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

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A R T I C L E I N F O

A B S T R A C T

We compare the performance of safe-haven assets during the Global Financial Crisis (GFC) and COVID-19 pandemic. First, regarding the GFC, we find, intermediate (weak) safe haven evidence for US dollar, Swiss franc and T-bonds (Gold, Silver and T-bills). Second, with regard to COVID, we find gold is very risky in some settings, while silver has become extremely risky. Collectively, our findings suggest that the character of safe-haven assets has changed between the crises. Therefore, investors should exercise extreme care when investing in potential safe-haven assets during times of market stress.

1. Introduction

In this paper, we examine the success of a wide array of claimed safe-haven assets during two stressful stock market regimes – the 2008 Global Financial Crisis (GFC) versus COVID-19 pandemic. COVID provides an enticing research setting in which to examine whether the traditional safe assets[1] provide protection from stock market losses, given the unique nature of this twin health/economic crisis.[2] Indeed, we are motivated by an emerging pattern of conflicting statements in the financial press, along with a growing lack of consensus in the academic literature, regarding the performance of traditional safe havens such as gold and silver during COVID. For instance, several financial press articles claim gold and silver as safe havens during COVID (e.g. Fenton, 2020; Iyer, 2020; Tan, 2020); whereas, several others suggest the opposite (e.g. Mazneva, 2020; Vasquez, 2020).

Our basic research question is – do traditional assets that were safe havens during the GFC (e.g. Baur & McDermott, 2010; Low, Yao, & Faff, 2016) maintain their safe haven status during the COVID-19 pandemic? Further, COVID-19 provides us the opportunity to examine whether

high-rated US corporate bonds (AAA-grade) offer any type of safe haven shelter, since the largest multinational firms are hoarding almost three times more cash reserves in recent years relative to the 2001 levels (e.g. Faulkender, Hankins, & Petersen, 2019) that could insulate them from the stock market crisis during COVID.

Unforeseen and unanticipated events such as the 1987 stock market crash and the 2008 Global Financial crisis (GFC), trigger flight to quality episodes where investors transfer their investments from risky to safe assets (e.g. Adrian, Crump, & Vogt, 2019; Baele, Bekaert, Inghelbrecht, & Wei, 2020; Caballero & Krishnamurthy, 2008). It is well claimed in the literature that gold (e.g. Baur & Lucey, 2010; Białkowski, Bohl, Stephan, & Wisniewski, 2015; Hillier, Draper, & Faff, 2006; Pullen, Benson, & Faff, 2014); US Treasury bills and bonds (e.g. Baur, Dimpfl, & Kuck, 2021; Chan, Treepongkaruna, Brooks, & Gray, 2011; Fleming, Kirby, & Ostdiek, 1998; Hartmann, Straetmans, Vries, & d., 2004; Noeth & Sengupta, 2010); and currencies such as the US dollar and the Swiss franc (e.g. Grisse & Nitschka, 2015; Kaul & Sapp, 2006; Ranaldo & Söderlind, 2010) act as safe havens during periods of stock market turmoil. However, Baur and Lucey (2010) and Chan et al. (2011) suggest

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[1] The traditional safe havens are gold and silver, and to a lesser extent, US Treasury bills and bonds, the US dollar, and the Swiss franc.
[2] 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. Stock markets around the world plummeted to their lowest levels since the 2008 Global Financial Crisis (GFC) (BBC, 2020). Further, COVID negatively impacted stock markets more than any previous infectious disease outbreak, including the 1918 Spanish Flu (Baker et al., 2020).

that Treasury bonds possess better properties than gold as a safe haven during stock market crises.[3] Moreover, Brunnermeier, Merkel, and Sannikov (2020) propose US Treasuries as a global safe asset in times of crisis.

Our empirical strategy on the efficacy of safe-haven assets, meaningfully diverges from the existing literature in three ways. First, existing studies generally examine just one or two safe haven assets (e.g. Baur & McDermott, 2010). In contrast, we provide a comprehensive and comparative empirical scrutiny in one unified and integrated analysis, across seven alternative candidates.

