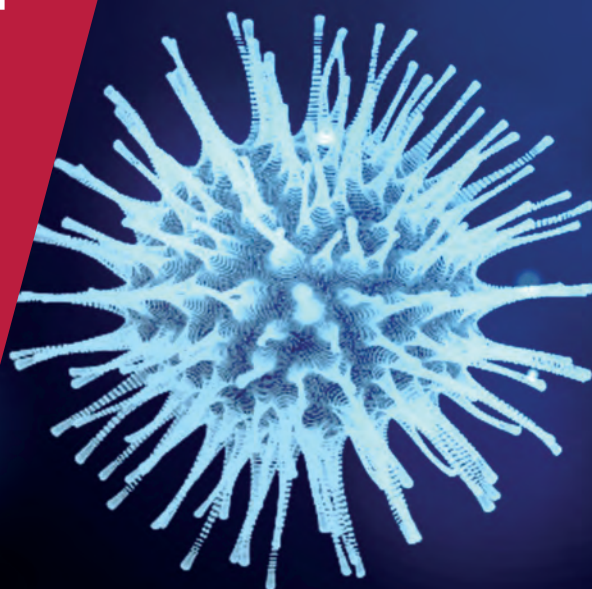


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COVID ECONOMICS
VETTED AND REAL-TIME PAPERS

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Covid Economics

Vetted and Real-Time Papers

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Ethics

Covid Economics will feature high quality analyses of economic aspects of the health crisis. However, the pandemic also raises a number of complex ethical issues. Economists tend to think about trade-offs, in this case lives vs. costs, patient selection at a time of scarcity, and more. In the spirit of academic freedom, neither the Editors of *Covid Economics* nor CEPR take a stand on these issues and therefore do not bear any responsibility for views expressed in the articles.

Submission to professional journals

The following journals have indicated that they will accept submissions of papers featured in *Covid Economics* because they are working papers. Most expect revised versions. This list will be updated regularly.

<i>American Economic Review</i>	<i>Journal of Econometrics</i> *
<i>American Economic Review, Applied Economics</i>	<i>Journal of Economic Growth</i>
<i>American Economic Review, Insights</i>	<i>Journal of Economic Theory</i>
<i>American Economic Review, Economic Policy</i>	<i>Journal of the European Economic Association</i> *
<i>American Economic Review, Macroeconomics</i>	<i>Journal of Finance</i>
<i>American Economic Review, Microeconomics</i>	<i>Journal of Financial Economics</i>
<i>American Journal of Health Economics</i>	<i>Journal of International Economics</i>
<i>Canadian Journal of Economics</i>	<i>Journal of Labor Economics</i> *
<i>Economic Journal</i>	<i>Journal of Monetary Economics</i>
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	<i>Quarterly Journal of Economics</i> *
	<i>Review of Economics and Statistics</i>
	<i>Review of Economic Studies</i> *
	<i>Review of Financial Studies</i>

(*) Must be a significantly revised and extended version of the paper featured in *Covid Economics*.

Covid Economics

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The 2008 global financial crisis and COVID-19 pandemic: How safe are the safe haven assets?

Muhammad A. Cheema,¹ Robert Faff² and Kenneth R. Szulczyk³

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This paper compares the performance of safe haven assets during two stressful stock market regimes – the 2008 Global Financial Crisis (GFC) and COVID-19 pandemic. Our analysis across the ten largest economies in the world shows that the traditional choice, gold, acts as a safe haven during the GFC but fails to protect investor wealth during COVID. Our results suggest that investors might have lost trust in gold. Furthermore, silver does not serve as a safe haven during either crisis, while US Treasuries and the Swiss Franc generally act as strong safe havens during both crises. The US dollar acts as a safe haven during the GFC for all the countries except for the United States, but only for China and India during COVID. Finally, Bitcoin does not serve as a safe haven for all countries during COVID; however, the largest stablecoin, Tether, serves as a strong safe haven. Thus, our results suggest that, during a pandemic, investors should prefer liquid and stable assets rather than gold.

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Introduction

The spread of COVID-19 – transforming from a regional crisis in China to a global pandemic within three months – has caused severe damage to human lives and the global economy. The stock markets around the world have plummeted to their lowest levels since the 2008 Global Financial Crisis (GFC) (BBC, 2020). Furthermore, the COVID-19 pandemic negatively impacted stock markets more than any previous infectious disease outbreak, including the 1918 Spanish Flu (Baker et al., 2020).

Unforeseen and unanticipated events such as the 1987 stock market crash, trigger flight to quality episodes where investors transfer their investments from risky to safe assets (e.g. Caballero and Krishnamurthy, 2008). It is well documented in the literature that gold (e.g. Baur and Lucey, 2010; Hillier et al., 2006; Pullen et al., 2014); US Treasury bills and bonds (e.g. Chan et al., 2011; Fleming et al., 1998; Hartmann et al., 2004; Noeth and Sengupta, 2010); and currencies such as the US dollar and Swiss Franc (e.g. Grisse and Nitschka, 2015; Kaul and Sapp, 2006; Rinaldo and Söderlind, 2010) act as safe havens during periods of stock market turmoil. However, Baur and Lucey (2010) and Chan et al. (2011) suggest that Treasury bonds possess better properties than gold as a safe haven during stock market crises. Moreover, Brunnermeier et al. (2020) propose US Treasuries as the global safe asset in times of the crisis.

Several recent studies argue that cryptocurrencies act as a safe haven during market turmoils (e.g. Cheema et al.; Stensås et al., 2019; Urquhart and Zhang, 2019); however, other studies view cryptocurrencies as a risky asset instead of a safe haven (e.g. Bouri et al., 2017; Smales, 2019). Most recently, Conlon and McGee (2020) and Kristoufek (2020) find that Bitcoin is not a safe haven during the COVID-19 pandemic, whereas Baur and Hoang (2020)

suggest using stablecoins, such as Tether, because it acts as a safe haven against Bitcoin during extreme market movements.¹

The COVID-19 pandemic provides an enticing research setting in which to examine whether the traditional safe assets such as gold, US Treasury bills and bonds, US dollar, and Swiss Franc provide protection from stock market losses given the unique nature of this twin health/economic crisis. Furthermore, we take the opportunity to compare the performance of safe haven assets during the GFC versus the COVID-19 pandemic. For instance, we ask the question – do traditional assets that were safe havens during the GFC (e.g. Baur and McDermott, 2010; Low et al., 2016) maintain their safe haven status during the COVID-19 pandemic? Furthermore, COVID-19 provides an opportunity to re-examine whether the largest traditional cryptocurrency, Bitcoin, and the largest stablecoin, Tether, serve as a safe haven against stock market losses.

A growing number of studies examine the impact of COVID-19 on the financial markets and financial assets (e.g. Al-Awadhi et al., 2020; Alfaro et al., 2020; Baker et al., 2020; Conlon et al., 2020; Conlon and McGee, 2020; Corbet et al., 2020; Kristoufek, 2020; Ramelli and Wagner, 2020; Zhang et al., 2020). For instance, Baker et al. (2020), Al-Awadhi et al. (2020) and Zhang et al. (2020) find a significant negative impact of COVID-19 on stock markets. Conlon et al. (2020) show that Tether acts as a safe haven for several stock indices; whereas Bitcoin and Ethereum do not. Nonetheless, no study has compared the performance of safe haven assets between the GFC and COVID-19.

In this paper, we perform a coordinated comparative examination of the safe haven efficacy of: (a) precious metals (gold and silver); (b) currencies (US dollar and Swiss Franc); (c) US Treasuries (T-bill and T-bond); and (d) cryptocurrencies (Bitcoin and Tether) from stock

¹ Stablecoins are cryptocurrencies that are pegged to other stable assets such as gold and the traditional currencies. Please refer to page 6 for further details.

market losses during the GFC and COVID-19. We select the stock markets of the ten largest economies; namely, the US, China, Japan, Germany, the UK, France, India, Italy, Brazil and Canada since investors prefer to invest in these markets. We estimate a GJR-GARCH model since it accounts for the asymmetric effects when the stock market returns exhibit higher (lower) volatility to bad news (good news).

