitcoin, USD-backed Tether, and gold-backed DGX, as denominated in U.S. dollars, at a two-hour interval from bitfinex.com during December 2018 – June 2020. The whole sample is further broken into two subsamples: pre-pandemic (December 2018 – December 2019) and pandemic (January 2020 to June 2020).

Table 1: Summary Statistics

	Pre-Pandemic				Pandemic			
	Bitcoin	**Tether**	**DGX**	**Gold**	**Bitcoin**	**Tether**	**DGX**	**Gold**
Observations	387	387	387	387	153	153	153	153
Mean	0.002	0.000	0.000	0.001	0.002	0.000	0.001	0.001
Standard Deviation	0.037	0.004	0.020	0.007	0.056	0.001	0.035	0.013
Skewness	0.232	-0.216	-1.751	0.158	-4.199	1.295	-0.312	-0.002
Kurtosis	3.321	6.144	35.404	1.190	37.660	22.788	1.850	2.384
Maximum	0.159	0.017	0.154	0.025	0.144	0.010	0.096	0.050
Minimum	-0.140	-0.021	-0.206	-0.022	-0.492	-0.008	-0.128	-0.037

This table presents the summary statistics of daily returns of Bitcoin, Tether, DGX, and gold. Pre-Pandemic is from December 2018 to December 2019, and Pandemic is from January 2020 to June 2020.

Although we use bi-hourly granularity in our empirical tests, we present the summary statistics of daily returns in Table 1 and correlations in Table 2 for an apples-to-apples comparison among Bitcoin, Tether, DGX, and gold. Compared with Bitcoin, stablecoins exhibit lower volatility for both before and during the pandemic. It is also worth noting that the co-movements between Tether and Bitcoin change from a weak direct relationship (correlation at 0.103) before the pandemic to a moderate inverse one (correlation at -0.557) during the pandemic.

Table 2: Return Correlations between Assets

Panel A: Pre-Pandemic				
	Bitcoin Return	**Tether Return**	**DGX Return**	**Gold Return**
Bitcoin Return	1.000	0.103	0.156	0.152
Tether Return	0.103	1.000	0.083	-0.041
DGX Return	0.156	0.083	1.000	0.213
Gold Return	0.152	-0.041	0.213	1.000

This table displays the return correlations before (Panel A) and during (Panel B) the pandemic period between Bitcoin, Tether, DGX, and gold. Pre-Pandemic is from December 2018 to December 2019, and Pandemic is from January 2020 to June 2020

3. Methodology and Results

3.1 Econometric Model

To investigate how stablecoins react to extreme movements in Bitcoin, we adapt the econometric model used by Baur and Hoang (2020):

$$r_{stablecoins} = \alpha_1 + \beta_1 r_{BTC} + \alpha_2 Q_{10\%} + \beta_2 r_{BTC} Q_{10\%} + \varepsilon \qquad (1)$$

where $r_{stablecoins}$ is the log return of stablecoins under consideration (i.e., Tether or DGX), r_{BTC} denotes the log return of Bitcoin, and the dummy variable $Q_{10\%}$ equals 1 if r_{BTC} is below the 10% quantile (i.e., extreme downward movements), and 0 otherwise.

If a stablecoin is immune to changes in the cryptocurrency markets, all βs are expected to be zero; if a stablecoin is subject to fluctuations in the cryptocurrency markets but do not react to extreme losses in particular, β_1 is expected to be non-zero, and β_2 is expected to be zero; and if a stablecoin serves as a safe-haven asset, β_2 is expected to be negative. It is also worth noting that if a stablecoin does not function as a "stable" asset but instead positively correlates with acute losses in the cryptocurrency markets, β_2 is expected to be positive.

Table 3: Regression Results

	Dependent Variable: Tether		Dependent Variable: DGX	
	Pre-Pandemic	**Pandemic**	**Pre-Pandemic**	**Pandemic**
$\boldsymbol{\beta_1}$	0.0884***	0.1118***	0.0954***	0.1703**
	(0.0121)	(0.0513)	(0.0148)	(0.0689)
$\boldsymbol{\alpha_1}$	0.0010	-0.0029***	0.0012	0.0036
	(0.0001)	(0.0043)	(0.0011)	(0.0041)
$\boldsymbol{\beta_2}$	-0.1262***	-0.1236***	0.1223***	-0.1198
	(0.0433)	(0.1263)	(0.0318)	(0.1231)
$\boldsymbol{\alpha_2}$	-0.0003**	-0.0002**	0.0001	-0.0001
	(0.0001)	(0.001)	(0.0001)	(0.001)
Observations	5654	1291	5654	1291
R^2	0.032	0.006	0.025	0.006
Adjusted R^2	0.031	0.005	0.025	0.004

This table shows OLS estimates for the regression model: r_stablecoins=α_1+β_1 r_BTC+α_2 Q_(10%)+β_2 〖r_BTC Q〗_(10%)+ε, where r_stablecoins is the log return of stablecoins under consideration (i.e., Tether or DGX), r_BTC denotes the log return of Bitcoin, and the dummy variable Q_(10%) equals 1 if r_BTC is below the 10% quantile (i.e., extreme downward movements), and 0 otherwise. Pre-Pandemic is from December 2018 to December 2019, and Pandemic is from January 2020 to June 2020. The standard error is reported in parentheses. *p<0.1, **p<0.05, ***p<0.01.