Second, existing studies use an overly simple two-dimensional criteria (sign and statistical significance) to differentiate between "weak" and "strong" safe havens, [e.g. weak (strong) safe haven status is defined as an asset that is uncorrelated (significantly negatively correlated) with another asset during stock market crises]. Instead, we apply three-dimensional criteria (by adding economic magnitude) to more meaningfully characterize a trichotomy of situations: "weak", "intermediate" and "strong" safe havens. We argue that this alternative classification is much better aligned with the practical economic experience of safe-haven assets from the perspective of investors.

Finally, existing studies (e.g. Baur & McDermott, 2010; Low et al., 2016) commonly report the effect of stock market crises on safe haven assets with incremental *significance* which is prone to distorted conclusions. In contrast, we explicate the impact of such crises on candidate safe-haven assets based on the significance of total effects.

A growing number of studies examine the impact of COVID-19 on the financial markets and financial assets (e.g. Al-Awadhi, Al-Saifi, Al-Awadhi, & Alhamadi, 2020; Alfaro, Chari, Greenland, & Schott, 2020; Baker et al., 2020; Kristoufek, 2020; Ramelli & Wagner, 2020; Zhang, Hu, & Ji, 2020). Further, during the several-year development of our paper, a range of contemporary working papers and recent articles also focus on the safe haven assets during COVID and provide contrasting results (e.g. Akhtaruzzaman, Boubaker, Lucey, & Sensoy, 2021; Conlon, Corbet, & McGee, 2020; Conlon & McGee, 2020; Corbet, Hou, Hu, Larkin, & Oxley, 2020; Corbet, Larkin, & Lucey, 2020; Disli, Nagayev, Salim, Rizkiah, & Aysan, 2021; Ji, Zhang, & Zhao, 2020; Mariana, Ekaputra, & Husodo, 2021).[4] For instance, Akhtaruzzaman et al. (2021) find that gold serves as a safe haven asset during Phase I (31 Dec 2019–16 Mar 2020) of the COVID pandemic but lost safe haven status during Phase II (17 Mar −24 April 2020).[5] Furthermore, Ji et al. (2020) compare the performance of safe haven assets between August–December 2019 and December 2019–March 2020, and find that gold and soybean futures remain as safe haven assets during COVID. Using a limited data sample (December 31, 2019 - May 28, 2020), Salisu, Raheem, and Vo (2021) find that gold serves as a safe haven during the pandemic. But, none of these studies compare the performance of safe haven assets between the GFC and COVID. Moreover, the choice of the beginning date of COVID-19 pandemic in these studies started well before the turmoil in the stock markets.

Accordingly, 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-bills and T-bonds); and (d) US corporate bonds (AAA-grade) from stock market losses during the GFC and COVID. We select the stock markets from the world's 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.

Our main findings are summarized as follows. First, with regard to the GFC crisis, we find intermediate (weak) safe haven status for the US dollar, the Swiss franc and T-bonds (Gold, Silver and T-bills) during the 2008 GFC. Second, with regard to the COVID crisis, we find that gold is very risky in some settings, especially in China and Japan. Further, silver is very risky right across the board. Third, we find general evidence of a weakening of safe-haven character during COVID (compared to the GFC), especially for the traditional safe-haven assets, gold and silver, but also in the case of the US dollar and the T-bonds.

Our primary contribution to knowledge is captured by the following collection of insights. Traditional safe-haven assets, gold and silver are not reliable protectors of investor wealth in all stressful markets or settings. Instead, other alternatives like the Swiss franc, and AAA-grade corporate bonds are candidates worthy of serious consideration. Collectively, our analysis shows that the character of safe haven assets has changed substantially between the two big crises of our time and, as such, there is a major diversity of experience possible across alternative candidates. Finally, in answering the question posed in our paper's title: while some safe haven assets provide some shelter during COVID (at least for now), others are definitely NOT really that safe – to the point where they are down-right dangerous. Our bottom-line message is simple: investors should exercise extreme care when seeking to invest in safe haven assets during times of market stress.