Our analysis shows that gold serves as a strong, safe haven for six countries and as a weak safe haven for the other four countries during the GFC. However, notably, gold loses its safe haven status during COVID since its price has moved in tandem with the stock markets of all ten countries. The obvious question is, why? We suggest that gold loses its safe haven status because investors might have lost trust in gold as a stable asset after the precious metal lost 45% of its USD value between 2011 to 2015. Somewhat in contrast, silver does not function as an effective, safe haven during either crisis. The US dollar acts as a safe haven for all the countries except the US during the GFC, but a safe haven only for China and India during the COVID-19 pandemic. Interestingly, the Swiss Franc and both Treasuries, T-bills and T-bonds, act as a reliable safe haven during both crises. Finally, Bitcoin does not act as a safe haven, whereas Tether serves as an effective, safe haven during the COVID-19 pandemic for all ten countries.

This study makes three important contributions to the literature. First, by comparing the performance of the traditional safe-haven assets across stock markets of the world's largest ten economies, we uncover new evidence that gold is not reliable protection of investor wealth in all stressful markets or settings. Second, we show that investors from both developed and emerging markets make similar choices about safe haven assets during both crises. Third, we extend the existing literature on global safe assets (e.g. Brunnermeier et al., 2020) and propose that the Swiss Franc and Tether also acts as a global safe asset along with US treasuries in times of the crisis.

The remainder of the paper is organized as follows. Section 2 describes the data and methods, and Section 3 presents the results. Section 4 offers a potential explanation of why gold is not a safe haven during the COVID-19 pandemic, and Section 5 concludes the study.

2. Data and Methods

The analysis includes stock market indices of the ten largest economies in the world, namely, S&P500 US index, SSE composite index China, NIKKEI 225 Index Japan, MSCI Germany Index, FTSE100 Index UK, CAC 40 Index France, NIFTY 500 Index India, FTSE MIB Index Italy, MSCI Brazil Index, and TSX composite index Canada. The daily returns of stock market indices are denominated in US dollars, which is the preferred currency of international investors. Furthermore, returns denominated in the US dollar allow a direct comparison between stock market indices and safe haven assets.

Potential safe-haven assets include precious metals (gold and silver); currencies (US Dollar Index and Swiss Franc Index); Treasuries (S&P US Treasury bill index (T-bill) and S&P US Treasury bond index (T-bond)); and cryptocurrencies (Bitcoin and Tether). Bitcoin is the first and largest cryptocurrency; whereas, Tether is the first and largest stablecoin. According to the data obtained from coinmarketcap.com on June 27, 2020, the market capitalization of Bitcoin and Tether is over \$167 billion and \$9 billion, respectively. Any physical commodity or precious metals do not back Bitcoin tokens; whereas, Tether tokens are 100% backed by liquid reserves, including traditional currencies and other assets that make Tether a stable asset.² US dollar index and the Swiss Franc index represents the value of the US dollar and Swiss Franc relative to a basket of foreign currencies, respectively. DataStream International provides all data except data for the Swiss Franc index and the cryptocurrencies. The data of Swiss Franc index is collected from the online database of Swiss National Bank, while coinmarketcap.com

² For details, please refer to Lipton et al. (2020) and Tether's Limited website, <https://tether.to/>

furnishes the data for Bitcoin and Tether. The sample period for all the assets except cryptocurrencies starts December 31, 2003; whereas the sample period for cryptocurrencies starts September 17, 2014. We restrict the start date to December 31, 2003, since the aim of this study is to examine the role of safe-haven assets during the 2008 GFC and COVID-19 pandemic. The sample period for all the assets ends May 19, 2020.

Following the literature (e.g. Baur and McDermott, 2010), we estimate the model,

$$RA_{i,t} = b_0 + b_1 \cdot RS_{j,t} + b_2 \cdot GFC \cdot RS_{j,t} + b_3 \cdot COVID \cdot RS_{j,t} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + (\alpha + \gamma I_{t-1}) \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (2)$$

where RA_i represents the log return of each given safe-haven asset i . RS_j denotes the daily log returns in US dollars of a stock market index j , with j equal to a given one of the ten countries in our sample. GFC is a dummy variable, which takes the value one from the designated start date (explained shortly) and the subsequent 20 trading days of the 2008 GFC, and zero otherwise. The dummy variable, $COVID$, is similarly constructed to the GFC variable. The residual term ε_t is modelled as a GJR-GARCH process introduced by Glosten et al. (1993) as defined in Equation (2). The γI_{t-1} is an indicator function that is equal to one if the corresponding lagged unconditional standard deviation is less than zero, and zero otherwise. The GJR-GARCH model accounts for the asymmetric effects when the stock market returns exhibit high volatility in response to bad news and low volatility to good news.

Following the literature (e.g. Baur and McDermott, 2010), we assume that the adverse effect of a stock market crisis occurs in the first 20 trading days since the start of the crisis. Figure 1 shows the stock market crises for both the GFC and COVID. It is evident from Figure 1 that the GFC stock market crisis intensified in September 2008 with the collapse of Lehman Brothers; whereas, the stock market crisis from COVID intensified in February 2020.