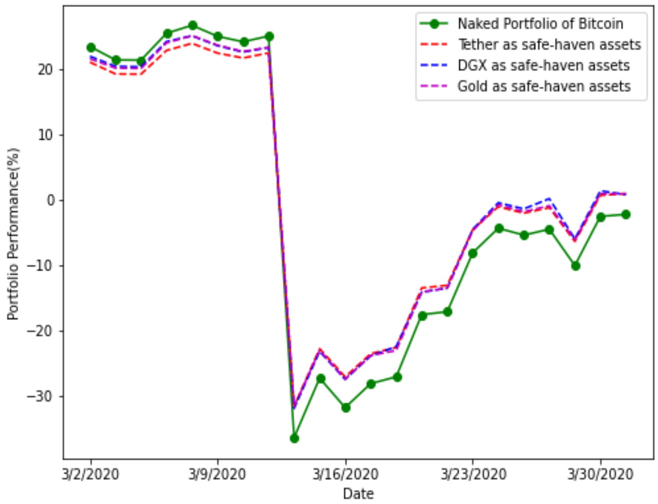
Table 3 shows our model estimation for Tether and DGX. The characteristics of Tether are relatively consistent, with statistically significant positive β_1s (0.0884 and 0.1118) and statistically significant negative β_2s (-0.1262 and -0.1236) in both the pre-pandemic and pandemic periods. The negative β_2s in both testing periods suggest that Tether consistently reacts negatively to extreme losses in Bitcoin, thereby supporting the safe-haven properties of Tether.

As to the gold-backed DGX, it reports a statistically significant positive β_2 (0.1223) before the COVID-19 pandemic and a negative β_2 (-0.1198) without significance during the pandemic. The pre-pandemic analysis finds that returns of DGX plummet, along with extreme downturns in Bitcoin. This observation indicates that DGX, a less-dominant stablecoin with a market capitalization of only 7 million, fails to function as a safe-haven asset in the pre-pandemic period. The negative β_2 (-0.1198) reported for the pandemic period indicates a somewhat promising inverse relationship between DGX and extreme losses in Bitcoin. However, such safe-haven properties of DGX do not show statistical significance.

3.2 Portfolio Analysis

In this subsection, we consider a portfolio worth $1 million with four possible asset allocations: 1) holding Bitcoin alone; 2) holding Bitcoin and Tether; 3) holding Bitcoin and DGX; and 4) holding Bitcoin and gold. For simplicity, we assume 90% and 10% weights for Bitcoin and the safe-haven position for this exercise. Figure 1 plots the performance of constructed portfolios in March 2020 when acute losses occurred. We find that portfolios with safe-haven assets navigate such severe losses much better than the naked portfolio.

Figure 1: Portfolio Performance



Note: This figure compares the performance of constructed portfolios in March 2020. The naked portfolio only consists of Bitcoin, with Tether, DGX, and gold introduced as safe-haven assets. For simplicity, Bitcoin and safe-haven asset positions are 90% and 10% in these portfolios.

In addition, we consider the risk-adjusted returns of cryptocurrency portfolios. It is worth noting that economic crisis periods such as the recent pandemic can easily be associated with negative asset returns. The use of classic evaluation measures requires additional caution during such a time. Take the Sharpe ratio, which is defined as $\frac{r_p - r_f}{\sigma_p}$, where r_f stands for the risk-free return, r_p for the portfolio return, and σ_p for the portfolio standard deviation. During a time of acute financial losses (i.e., $r_p - r_f < 0$), the imputed value of the Sharpe ratio falls into the negative spectrum, which can lead to a misleading interpretation. In Appendix A, we discuss the limitation of the Sharpe ratio in detail.

To address this concern, we use three alternative evaluation measures in this paper. The first one is the Certainty Equivalent Return (CER) (Ferreira and Santa-Clara, 2011). Stemming from the classic mean-variance framework, CER ($\equiv \bar{r_p} - \frac{\gamma}{2}\sigma_p{}^2$, where $\bar{r_p}$ is the expected portfolio return, σ_p is the portfolio standard deviation, and γ is the risk aversion parameter) is defined as the risk-free return that an investor with a risk aversion coefficient γ may consider as equivalent to investing in a particular portfolio.

The second measure is the Expected Shortfall (ES) (Rockafellar and Uryasev, 2002). With a pre-specified confidence level ($1-\alpha$), ES estimates the average of the worst $100\alpha\%$ scenarios. Without requiring any artificial parameter, ES quantifies the fluctuations of portfolio values in an intuitive manner. However, such a measure does not fully capture the economic gains resulting from taking reasonable risks.