2. Research method and preliminary analysis

2.1. Data and sampling

Our analysis encompasses 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, MSCI France Index, NIFTY 500 Index India, MSCI Italy Index, Brazil Stock Exchange Index (BOVESPA), and TSX composite Index Canada. All empirical constructs are denominated in US dollars, allowing a direct and fair 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 bills index (T-bills) and S&P US Treasury bonds index (T-bonds)); and corporate bonds (S&P 500 AAA-grade bonds index). US dollar index and Swiss franc index represent the value of the US dollar and Swiss franc relative to a basket of foreign currencies, respectively. DataStream International provides all data except for the Swiss franc index which is collected from the online database of the Swiss National Bank. The sample period starts January 01, 1990 and ends December 31, 2021.

2.2. Basic safe-haven model

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

$$RA_{i,t} = b_0 + b_1 \bullet RS_{j,t} + b_2 \bullet GFC \bullet RS_{j,t} + b_3 \bullet COVID \bullet RS_{j,t} + \varepsilon_t \tag{1}$$

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

where $I_t = \begin{cases} 1 \text{ if} & \varepsilon_{t-1} < 0 \\ 0 \text{ otherwise} \end{cases}$ where RA_i represents the log return of each given safe-haven asset i. RS_j denotes the daily log returns of a stock market index j, with j equal to a given one of the ten countries in our sample. *GFC* (*COVID*) is a dummy variable, which takes the value one from the designated start date (explained shortly) until the

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[3] Gold is a safe haven against the US dollar (Reboredo, 2013), and it also provides strong downside risk reduction for stock market investors over short and medium investment horizon (Bredin, Conlon, & Potì, 2017). Lucey and Li (2015) show gold is not always the strongest safest haven. There are times when silver, platinum and palladium provide better safe haven protection than gold.

[4] Disli et al. (2021) find that gold, oil, and Bitcoin do not serve as safe-haven asset for traditional, sustainable, and Islamic investors during the COVID-19 pandemic. Hasan, Hassan, Rashid, and Alhenawi (2021) find that the Islamic stock index and Tether act as safe havens during the COVID-19 pandemic.

[5] The stock markets did not experience any turmoil before February 19, 2020. In fact, the S&P500 gained 5.1% between December 31, 2019 and February 19, 2020.
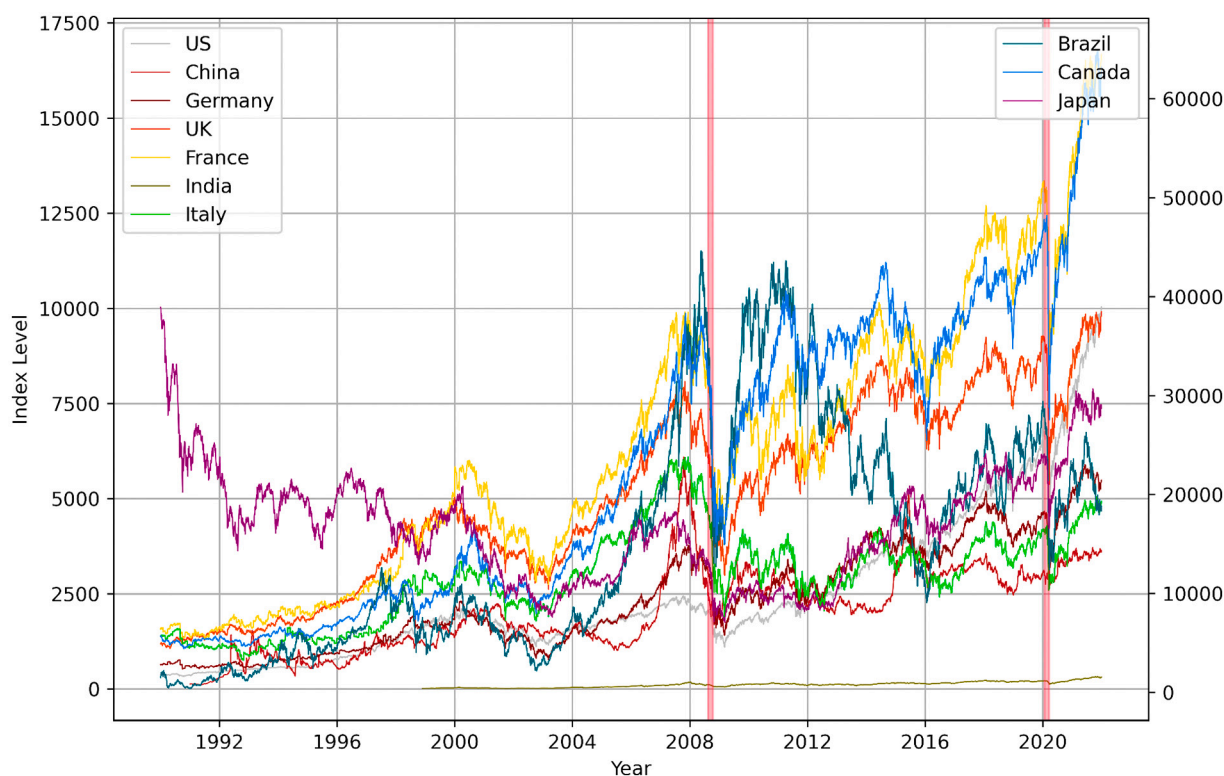
Fig. 1. The figure displays the daily index level of the stock markets across the ten largest economies in the world over the sample period. For convenience, the index level of Brazil, Canada, and Japan is labelled on the right vertical axis, and the index level of other seven countries is labelled on the left vertical axis.