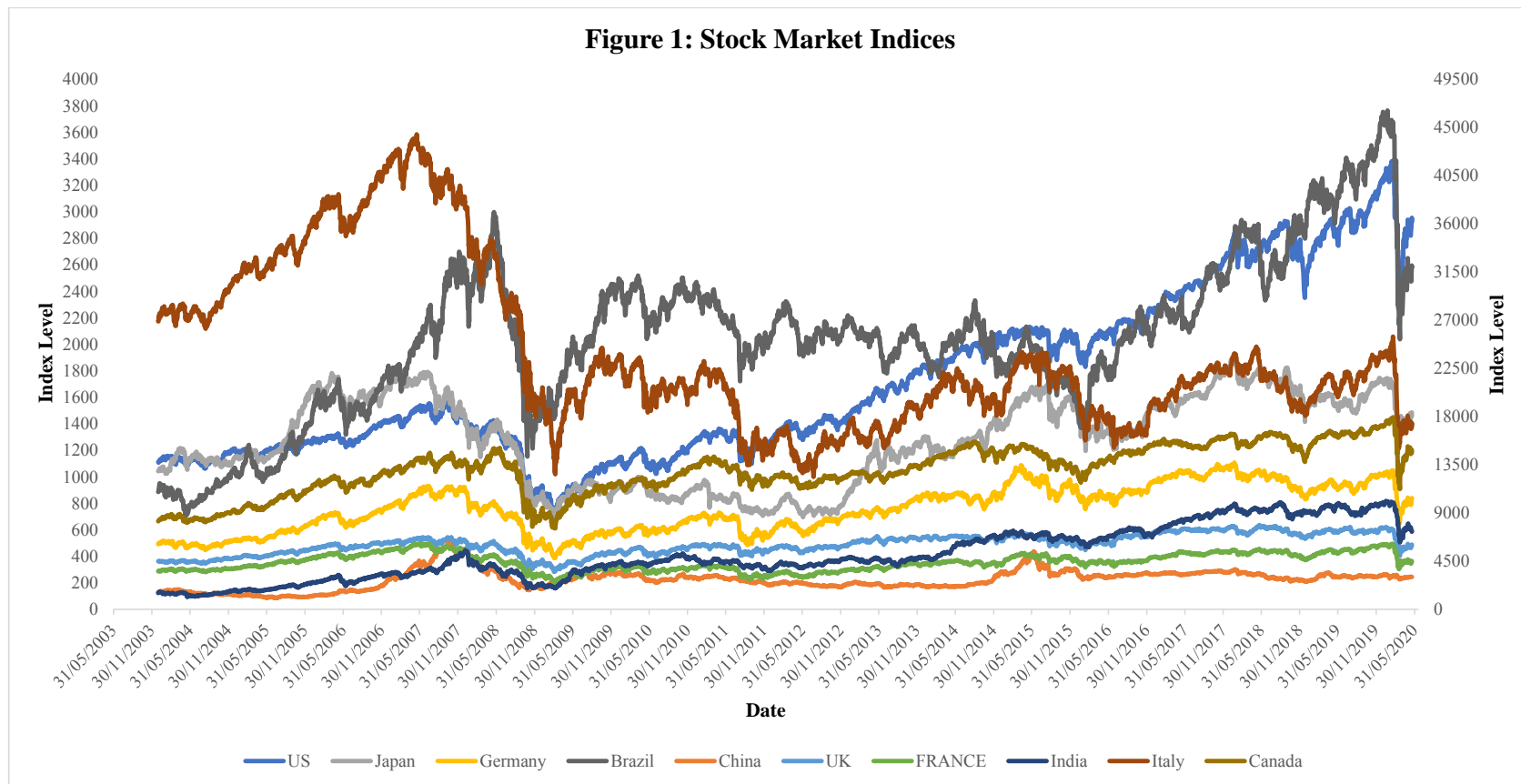


Figure 1: This figure displays the daily index level of the stock markets of all the ten largest economies in the world over the sample period. For the readers convenience, the index level of the US, Japan, Germany and Brazil is labelled on the left vertical axis, and the index level of other six countries is labelled on the right vertical axis

Therefore, we define the start date for GFC on September 12, 2008, and COVID on February 20, 2020.³

The interpretation of Equations (1) – (2) to see whether asset i serves as a safe haven during the GFC and COVID, is as follows. Parameter b_1 is the safe-haven asset's baseline (i.e. “normal” times, excluding GFC and COVID) beta with respect to the market in question. If parameter b_2 (including b_1) is non-positive and statistically significant (insignificant), then asset i serves as a strong (weak) safe haven from stock market losses during the GFC. Finally, if parameter b_3 (including b_1) is non-positive and statistically significant (insignificant) then asset i serves as a strong (weak) safe haven from stock market losses during the COVID.

3. Results and Discussion

3.1. Descriptive statistics

Table 1, Panel A summarises the descriptive statistics of the daily log-returns of all assets in our study. The average returns (mean) of the safe haven assets except Bitcoin varies between 0.005% to 0.033% per day, while the average returns of Bitcoin are 0.177% per day. The T-bill shows the lowest standard deviation, whereas Bitcoin, silver and gold show the highest standard deviation. Furthermore, the negative skewness and high excess kurtosis of gold, silver and Bitcoin imply a significant crash risk that counters their effectiveness as a safe haven asset. The other safe haven assets show positive skewness and high excess kurtosis that indicates the possibility of having extreme positive returns instead of extreme negative returns. The descriptive statistics suggest that Bitcoin, silver and gold possess characteristics of risky assets rather than safe haven assets.

³ Low et al. (2016) use September 12, 2008 as a start date of the 2008 GFC. The 2020 stock market crash started in late February 2020 from the uncertainty and threat of COVID-19 (e.g. Baker et al., 2020).

Table 1: Descriptive Statistics

Panel A summarises the descriptive statistics for the daily returns (%) denominated in US dollars of all assets, while Panel B shows correlations between all assets with respective *p* values in the parenthesis. The sample period starts on December 31, 2003 and ends May 19, 2020.

Panel A: Descriptive Statistics								
Variable	N	Mean	Median	Minimum	Maximum	Std Dev	Skewness	Kurtosis
Safe Haven Assets								
Gold	4274	0.0330	0.0340	-10.1620	6.8650	1.1120	-0.4635	5.7784
Silver	4274	0.0220	0.0290	-19.4890	12.4700	2.0390	-0.9328	7.3540
US Dollar Index	4104	0.0030	0.0000	-2.7170	2.5240	0.4960	0.0052	1.8987
Swiss Franc Index	4261	0.0100	-0.0010	-7.8070	14.9720	0.4530	7.1365	306.0240
T-bill	4274	0.0050	0.0020	-0.2000	0.1270	0.0110	0.7648	43.8954
Tbond	4274	0.0140	0.0100	-1.6880	1.7880	0.2270	0.1040	5.5616
Bitcoin	1479	0.1770	0.1920	-46.4730	22.5120	4.2350	-1.0573	13.9434
Tether	1357	0.0010	0.0000	-5.2570	5.6610	0.5600	0.7356	29.9309
Stock Market Returns								
US	4274	0.0230	0.0380	-12.7650	10.9570	1.2030	-0.5420	15.4573
China	4260	0.0200	0.0140	-10.4660	9.1570	1.5750	-0.5614	5.3733
Japan	4230	0.0070	0.0410	-15.8610	17.6870	1.4120	-0.2980	18.4972
Germany	4230	0.0120	0.0500	-13.7630	24.3950	1.5840	0.5218	22.6394
UK	4243	0.0010	0.0310	-12.1420	11.0000	1.3270	-0.4076	10.6399
France	4230	0.0040	0.0370	-13.5220	25.6200	1.6160	0.5387	23.2506
India	4226	0.0270	0.1000	-14.2330	19.3620	1.5730	-0.3626	12.7007
Italy	4230	-0.0120	0.0380	-18.9380	24.3370	1.7740	-0.0179	17.2532
Brazil	3806	-0.0110	0.0000	-18.8250	19.7850	2.2670	-0.3420	9.2452
Canada	4246	0.0140	0.0820	-13.4360	11.1600	1.3740	-1.0627	14.3581