The third measure under consideration is the Economic Value of the Incremental Expected Shortfall (EVIES) (Kang, Ong, and Zhao, 2019), which allows us to evaluate the role of stablecoins from a cost-efficiency perspective. Building upon the fundamental principle of costs and benefits, EVIES was originally designed for corporations with hedging benefits captured in reinvesting the reduction in the capital reserve and hedging costs quantified by reduced cashflows. It is also worth noting that EVIES is mathematically proven to be monotonic, concave, and scale invariant, properties that guarantee stable hedging-effectiveness evaluations (Kang, Ong, and Zhao, 2019).

To implement EVIES in the context of cryptocurrency investment, we modify the original specifications of EVIES as the following: EVIES $\equiv r_{alternative} \times \Delta ES_{a} - (1 - \tau_{income}) \times \Delta(\mathit{Expected\ Revenue})$, where $r_{alternative}$ is the excess return of the alternative investment (estimated at 4%[2]), ΔES_{a} is the change in the Expected Shortfall after adding safe-haven assets to the naked portfolio, τ_{income} is the tax rate for the short-term capital gain (30%), and $\Delta(\mathit{Expected\ Revenue})$ is the change in the expected return, compared to the naked portfolio.

Table 4 presents the imputed evaluation measures of CER, ES, and EVIES. In terms of CER, we observe that holding Bitcoin alone reports the lowest performance (3.48%). The risk-adjusted return can be improved by adding Tether (3.52%), DGX (3.51%), or gold (3.59%) to the portfolio. When measured in ES, the naked portfolio of Bitcoin reports the largest ES at $126,363, and the portfolio with Tether reports the smallest ES at $113,278. The mechanism of EVIES builds upon the comparison against a benchmark model – holding Bitcoin alone; thus, the benchmark portfolio does not report an imputed EVIES.

Table 4: Portfolio Analysis

Portfolio	(1) **CER**	(2) **ES ($)**	(3) **EVIES ($)**
Bitcoin	3.48%	-126,363	
Bitcoin + Tether	3.52%	-113,278	769.13
Bitcoin + DGX	3.51%	-113,671	723.65
Bitcoin + Gold	3.59%	-114,022	632.00

This table considers portfolios worth $1 million during the pandemic period. The first row represents the naked portfolio (which consists of Bitcoin), and the following rows represent portfolios with safe-haven assets such as Tether, DGX, and gold, respectively. For simplicity, Bitcoin and safe-haven asset positions are 90% and 10% in these portfolios. Column (1) reports the imputed Certainty Equivalent Return. Column (2) reports the Expected Shortfall, and Column (3) reports the Economic Value of Incremental Expected Shortfall.

Compared with this benchmark model, the portfolio with Tether reports the highest net economic value of $769.13, followed by DGX ($723.65) and gold ($632.00). Our empirical results suggest that adding safe-haven assets increases the risk-adjusted return relative to the naked cryptocurrency portfolio, with Tether delivering comparable and oftentimes superior performance than traditional safe-haven assets such as gold.

It is worth noting that we use 90% Bitcoin and 10% safe-haven assets in the portfolio analysis for simplicity and conservatism. In unreported tests (available upon request), we find that the portfolio with Tether overperforms other portfolios even more as the weight of safe-haven assets increases.

4. Conclusion

Stablecoins is a fast-growing sub-class of cryptocurrencies designed to offer price stability for cryptocurrency holders. This paper examines the role of stablecoins as safe-haven assets in traditional cryptocurrency portfolios with fresh evidence from the COVID-19 pandemic. By conducting both a regression-based econometric model and a portfolio analysis, we find that 1) Tether functions as a safe-haven asset in traditional cryptocurrency portfolios, before and during the COVID-19 pandemic, whereas the less-dominant gold-backed stablecoin DGX does not; 2) the

[2] Motivated by Constantinides et al. (2011)

characteristics of DGX change after the pandemic hit, whereas those of Tether do not; and 3) when measured using risk-adjusted measures, the cryptocurrency portfolio with Tether outperforms both the naked portfolio and the one using gold as a safe-haven asset. Recognizing the various characteristics of different stablecoins, this paper motivates future research concerning the heterogeneity of stablecoins.

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Appendix A: Limit of the Sharpe Ratio

To illustrate the limits of the Sharpe ratio during the COVID-19 pandemic, we present two cases using four portfolios A, B, C, and D. The construct is presented in the following table.

	Case 1		**Case 2**	
	A	**B**	**C**	**D**
$r_p - r_f$	-10%	-10%	-10%	-5%
σ_p	5%	10%	5%	5%
Sharp Ratio	-2%	-1%	-2%	-1%

Let us consider the first case. With same expected return, A exhibits lower volatility, and thus should be preferred over B. In other words, a more negative figure of the Sharpe ratio implies better portfolio performance.

Let us consider the second case. With the same volatility, D exhibits a better return, and thus should be preferred over C. In other words, a less negative figure of the Sharpe ratio implies better portfolio performance.

This sample example sheds light on the inconsistency of the Sharpe ratio, which hinders its use during the COVID-19 pandemic.

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