subsequent 20-trading day period, and zero otherwise.[6] The residual term ε_t is modelled as a GJR-GARCH process introduced by Glosten, Jagannathan, and Runkle (1993) as defined in Eq. (2). Maximum log likelihood jointly estimates the parameters in (1) and (2). The GJR-GARCH model accounts for the asymmetric effects where the stock market returns exhibit high volatility in response to bad news as opposed to good news.

Fig. 1 depicts the evolving stock market value, across our ten chosen markets, for both the GFC and COVID crises. Broadly, it is evident from Fig. 1 that the GFC stock market crisis intensified in September 2008 (coinciding with the collapse of Lehman Brothers); whereas, the stock market crisis from COVID intensified in February 2020. In line with these observations, we deem the start date for GFC on September 12, 2008, and COVID on February 20, 2020.[7]

The interpretation of Eqs. (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 "hedge" (i.e. "normal" times, excluding GFC and COVID) beta with respect to the market in question. Asset i is deemed as a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically "moderate" (i.e. < -0.05 but > -0.20), or negative and economically "large" (i.e. < -0.20), respectively.[8] Parameter b_2 (b_3) is the incremental safe-haven asset beta for the GFC (COVID) and, therefore, the sum of the two parameters, $b_1 + b_2$ ($b_1 + b_3$), is the total safe-haven asset beta for the GFC (COVID). If the sum, $b_1 + b_2$, is economically "small", negative and economically "moderate", or negative and economically "large", then asset i serves as a weak, intermediate or a strong safe haven from stock market losses during the GFC, respectively. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID.[9]

2.3. Descriptive statistics

Panel A of Table 1 summarises the descriptive statistics of the daily log-returns of all assets in our study. The average returns (mean) of the safe-haven assets varies between 0.001% to 0.019% per day. The T-bills shows the lowest standard deviation, whereas silver and gold show the highest standard deviation. Furthermore, the negative skewness and high excess kurtosis of AAA-grade bonds, silver and gold imply a

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[6] Following 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. However, the pragmatic stance relevant to financial-market practitioners is that the fulsome adverse effect of major crises such as the GFC and COVID plays out over a longer period exceeding 20 trading days. Therefore, we also employ a longer time window based on the peak and bottom index values for each stock market during the GFC and COVID. We only consider negative stock market returns to avoid the impact of any partial recovery. In this alternative analysis, we define the start date of GFC as October 9, 2007, when the S&P500 peaked at a closing price of 2447.03, and June 30, 2009, as the end date when the National Bureau of Economic Research declared the end of the U.S. recession. We define the start date of COVID as January 30, 2020, when the WHO declared COVID-19 pandemic a Public Health Emergency of international concern, and December 31, 2021, as the end date, our sample end date. We report the peak and bottom index values in the online Appendix Table 1. We find similar results using a longer duration to define the GFC and COVID and provide those results in the online Appendix, Tables 3–6.