Panel B: correlation matrix																		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Gold (1)	1																	
Silver (2)	0.6604 (0.0001)	1																
Dollar (3)	-0.3417 (0.0001)	-0.3854 (0.0001)	1															
Franc (4)	0.1092 (0.0001)	0.0370 (0.0158)	-0.0768 (0.0001)	1														
T-bill (5)	0.0612 (0.0001)	0.0007 (0.9627)	-0.0428 (0.0061)	0.0335 (0.0288)	1													
Tbond (6)	0.1072 (0.0001)	0.0195 (0.2023)	-0.1060 (0.0001)	0.0946 (0.0001)	0.2373 (0.0001)	1												
Bitcoin (7)	0.1120 (0.0001)	0.0783 (0.0026)	-0.0018 (0.9451)	0.0850 (0.0011)	-0.0388 (0.1361)	-0.0118 (0.6501)	1											
Tether (8)	-0.0436 (0.1088)	0.0374 (0.1687)	-0.0016 (0.9527)	0.0384 (0.159)	0.0236 (0.3844)	0.0106 (0.6965)	-0.0240 (0.3774)	1										
SP500 (9)	0.0020 (0.8977)	0.1334 (0.0001)	-0.1491 (0.0001)	-0.0959 (0.0001)	-0.1357 (0.0001)	-0.4018 (0.0001)	0.1379 (0.0001)	-0.0988 (0.0003)	1									
China (10)	0.0530 (0.0005)	0.0878 (0.0001)	-0.0445 (0.0044)	-0.0616 (0.0001)	-0.0282 (0.066)	-0.0538 (0.0004)	0.0215 (0.409)	0.0169 (0.5362)	0.0896 (0.0001)	1								
Japan (11)	0.0809 (0.0001)	0.1445 (0.0001)	-0.1089 (0.0001)	-0.1386 (0.0001)	-0.0380 (0.0135)	0.0164 (0.2855)	-0.0204 (0.4349)	0.0029 (0.9141)	0.0243 (0.1141)	0.2112 (0.0001)	1							
Germany (12)	0.1247 (0.0001)	0.2497 (0.0001)	-0.3044 (0.0001)	-0.1100 (0.0001)	-0.0903 (0.0001)	-0.2645 (0.0001)	0.0982 (0.0002)	-0.0731 (0.0072)	0.5790 (0.0001)	0.1576 (0.0001)	0.1435 (0.0001)	1						
UK (13)	0.1271 (0.0001)	0.2798 (0.0001)	-0.2909 (0.0001)	-0.1322 (0.0001)	-0.1436 (0.0001)	-0.2822 (0.0001)	0.0754 (0.0038)	-0.0825 (0.0024)	0.5744 (0.0001)	0.1722 (0.0001)	0.2436 (0.0001)	0.8041 (0.0001)	1					
France (14)	0.1151 (0.0001)	0.2512 (0.0001)	-0.3127 (0.0001)	-0.1196 (0.0001)	-0.1107 (0.0001)	-0.2765 (0.0001)	0.0933 (0.0003)	-0.0809 (0.0029)	0.5733 (0.0001)	0.1599 (0.0001)	0.1582 (0.0001)	0.9515 (0.0001)	0.8335 (0.0001)	1				
India (15)	0.0952 (0.0001)	0.1673 (0.0001)	-0.1048 (0.0001)	-0.1535 (0.0001)	-0.0653 (0.0001)	-0.1114 (0.0001)	0.0221 (0.3961)	-0.0838 (0.002)	0.2505 (0.0001)	0.2306 (0.0001)	0.2785 (0.0001)	0.3791 (0.0001)	0.4073 (0.0001)	0.3756 (0.0001)	1			
Italy (16)	0.0983 (0.0001)	0.2258 (0.0001)	-0.3179 (0.0001)	-0.1109 (0.0001)	-0.0969 (0.0001)	-0.2720 (0.0001)	0.1151 (0.0001)	-0.1130 (0.0001)	0.5398 (0.0001)	0.1380 (0.0001)	0.1416 (0.0001)	0.8845 (0.0001)	0.7645 (0.0001)	0.9193 (0.0001)	0.3445 (0.0001)	1		
Brazil (17)	0.1158 (0.0001)	0.2424 (0.0001)	-0.2245 (0.0001)	-0.1066 (0.0001)	-0.1291 (0.0001)	-0.2624 (0.0001)	0.1184 (0.0001)	-0.1302 (0.0001)	0.5718 (0.0001)	0.1813 (0.0001)	0.1811 (0.0001)	0.5300 (0.0001)	0.5868 (0.0001)	0.5462 (0.0001)	0.3638 (0.0001)	0.4949 (0.0001)	1	
Canada (18)	0.1984 (0.0001)	0.3359 (0.0001)	-0.2912 (0.0001)	-0.1008 (0.0001)	-0.1163 (0.0001)	-0.2962 (0.0001)	0.1382 (0.0001)	-0.0807 (0.003)	0.7289 (0.0001)	0.1512 (0.0001)	0.1537 (0.0001)	0.6210 (0.0001)	0.6625 (0.0001)	0.6335 (0.0001)	0.3334 (0.0001)	0.5867 (0.0001)	0.6394 (0.0001)	1

The average daily returns of stock market indices range between -0.012% (Italy) to 0.027 (India) per day. The standard deviation for each of the stock market indices is higher than all the safe-haven assets except Bitcoin and silver. Furthermore, all stock market indices exhibit negative skewness and high excess kurtosis, which indicates a significant crash risk. In sum, the descriptive statistics in Panel A suggest that the US Treasuries, US dollar, Swiss Franc and Tether could act as better safe havens than Bitcoin, gold and silver.

Table 1, Panel B, shows the correlations between the assets in our study. As expected, the correlation between gold and silver is positively correlated (0.66) and indicates that precious metals move in tandem. The correlation between gold and the US dollar is negatively correlated (-0.34) and indicates that these assets move in the opposite direction; thus, logically both assets cannot act as safe havens at the same time. The correlations between other safe haven assets are generally small, indicating that these assets do not have a tendency to move either in the same or in the opposite direction. Returns on the stock market indices for all ten countries are positively correlated to each other, with strong positive correlations between the US and Europe, and Canada and Brazil.

3.2. Maximum Losses during 2008 GFC and Covid-19 Pandemic

In this section, we examine the performance of safe haven assets during days of extreme stock market losses in the S&P500, during the 2008 GFC and COVID-19 pandemic. We use the S&P 500 stock market index since it is the proxy of the largest economy in the world, the US. Nonetheless, we find similar results for the stock markets of other nine countries as well.⁴

We expect assets to earn positive or, at worst, close to zero returns on the days of large stock market losses if they possess qualities of safe-haven assets.

⁴ We do not report the results of the other nine countries for the sake of brevity. However, those results are available upon request from the authors.

Table 2: Extreme Losses during the 2008 GFC and COVID-19 Pandemic

Panels A and B list the ten largest daily losses of S&P 500 returns and the respective returns of safe haven assets during the 2008 GFC and COVID-19 pandemic, respectively.

Panel B: Extreme losses of SP500 Index during 2008 GFC							
Date	SP500	Gold	Silver	Dollar	Franc	T-bill	T-bond
15/10/2008	-9.4700	0.9800	-8.2920	0.8445	-0.0750	0.0286	0.1385
01/12/2008	-9.3540	-4.9180	-8.6740	1.2182	0.6250	0.0206	1.0559
29/09/2008	-9.2000	1.0180	-3.5920	0.6735	-0.0860	0.0383	1.0870
09/10/2008	-7.9220	-1.7390	0.8720	0.3085	0.0830	-0.0022	-0.5695
20/11/2008	-6.9480	0.1400	-3.1430	0.7531	0.2270	0.0220	0.9694
19/11/2008	-6.3110	1.3450	-2.5470	-0.0687	-0.5900	0.0149	0.5528
22/10/2008	-6.2950	-3.3520	-6.2930	1.6297	1.1680	0.0144	0.2707
07/10/2008	-5.9110	1.6080	0.8400	-0.8730	0.3810	-0.0311	-0.3689
20/01/2009	-5.4260	3.1880	-0.3580	2.3589	-0.2510	0.0024	-0.1339
05/11/2008	-5.4120	-1.3490	3.1590	-0.2007	-0.5410	0.0212	0.2961

Panel B: Extreme losses of SP500 Index during COVID-19 Pandemic									
Date	SP500	Gold	Silver	Dollar	Franc	T-bill	T-bond	Bitcoin	Tether
16/03/2020	-12.7650	-1.8930	-12.3410	-0.6706	0.6740	0.0182	1.5490	-7.2650	-0.4986
12/03/2020	-9.9940	-4.8790	-4.7040	0.9898	0.5230	0.0182	-0.2671	-46.4730	5.3393
09/03/2020	-7.9010	-0.1390	-1.2090	-1.1003	0.7900	0.0219	0.7507	-2.3010	-1.0680
18/03/2020	-5.3220	-3.2240	-5.9590	1.5742	0.0010	0.0309	-1.0611	0.2450	-0.1945
11/03/2020	-5.0100	-0.3120	-1.0590	0.1037	-0.2030	0.0129	-0.2964	0.0210	-0.2914
27/02/2020	-4.5170	0.5210	-0.9990	-0.5673	0.0780	0.0216	0.3753	-0.4090	-0.4327
01/04/2020	-4.5150	-1.5180	-1.2220	0.7250	0.1800	0.0035	0.3195	2.5780	0.1712
20/03/2020	-4.4330	0.7770	2.0490	0.0584	-0.8110	0.0037	1.7885	0.1220	-0.5635
05/03/2020	-3.4510	1.1760	0.8520	-0.5356	0.0460	0.0358	0.6556	3.6280	0.1897
27/03/2020	-3.4270	-0.2470	-0.9710	-1.0617	0.3530	-0.0037	0.6890	-3.7410	1.4748

Table 2, Panel A reports the results of safe-haven assets on the ten days of the largest losses in the S&P 500 during the period of the GFC from September 12, 2008, to June 30, 2009. The results show that gold returns are positive for six of the 10 days; silver shows positive returns for only three days, and the remaining safe haven assets, Treasuries and currencies, are positive for at least seven out of ten days. These results imply that, with the exception of silver, the chosen candidate assets generally exhibit the characteristics of a safe haven during days of large stock market losses during the GFC.