[7] 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).

[8] While arbitrarily chosen, the cut-off values that we select for "small", "moderate" and "large" are designed to sensibly balance being conservative, realistic and meaningful. We are particularly keen to avoid a situation (typical in most prior literature) in which any estimate that is statistically significant and negative is "blindly" ascribed a "strong" safe-haven asset.

[9] We repeat the same cut-off values as for b_1, following the same logic outlined in the previous footnote. We elaborate how we empirically operationalize these safe-haven interpretations later, in Section 3.

Table 1
Descriptive Statistics.

Panel A: Descriptive Statistics								
Variable	N	Mean	Median	Minimum	Maximum	Std Dev	Skewness	Kurtosis
Safe Haven Assets								
Gold	8350	0.0181	0.0000	−10.1624	7.3820	0.9684	−0.4003	7.8216
Silver	8350	0.0151	0.0069	−19.4886	12.4702	1.7940	−0.7867	8.0961
US Dollar Index	8350	0.0003	0.0000	−3.0646	2.8533	0.4954	−0.0593	2.0828
Swiss Franc Index	5501	0.0098	0.0004	−7.8074	14.9729	0.4188	7.0128	325.0707
T-bills	8350	0.0105	0.0058	−0.1996	0.1423	0.0149	1.3728	10.3113
T-bonds	8350	0.0186	0.0153	−1.6881	1.7886	0.2285	−0.1208	3.7051
AAA-bonds	7044	0.0193	0.0200	−3.1754	1.8423	0.3199	−0.6326	7.0737
Stock Market Returns								
US	8869	0.0413	0.0401	−12.7605	10.9582	1.1114	−0.4568	11.9288
China	8087	0.0414	0.0000	−17.8538	71.9152	2.1346	5.5807	175.8950
Japan	8869	0.0034	0.0000	−12.1110	13.2346	1.4123	−0.1507	6.3297
Germany	8869	0.0308	0.0170	−19.8565	16.2862	1.4994	−0.1930	20.8935
UK	8869	0.0270	0.0473	−14.1482	12.2962	1.2356	−0.3532	11.0037
France	8869	0.0338	0.0149	−15.2542	20.0352	1.4682	0.2428	18.0079
India	6026	0.0509	0.0969	−15.5279	18.0985	1.5989	−0.5181	8.8399
Italy	8869	0.0177	0.0081	−20.5433	21.8611	1.6198	0.5008	24.0518
Brazil	8869	0.0414	0.0615	−26.2232	32.5315	3.0426	−0.1002	9.4593
Canada	8869	0.0316	0.0633	−14.0504	11.7061	1.1760	−1.0151	16.2445

Panel B: Correlation Matrix																	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Gold (1)	1																
Silver (2)	0.5830	1															
Dollar (3)	−0.2606	−0.2872	1														
Franc (4)	0.1110	0.0370	−0.0806	1													
T-bills (5)	0.0026	−0.0159	−0.0465	0.0339	1												
T-bonds (6)	0.0545	−0.0072	−0.1080	0.0929	0.2915	1											
AAA-bonds (7)	0.0601	0.0262	−0.1014	0.0514	0.1648	0.8082	1										
US (8)	−0.0295	0.0712	−0.0311	−0.0990	−0.0476	−0.2243	−0.1571	1									
China (9)	0.0230	0.0398	−0.0237	−0.0605	−0.0179	−0.0390	0.0092	0.0298	1								
Japan (10)	0.0181	0.0954	−0.0342	−0.2314	−0.0589	−0.0671	−0.0013	0.1347	0.1137	1							
Germany (11)	0.1023	0.1946	−0.3274	−0.0968	−0.0423	−0.1972	−0.1194	0.4274	0.0689	0.1811	1						
UK (12)	0.0929	0.2160	−0.2653	−0.1294	−0.0543	−0.1725	−0.0895	0.4832	0.0773	0.2903	0.6432	1					
France (13)	0.1046	0.2048	−0.3530	−0.1113	−0.0480	−0.1878	−0.1077	0.4051	0.0668	0.2011	0.8949	0.6938	1				
India (14)	0.0866	0.1498	−0.0886	−0.1549	−0.0677	−0.1033	−0.0126	0.2113	0.1890	0.3000	0.3161	0.3539	0.3335	1			
Italy (15)	0.0893	0.1826	−0.3215	−0.0980	−0.0465	−0.1716	−0.0977	0.3568	0.0623	0.1665	0.7836	0.6039	0.8278	0.3124	1		
Brazil (16)	0.0601	0.1262	−0.0924	−0.0851	−0.0663	−0.1100	−0.0727	0.4055	0.0535	0.1334	0.2899	0.3621	0.2993	0.2697	0.2682	1	
Canada (17)	0.1899	0.3026	−0.1995	−0.0971	−0.0641	−0.1974	−0.0940	0.6808	0.0625	0.2328	0.4832	0.6110	0.4994	0.3006	0.4539	0.4275	1