Table 2, Panel B reports a counterpart analysis for candidate safe-haven assets across the ten days of largest losses in the S&P 500 during COVID, covering February 20, 2020, to May 19, 2020, our current sample end date. The results show that gold returns generally move in tandem with the ten extreme stock market losses in the S&P 500 during COVID, with seven negative gold returns. For instance, gold lost 4.90% of its value on March 12, 2020, when the S&P500 index incurred a 10% loss. Silver also moved in tandem with extreme stock market losses during COVID, with eight out of 10 negative silver returns. Five out of the ten US dollar returns were negative, but only two Swiss Franc returns were negative on the days of the largest 10 losses in the S&P500. Notably, the T-bills recorded only one negative return, while the T-bond recorded two negative returns. Bitcoin and Tether have five and six negative returns, respectively, but the magnitude of Bitcoin's negative returns is much larger than Tether's negative returns. For example, Bitcoin dropped in value by 46.5% on March 12, 2020, while Tether recorded the maximum loss of just 1.07% on March 9, 2020. In sum, the results in Panel B imply that gold, silver and Bitcoin fail to protect the wealth of investors on those days when they needed it the most.

3.3. Estimation Results

In this section, we examine the relationship between safe haven assets and stock market returns using the regression model in Equations (1) and (2). Based on the preliminary analysis

shown in Section 3.2, we expect gold to act as a safe haven asset during the GFC but not during the COVID-19 pandemic. Furthermore, we expect Treasuries and currencies to act as safe haven assets for both the GFC and COVID. Finally, while Tether might act as a safe haven during the COVID; we do not expect Bitcoin to act as a safe haven asset since it can lose extreme value during days of extreme stock market losses.

Tables 3, 4, 5, and 6 present the estimation results for metals, currencies, Treasuries, and cryptocurrencies, respectively. The tables include the parameter estimates of b_0 (constant), b_1 (hedge), the total effects during the 2008 GFC (sum of b_1 and b_2), and the total effect during the COVID-19 pandemic (sum of b_1 and b_3). All parameter estimates are multiplied by 100 for readability, while the t-statistics are provided in the parenthesis to determine the significance level of each coefficient.

3.3.1 Metals

Starting with gold, Panel A of Table 3 shows the parameter estimate, b_1 is positive for all ten countries and statistically significant for nine countries that indicates that gold does not serve as a hedge against the stock market indices except the US where it might act as a weak hedge. These results are generally consistent with Low et al. (2016) who show that gold is not a hedge for indices of several international markets. These results also partially corroborate Baur and McDermott (2010) who show that gold is not a hedge for most of the indices except North America using a sample between March 1979 and March 2009.

Most importantly, gold serves as a safe haven against the stock market losses for the ten countries during the GFC, strong safe haven against six, and weak safe haven against the other four countries that are generally consistent with the literature (e.g. Baur and McDermott, 2010; Low et al., 2016). Conforming to our expectations, gold fails to act as a safe haven against the stock market losses from all countries except Canada during COVID, where it serves as a weak

Table 3: Estimation results for Gold and Silver as safe haven assets during the 2008 GFC and Covid-19 pandemic

Table presents the estimation results of the role of gold and silver as a hedge and safe haven asset in the periods of stock market crises, such as the 2008 GFC and COVID-19 pandemic. The crisis duration is set to 20 trading days. The GFC starts on September 12, 2008, and ends October 10, 2008, while the COVID-19 pandemic starts on February 20, 2020, and ends March 18, 2020. The significant negative coefficients, b_1 , in the hedge row indicates that the asset is a strong hedge, while insignificant coefficients, b_1 , indicates a weak hedge. The significant negative coefficients, b_2 and b_3 , in the GFC and COVID rows indicate that the asset is a strong safe haven during the 2008 GFC and COVID-19 pandemic, respectively, while insignificant coefficients, b_2 and b_3 , indicate a weak safe haven during the 2008 GFC and COVID-19 pandemic, respectively. The t -statistics in the parenthesis refer to the marginal effect.

Panel A: Gold										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.031 (2.17)	0.031 (2.20)	0.032 (2.29)	0.033 (2.32)	0.031 (2.17)	0.033 (2.29)	0.030 (2.14)	0.033 (2.29)	0.025 (1.66)	0.026 (1.85)
Hedge (b_1)	1.170 (0.92)	3.660 (4.29)	5.880 (5.94)	6.760 (7.14)	10.080 (9.15)	5.930 (6.3)	5.620 (5.67)	3.960 (4.82)	6.550 (9.45)	19.170 (16.09)
GFC (b_2)	-19.870 (-2.78)	-18.240 (-2.26)	-4.000 (-1.06)	1.200 (-0.46)	-15.430 (-1.8)	-5.700 (-1.09)	-26.310 (-2.08)	-4.740 (-0.8)	-14.330 (-5.13)	-7.360 (-3.32)
COVID (b_3)	13.430 (4.47)	73.360 (11.12)	45.230 (6.75)	28.190 (4.75)	29.430 (4.13)	26.020 (4.98)	31.770 (6.19)	15.400 (4.53)	9.610 (1.57)	17.840 (-0.47)

Panel B: Silver										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.012 (0.44)	0.017 (0.63)	0.023 (0.87)	0.025 (0.94)	0.021 (0.82)	0.026 (0.98)	0.018 (0.69)	0.022 (0.82)	0.014 (0.53)	0.004 (0.14)
Hedge (b_1)	23.060 (9.75)	8.750 (5.53)	14.510 (7.43)	26.740 (16.60)	36.590 (20.60)	25.640 (16.67)	16.520 (9.39)	19.020 (14.21)	21.410 (17.32)	56.550 (27.15)
GFC (b_2)	-3.530 (-1.99)	16.880 (0.52)	27.730 (1.35)	47.830 (1.61)	35.905 (-0.05)	35.180 (0.78)	36.790 (1.30)	36.680 (1.39)	5.920 (-2.41)	42.340 (-1.11)
COVID (b_3)	11.410 (-3.37)	168.050 (17.76)	129.490 (13.76)	76.930 (11.86)	82.530 (9.72)	76.180 (11.86)	112.540 (17.30)	8.960 (-3.69)	50.770 (8.14)	8.250 (-16.13)

safe haven. However, the estimate of the total effect is positive, which indicates that the positive relationship between gold and Canada weakened during COVID.

Panel B shows that silver does not act as a hedge for the ten countries, consistent with the findings of Low et al. (2016). In fact, parameter estimate, b_I , shows that silver generally moves in tandem with stock market returns. Furthermore, silver serves as a strong, safe haven only for the US and Brazil during the GFC. However, the estimate of the total effect is positive for Brazil, which indicates that the positive relationship between silver and Brazil weakened during the GFC. Silver acted as a weak safe haven for the UK and Canada during the GFC; however, the total effect estimate is positive for both the UK and Canada, which implies that the positive relationship between silver and these countries weakened during the GFC. The total effects estimates are positive and relatively large for the other six countries implying that silver does not act as a safe haven despite the statistical insignificance. The non-significance of the positive coefficient estimates must be treated with care since it is based on observations of 20 trading days.

Silver does not act as a safe haven against stock market losses across all countries except the US, Italy and Brazil; however, the estimates of the total effect are also positive for these countries suggesting that the positive relationship between silver and stock market indices of the US, Italy and Brazil weakened during COVID. In sum, the results in Table 3 strongly refutes the use of gold and silver as safe havens during COVID and suggest that gold and silver could lose its safe haven status during pandemics. Section 4 provides further explanation of gold losing its status of a safe haven asset during COVID.