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. The sample period starts on January 01, 1990, and ends December 31, 2021.

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

Panel A: Extreme Losses of SP500 Index during the 2008 GFC							
Date	SP500	Gold	Silver	Dollar	Franc	T-bills	T-bonds	AAA-bond
15/10/2008	−9.4595	0.9804	−8.2916	0.8445	−0.0748	0.0286	0.1388	−0.3711
01/12/2008	−9.3469	−4.9181	−8.6740	0.2309	0.6253	0.0206	1.0560	0.9978
29/09/2008	−9.1957	1.0182	−3.5924	0.6735	−0.0858	0.0383	1.0869	0.4862
09/10/2008	−7.9213	−1.7386	0.8723	0.3085	0.0836	−0.0022	−0.5696	−0.9663
20/11/2008	−6.9437	0.1402	−3.1427	0.7531	0.2269	0.0220	0.9695	−0.1159
19/11/2008	−6.2990	1.3455	−2.5469	−0.0687	−0.5907	0.0149	0.5529	0.2680
22/10/2008	−6.2739	−3.3520	−6.2932	1.6297	1.1687	0.0144	0.2709	0.6857
07/10/2008	−5.9099	1.6085	0.8401	−0.8730	0.3805	−0.0311	−0.3688	−0.0186
20/01/2009	−5.4254	3.1880	−0.3578	1.4459	−0.2499	0.0024	−0.1340	−0.2581
05/11/2008	−5.3515	−1.3494	3.1588	−0.2007	−0.5403	0.0212	0.2960	0.7461

Panel B: Extreme Losses of SP500 Index during the COVID-19 Pandemic							
Date	SP500	Gold	Silver	Dollar	Franc	T-bills	T-bonds	AAA-bond
16/03/2020	−12.7605	−1.8931	−12.3408	−0.6910	0.6881	0.0182	1.5490	0.9732
12/03/2020	−9.9726	−4.8792	−4.7044	0.9898	0.5461	0.0182	−0.2670	−1.7597
09/03/2020	−7.8900	−0.1386	−1.2088	−1.1004	0.7551	0.0219	0.7507	0.1945
11/06/2020	−6.0631	1.4106	0.4965	0.7992	0.6262	0.0014	0.3595	0.1696
18/03/2020	−5.3221	−3.2240	−5.9588	1.5843	0.0257	0.0309	−1.0609	−1.5417
11/03/2020	−5.0028	−0.3124	−1.0586	0.1037	−0.1924	0.0129	−0.2965	−1.3524
01/04/2020	−4.5139	−1.5176	−1.2218	0.6240	0.1702	0.0035	0.3196	0.5947
27/02/2020	−4.4961	0.5208	−0.9987	−0.4962	0.0779	0.0216	0.3753	0.1568
20/03/2020	−4.4154	0.7773	2.0495	0.0584	−0.8018	0.0037	1.7886	0.4572
28/10/2020	−3.5926	−1.4611	−5.0550	0.4937	0.0327	0.0001	0.0221	−0.0249

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.

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 silver, AAA-grade bonds, and gold possess characteristics of risky assets rather than safe haven assets.