3.3.2 Currencies

Table 4, Panel A shows that the US dollar serves as a strong hedge for the ten countries except for China, where it serves as a weak hedge. Furthermore, it serves as a safe haven against the stock market losses for all the countries except the US and Brazil during the GFC; however,

Table 4: Estimation results for US Dollars and Swiss Francs as safe haven assets during the 2008 GFC and Covid-19 pandemic

Table presents the estimation results of the role of US Dollar and Swiss Franc as a hedge and safe haven asset in the periods of stock market crises, such as the 2008 GFC and COVID-19 pandemic. The crisis duration is set to 20 trading days between the start and end dates. The GFC starts on September 12, 2008, and ends October 10, 2008, while COVID-19 pandemic starts on February 20, 2020, and ends March 18, 2020. The significant negative coefficients, b_1 , in the hedge row indicates that the asset is a strong hedge, while insignificant coefficients, b_1 , indicates a weak hedge. The significant negative coefficients, b_2 and b_3 , in the GFC and COVID rows indicate that the asset is a strong safe haven during the 2008 GFC and COVID-19 pandemic, respectively, while insignificant coefficients, b_2 and b_3 , indicate a weak safe haven during the 2008 GFC and COVID-19 pandemic, respectively. The t -statistics in the parenthesis refer to the marginal effect.

Panel A: US Dollar Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.005	0.002	0.002	0.002	0.002	0.002	0.001	0.000	0.003	0.005
	(0.75)	(0.29)	(0.22)	(0.34)	(0.24)	(0.29)	(0.14)	(0.01)	(0.36)	(0.78)
Hedge (b_1)	-6.100	-0.663	-3.060	-8.630	-9.020	-8.840	-1.910	-8.300	-3.940	-11.380
	(-9.49)	(-1.51)	(-6.12)	(-18.99)	(-16.42)	(-20.19)	(-3.85)	(-21.21)	(-11.58)	(-20.05)
GFC (b_2)	5.210	-13.953	-9.360	-14.410	-13.070	-12.090	-9.020	-13.550	-1.420	-8.200
	(5.48)	(-4.55)	(-3.92)	(-2.45)	(-1.41)	(-1.25)	(-2.19)	(-2.51)	(2.00)	(1.11)
COVID (b_3)	4.480	-2.223	3.850	-0.380	-0.370	0.300	-3.870	0.980	1.460	2.260
	(10.67)	(-0.74)	(4.35)	(6.71)	(6.69)	(8.42)	(-1.14)	(11.22)	(8.07)	(14.56)

Panel B: Swiss Franc Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	-0.002	-0.001	0.002	0.002	0.001	0.002	0.001	0.003	0.036	0.005
	(-0.47)	(-0.17)	(0.34)	(0.51)	(0.17)	(0.44)	(0.21)	(0.65)	(7.09)	(1.07)
Hedge (b_1)	0.630	0.191	-2.610	-1.700	-6.260	-1.470	-0.847	-2.490	-1.520	-5.200
	(1.46)	(0.68)	(-7.15)	(-5.57)	(-17.51)	(-4.86)	(-2.92)	(-9.74)	(-5.20)	(-12.58)
GFC (b_2)	-1.290	-9.749	-8.440	-8.000	-10.310	-7.910	-12.227	-8.170	-3.460	-6.116
	(-0.58)	(-2.71)	(-2.49)	(-2.08)	(-1.66)	(-2.14)	(-1.64)	(-2.06)	(-1.56)	(-0.34)
COVID (b_3)	-5.240	-9.829	-8.400	-6.120	-7.027	-6.110	-7.517	-5.050	-3.460	-5.027
	(-5.60)	(-3.94)	(-3.60)	(-4.30)	(-0.73)	(-4.67)	(-4.25)	(-3.70)	(-2.34)	(0.19)

the total effect estimate is negative for Brazil indicating that the negative relationship between US dollar and Brazilian stock market is weakened during the GFC. The US dollar does not act as a safe haven from the stock market losses for the countries except China and India where it serves as a weak safe haven; however, the estimate of the total effect is negative for UK and Germany indicating a weakness in the negative relationship during COVID.

Table 4, Panel B shows that the Swiss Franc serves as a strong hedge for the ten countries except for China and the US, where it serves as a weak hedge. Furthermore, it serves as a safe haven against the stock market losses for all the countries during the GFC and COVID. In sum, the results in Table 4 indicate that the Swiss Franc has maintained its role as a safe haven asset during COVID. On the other hand, the US dollar is less effective as a safe haven for the majority of the stock markets during COVID.

3.3.3 Treasuries

Table 5, Panel A, shows that the T-bill is a strong hedge for the US, Germany, UK, France, Italy, and Canada; whereas, a weak hedge for the other four countries. Furthermore, the T-bill serves as a strong safe haven during the GFC for all the countries except the US and China, where it serves a weak safe haven. Moreover, the T-bill has maintained its safe haven status during COVID and serves as a strong safe haven for all the countries except Italy and Brazil, where it serves a weak safe haven.

Table 5, Panel B, shows that the T-bond is a strong hedge for all the countries except Japan, where it serves as a weak hedge. Similar to the results in Panel A for the T-bill, the T-bond also serves as a strong safe haven for all the countries except Japan during the GFC, where it serves as a weak safe haven. Although T-bond also serves as a safe haven for all the countries during COVID, it is a weak safe haven except for Japan, China and Brazil where it serves as a strong safe haven. In sum, the results in Table 5 suggest that Treasuries acts as a safe haven asset cross

Table 5: Estimation results for T-bill and T-bond as safe haven assets during the 2008 GFC and Covid-19 pandemic

Table presents the estimation results of the role of T-bill and T-bond as a hedge and safe haven asset in the periods of stock market crises, such as the 2008 GFC and COVID-19 pandemic. The crisis duration is set to 20 trading days from the start and end dates The GFC starts on September 12, 2008, and ends October 10, 2008, while the COVID-19 pandemic starts on February 20, 2020, and ends March 18, 2020. The significant negative coefficients, b_1 , in the hedge row indicates that the asset is a strong hedge, while insignificant coefficients, b_1 , indicates a weak hedge. The significant negative coefficients, b_2 and b_3 , in the GFC and COVID rows indicate that the asset is a strong safe haven during the 2008 GFC and COVID-19 pandemic, respectively, while insignificant coefficients, b_2 and b_3 , indicate a weak safe haven during the 2008 GFC and COVID-19 pandemic, respectively. The t -statistics in the parenthesis refer to the marginal effect.

Panel A: US Treasury Bills Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.001 (16.10)	0.001 (13.03)	0.001 (12.84)	0.001 (14.57)	0.001 (12.89)	0.001 (12.97)	0.002 (12.74)	0.001 (13.16)	0.001 (12.25)	0.001 (12.93)
Hedge (b_1)	-0.014 (-3.49)	0.001 (0.12)	0.007 (0.97)	-0.010 (-2.42)	-0.015 (-2.31)	-0.013 (-2.13)	-0.007 (-1.15)	-0.009 (-1.84)	-0.005 (-1.23)	-0.013 (-2.00)
GFC (b_2)	-0.126 (-1.62)	0.052 (0.37)	-0.237 (-5.81)	-0.295 (-3.31)	-0.493 (-9.14)	-0.352 (-3.85)	-0.600 (-25.34)	-0.302 (-3.55)	0.038 (1.75)	-0.315 (-7.04)
COVID (b_3)	-0.094 (-2.14)	-0.494 (-4.06)	-0.261 (-5.40)	-0.215 (-2.95)	-0.215 (-2.95)	-0.185 (-2.13)	-0.327 (-5.96)	-0.122 (-1.36)	-0.048 (-1.54)	-0.104 (-3.24)
Panel B: US Treasury Bonds Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.015 (5.36)	0.012 (4.14)	0.011 (3.85)	0.012 (4.40)	0.012 (4.24)	0.012 (4.34)	0.012 (4.16)	0.012 (4.17)	0.011 (3.74)	0.012 (4.30)
Hedge (b_1)	-8.120 (-30.27)	-0.633 (-3.32)	-0.082 (-0.38)	-3.780 (-19.49)	-4.220 (-18.06)	-3.870 (-20.50)	-1.250 (-5.76)	-3.210 (-18.96)	-1.870 (-12.61)	-4.410 (-17.77)
GFC (b_2)	-10.460 (-3.08)	-9.703 (-6.74)	1.548 (1.65)	-6.930 (-4.63)	-8.490 (-6.52)	-7.370 (-6.07)	-9.800 (-8.06)	-6.810 (-5.93)	-5.540 (-11.05)	-10.280 (-8.54)
COVID (b_3)	-8.186 (-0.08)	-9.133 (-4.14)	-11.472 (-7.73)	-2.760 (1.04)	-4.438 (-0.22)	-3.144 (0.83)	-2.560 (-1.07)	-2.735 (0.66)	-2.960 (-1.72)	-4.192 (0.24)

all countries during both crises which provides strong empirical support to Brunnermeier et al. (2020) who propose US Treasuries as a global safe asset in times of the crisis.

3.3.4 Cryptocurrencies

Table 6, Panel A shows that the parameter estimate, b_I , is positive for all countries except Japan and India which indicates that Bitcoin does not serve as an effective hedge for the majority of the countries in our study.⁵

Most importantly, the total effect estimates for COVID are all positive and statistically significant, implying that Bitcoin moves in tandem with the stock market losses and does not serve as a safe haven during the COVID.

Table 6, Panel B, shows that Tether is a weak hedge for all the countries except Germany. Furthermore, Tether serves as a strong safe haven against stock market losses for all the countries during COVID. Therefore, it is evident that Tether, the largest stablecoin, exhibits strong safe haven properties during a market turmoil because it is backed by traditional currencies and other assets. On the other hand, the largest traditional cryptocurrency, Bitcoin, suffers huge losses instead of serving as a safe haven asset.

3.3.5 Summary

Gold has acted as a safe haven asset during the GFC but loses its safe haven status during the COVID. Silver fails to exhibit safe haven characteristics during both crises. For currencies, the Swiss Franc has acted as a safe haven during both the crises; whereas, US dollar has served as a safe haven during the GFC but not for the majority of the countries during COVID. The Treasuries have exhibited safe haven characteristics during both the crisis. For cryptocurrencies, only Tether, a stablecoin, has acted as a safe haven asset during COVID.

⁵ The sample period for cryptocurrencies starts September 17, 2014. Therefore, we estimate Equations (1) and (2) without the 2008 GFC dummy.

Table 6: Estimation results for Bitcoin and Tether as a safe haven asset during Covid-19 pandemic

Table presents the estimation results of the role of Bitcoin and Tether as a hedge and safe haven assets during the COVID-19 pandemic. The crisis duration is set to 20 trading days starting on February 20, 2020, and ending March 18, 2020. The significant negative coefficients, b_1 , in the hedge row indicates that the asset is a strong hedge, while insignificant coefficients, b_1 , indicates a weak hedge. Significant negative coefficients, b_2 , in the COVID row indicate that the asset is a strong safe haven during the COVID-19 pandemic, while an insignificant b_2 indicates a weak safe haven. The t -statistics in the parenthesis refer to the marginal effect. The t -statistics in the parenthesis refer to the marginal effect.

Panel A: Bitcoin										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.194	0.202	0.204	0.205	0.202	0.204	0.208	0.207	0.210	0.201
	(1.96)	(2.04)	(2.03)	(2.06)	(2.04)	(2.04)	(2.1)	(2.07)	(2.13)	(2.03)
Hedge (b_1)	12.230	8.090	-16.170	3.900	0.627	2.890	-0.492	4.680	3.450	11.100
	(1.44)	(2.09)	(-1.99)	(0.59)	(0.08)	(0.43)	(-0.06)	(0.82)	(0.72)	(1.43)
COVID (b_2)	181.920	482.560	352.910	219.580	224.677	211.660	287.158	165.660	121.710	150.990
	(14.04)	(32.12)	(19.51)	(19.1)	(17.49)	(18.19)	(23.95)	(15.5)	(16.25)	(14.45)

Panel B: Tether										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.001	-0.004	-0.008	0.010	-0.003	-0.002	-0.003	-0.003	-0.004	-0.005
	(0.05)	(-0.50)	(-1.17)	(7.53)	(-0.49)	(-0.25)	(-0.37)	(-0.45)	(-0.51)	(-0.85)
Hedge (b_1)	0.404	-0.118	-0.528	1.980	-0.186	0.141	-0.011	-0.050	-0.206	-0.410
	(0.51)	(-0.21)	(-0.79)	(29.4)	(-0.31)	(0.26)	(-0.02)	(-0.09)	(-0.69)	(-0.64)
COVID (b_2)	-14.056	-21.778	-21.728	-6.410	-11.826	-11.009	-20.031	-9.660	-9.286	-6.560
	(-7.45)	(-9.25)	(-8.21)	(-10.19)	(-8.44)	(-9.46)	(-10.07)	(-8.81)	(-6.31)	(-7.31)

4. Potential Explanations

The most surprising finding from Section 3 is that the gold has lost its safe haven status during the COVID-19 pandemic. Traditionally, gold is considered as one of the most effective safe haven assets, and it has exhibited safe haven characteristics during the previous crises such as the 1987 stock market crash and the GFC (e.g. Baur and McDermott, 2010).

Figure 2 plots the gold price from January 1, 1990, to May 19, 2020. It is evident from Figure 2 that gold attained the maximum price of \$1898.25 on September 5, 2011 and lost its peak value by 45% by December 17, 2015. Therefore, investors might have lost their trust in the gold as a safe haven asset since a loss of 45% over four years indicates instability in gold prices. Therefore, we examine the performance of gold as a safe haven asset during extreme stock market movements after September 5, 2011. As in Baur and Lucey (2010), we define extreme stock market movements where stock market return at time t are in a low quantile, such as the 10%, 5%, and 1% quantile. To the extent, gold has lost its status of a safe haven among investors due to the extreme losses between 2011 and 2015; we hypothesize that gold does not act as a safe haven during extreme stock market movements. We estimate the following regression model first proposed and utilized by Baur and Lucey (2010):

$$RGold_t = b_0 + b_1 \cdot RS_{j,t} + b_2 \cdot D_{q10} \cdot RS_{j,t} + b_3 \cdot D_{q5} \cdot RS_{j,t} + b_4 \cdot D_{q1} \cdot RS_{j,t} + \varepsilon_t \quad (3)$$

Equation (3) models the relation of gold and stock market returns. The dummy variables, D , capture extreme stock market movements, taking a value of one if stock market return at time t is in the low quantile, such as 10%, 5% and 1%, and zero otherwise. The residual term ε_t is modelled as a GJR-GARCH process introduced by Glosten et al. (1993) as defined in Equation (2).