The average daily returns of stock market indices range between 0.018% (Italy) to 0.051% (India) per day. The standard deviation for each of the stock market indices is higher than all the safe-haven assets except silver. Furthermore, stock market indices of all countries exhibit negative skewness and high excess kurtosis, which indicate a significant crash risk. In sum, the descriptive statistics in Panel A suggest that the US Treasuries, US dollar, and Swiss franc could act as better safe havens than gold and silver.

Panel B of Table 1 shows the correlations between the assets in our study. As expected, the correlation between gold and silver is positively correlated (0.58) and indicates that precious metals move in tandem. The correlation between gold and the US dollar is negatively correlated (−0.26) 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 candidate safe-haven assets are generally not too distant from zero (with the exception between Treasuries and bonds and silver and the US dollar), 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.

2.4. Maximum losses during the 2008 GFC and the 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 GFC and COVID.[10] 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 the other nine countries as well.[11] Indicatively, 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.

Panel A of Table 2 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, the Swiss franc for five days, AAA-grade bonds for five days, and the remaining safe haven assets, Treasuries and the US dollar, 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.

Panel B of Table 2 reports the counterpart analysis for candidate safe-haven assets across the ten days of largest losses in the S&P 500 during the COVID-19 pandemic period, covering February 20, 2020, to December 31, 2021, our 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 the COVID-19 pandemic, with seven negative gold returns. For instance, gold lost 4.88% of its value on March 12, 2020, when the S&P500 index incurred a 9.97% loss. Silver also moved in tandem with extreme stock market losses during COVID, with eight out of 10 negative silver returns. Three 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

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[10] We find similar results when we use a two-day window instead of one day to counter the impact of mean-reversion. Those results are reported in the online Appendix Table 2. We thank the reviewer for this suggestion.

[11] For the sake of brevity, we do not report the results of the other nine countries. However, those results are available upon request from the authors.

Table 3
Estimation Results for Gold and Silver as Safe Haven Assets during the 2008 GFC and COVID-19 Pandemic.

Panel A: Gold

Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
	(1.33)	(1.19)	(1.20)	(0.96)	(1.03)	(0.91)	(2.51)	(1.05)	(1.07)	(0.68)
Hedge (b_1)	−0.0315	0.0032	−0.0005	0.0400	0.0358	0.0472	0.0412	0.0272	0.0084	0.1237
	(−4.45)	(0.99)	(−0.10)	(8.63)	(5.76)	(11.23)	(5.85)	(6.87)	(3.55)	(17.07)
ΔGFC (b_2)	−0.1709	−0.2117	−0.0785	−0.2025	−0.2298	−0.2598	−0.3080	−0.2168	−0.1586	−0.2196
	(−2.19)	(−2.14)	(−0.50)	(−1.37)	(−1.52)	(−1.86)	(−1.69)	(−1.52)	(−3.61)	(−2.63)
Total GFC ($b_1 + b_2$)	−0.2024	−0.2085	−0.0790	−0.1625	−0.1940	−0.2126	−0.2668	−0.1896	−0.1502	−0.0959
	(−2.60)	(−2.11)	(−0.50)	(−1.09)	(−1.28)	(−1.52)	(−1.46)	(−1.32)	(−3.42)	(−1.15)
ΔCOVID (b_3)	0.1776	0.7256	0.4869	0.2334	0.2366	0.2173	0.2253	0.1313	0.0883	0.0657
	(6.67)	(11.49)	(8.26)	(5.76)	(6.12)	(5.51)	(5.64)	(5.27)	(5.09)	(2.28)
Total COVID ($b_1 + b_3$)	0.1461	0.7288	0.4864	0.2734	0.2724	0.2645	0.2665	0.1585	0.0967	0.1894
	(5.70)	(11.55)	(8.28)	(6.77)	(7.11)	(6.73)	(6.76)	(6.43)	(5.63)	(6.77)