The gold is a hedge for the stock market j if the parameter b_1 is zero (weak hedge) and negative and significant (strong hedge), and the sum of parameters from b_2 to b_4 are not jointly

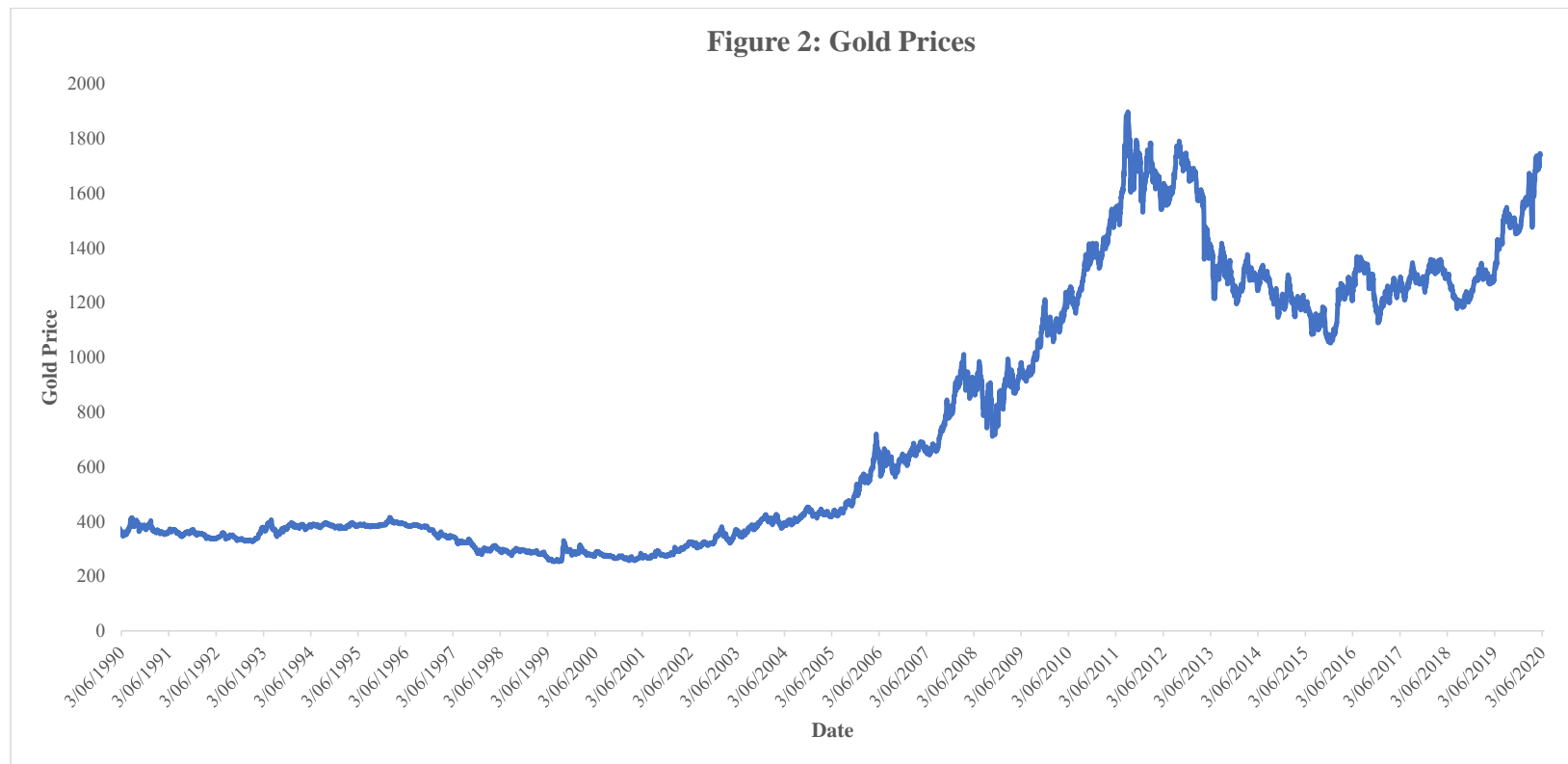


Figure 1: This figure displays the daily gold prices in US dollars from 1990 to 2020. The gold prices are labelled on the vertical axis, and date on the horizontal axis.

Table 7: Estimation results for gold as a safe haven in extreme market conditions

Table presents the estimation results of the role of gold as a hedge and safe haven asset during the periods of extreme market conditions namely, quantile 10% (b_2), 5% (b_3), and 1% (b_4). A significant negative coefficient, b_1 , in the hedge row indicates that an asset is a strong hedge, while an insignificant coefficient, b_1 , indicates a weak hedge. The significant negative coefficients b_2 , b_3 , and b_4 indicate that asset is a strong safe haven; whereas, insignificant coefficients indicates that asset is a weak safe haven. The t -statistics in the parenthesis refer to the marginal effect.

Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	-0.018	-0.011	-0.013	-0.001	-0.009	-0.011	-0.017	0.007	0.001	-0.019
	(-0.95)	(-0.54)	(-0.63)	(-0.05)	(-0.47)	(-0.57)	(-0.89)	(0.37)	(0.08)	(-0.99)
Hedge (b_1)	3.390	4.130	2.370	-2.650	2.540	-1.190	1.220	-2.870	3.230	14.530
	(1.51)	(2.06)	(1.29)	(-1.70)	(1.23)	(-0.72)	(0.62)	(-2.15)	(2.75)	(6.39)
Quantile 10% (b_2)	1.110	4.101	-0.180	-7.030	-6.690	-12.390	-14.980	3.970	10.870	5.040
	(-0.38)	(-0.01)	(-0.49)	(-0.91)	(-1.66)	(-2.24)	(-3.26)	(1.65)	(2.16)	(-1.65)
Quantile 5% (b_3)	-16.140	1.491	-4.570	0.320	0.350	-3.460	-4.830	1.720	-2.210	-6.920
	(-2.75)	(-0.52)	(-0.80)	(1.57)	(1.31)	(1.87)	(2.05)	(-0.53)	(-3.41)	(-2.04)
Quantile 1% (b_4)	6.670	-3.949	-3.270	4.600	8.190	4.440	9.360	-4.570	11.810	21.480
	(5.32)	(-1.80)	(0.35)	(1.70)	(2.36)	(3.25)	(3.66)	(-2.89)	(4.98)	(7.21)

positive exceeding the value of b_1 . If parameter b_2 , b_3 and b_4 (including b_1) are non-positive and statistically significant (insignificant), then gold serves as a strong (weak) safe haven.

For extreme negative stock market returns, half of the parameter estimates are positive for the 10% quantile; whereas four of the coefficient estimates are positive for 5% quantile. Most importantly, eight out of ten parameter estimates are positive for the most extreme quantile, 1%, which indicates that gold does not serve as a safe haven for adverse market returns. Therefore, gold has lost its status as a safe haven for extreme adverse market conditions since 2011. As previously mentioned, it could be that gold attained its peak value on September 5, 2011, and lost it by 45% over the next four years, and consequently, investors lost trust in gold as a stable asset.

5. Conclusion

This paper examines the performance of gold, silver, US Treasuries, US dollar, Swiss Franc, Bitcoin and Tether as safe haven assets from stock market losses of the world's largest ten economies during the 2008 GFC and COVID-19 pandemic. Our findings show that US Treasuries and Swiss Franc protect investors from stock market losses during both crises, which indicate that investors trust US Treasuries and Swiss Franc during both the GFC and the COVIDc. For the US dollar, our results show that it acts as a safe haven during the GFC, but it does not act as an effective safe haven during COVID. The most surprising finding comes from the gold that has acted as a safe haven during the GFC but not during the COVID1. Silver does not exhibit safe haven characteristics during both crises. Our results show that Bitcoin does not protect investors wealth during COVID, but the largest stablecoin, Tether that acts as an effective safe haven for the ten largest economies.

Our findings also show that investors from both developed and emerging markets not only seek the shelter of a safe haven asset in the same way during both crises but also choose the same safe haven assets. For instance, investors from the ten largest economies including the

emerging markets of China, India and Brazil choose gold as a haven asset during the GFC, but investors from those ten countries might have stayed away from gold as a safe haven during COVID.

We also explain why gold loses its value as a safe haven asset during COVID when, traditionally, it acted as a safe haven asset during the previous stock market crises of 1987 and the GFC. We suggest that investors might have lost trust in gold as a stable asset after losing 45% of its value between 2011 to 2015. Furthermore, investors now have access to more safe haven assets for shelter during crises, such as derivatives and stablecoins.

The findings are useful for investors and fund managers searching for the best safe haven, such as gold, silver, Treasuries, currencies and cryptocurrencies to offset large stock market losses. Furthermore, the results suggest that investors should prefer liquid and stable assets such as Tether and Treasuries during a pandemic rather than gold. Therefore, central banks, financial institutions and regulatory authorities should consider supporting financial assets that remain liquid during stock market crises. Future research endeavours should identify other safe haven assets during COVID.

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