Panel B: Silver

Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0000
	(0.40)	(0.55)	(0.69)	(0.50)	(0.42)	(0.43)	(0.82)	(0.49)	(0.43)	(0.23)
Hedge (b_1)	0.0321	0.0103	0.0591	0.1190	0.1814	0.1467	0.0921	0.1118	0.0435	0.3570
	(2.26)	(1.68)	(5.69)	(12.75)	(15.96)	(15.13)	(8.27)	(14.18)	(8.97)	(27.25)
ΔGFC (b_2)	−0.1332	−0.0267	0.3175	0.2066	−0.0269	−0.0086	−0.0670	0.0918	−0.0495	−0.1349
	(−1.18)	(−0.20)	(1.87)	(1.11)	(−0.16)	(−0.05)	(−0.24)	(0.54)	(−0.81)	(−1.18)
Total GFC ($b_1 + b_2$)	−0.1011	−0.0164	0.3766	0.3256	0.1545	0.1381	0.0251	0.2036	−0.0060	0.2221
	(−0.90)	(−0.10)	(2.22)	(1.76)	(0.90)	(0.79)	(0.10)	(1.19)	(−0.10)	(1.96)
ΔCOVID (b_3)	0.6054	1.8129	1.3881	0.6195	0.5968	0.5973	0.9082	0.4288	0.3881	0.3260
	(12.77)	(23.90)	(20.64)	(20.58)	(18.33)	(19.04)	(18.66)	(17.90)	(15.81)	(11.41)
Total COVID ($b_1 + b_3$)	0.6375	1.8232	1.4472	0.7385	0.7782	0.7440	1.0003	0.5406	0.4316	0.6830
	(14.06)	(24.11)	(21.80)	(25.77)	(25.37)	(24.88)	(21.00)	(23.87)	(17.96)	(26.65)

This 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 period ends 20 trading days after the start of the crisis. The GFC starts on September 12, 2008, while the COVID-19 pandemic starts on February 20, 2020. Asset i is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically intermediate, or negative and economically strong, respectively. We use the cutoff of 0.05 [−0.05, +0.05] to assess whether an estimated coefficient is economically "small". The estimated coefficient is deemed as economically "moderate" ("large") if the estimated coefficient is between −0.05 to −0.20 (lower than −0.20). Parameter b_2 is the incremental safe-haven asset beta for the GFC. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven asset beta for the GFC. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i serves as a weak safe haven from stock market losses during the GFC. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i serves as an intermediate (strong) safe haven from stock market losses during the GFC. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID. The respective t-statistics are provided in the parentheses.

recorded all positive returns, while the T-bonds recorded seven positive returns. Six out of ten AAA-grade bonds returns were positive on the days of the largest 10 losses in the S&P500. In sum, the results in Panel B imply that gold, and silver fail to protect the wealth of investors on those days when they needed it the most.

3. Main results and discussion

In this section, we examine the relationship between safe-haven assets and stock market returns using the regression model in Eqs. (1) and (2). Tables 3, 4, 5, and 6 present the estimation results for precious metals, currencies, Treasuries, and corporate bonds, respectively. The tables include the parameter estimates of b_0 (constant), b_1 (hedge), the incremental GFC effect (b_2), and the incremental COVID effect (b_3). The total GFC effect is the sum of b_1 and b_2, while the total COVID effect is the sum of b_1 and b_3.

We empirically operationalize the "weak" vs. "intermediate" vs. "strong" safe-haven interpretations as follows (using statistical significance at the 5% level). Asset i is deemed a weak hedge for stock market j if the parameter b_1 is negative, statistically insignificant or significant of either sign, but economically "small". Asset i is deemed an intermediate (strong) hedge for stock market j if the parameter b_1 is negative, significant and economically "moderate" ("large"). We use the cutoff of 0.05 to assess whether an estimated coefficient is economically "small" – that is, an estimated coefficient lying in the range [−0.05, +0.05]. The estimated coefficient is deemed as economically "moderate" ("large") if

the estimated coefficient lies between −0.05 to −0.20 (is less than −0.20).[12]

Parameter b_2 is the incremental safe-haven asset beta for the GFC, with the incremental t-statistics in parentheses. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven asset beta for the GFC, with the respective t-statistics of the total effect in parentheses. The interpretation of this sum follows the same cut-off values as above. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i is deemed a weak safe haven from stock market losses during the GFC. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i is deemed an intermediate (strong) safe haven from stock market losses during the GFC. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID.

3.1. Precious metals

Starting with gold, Panel A of Table 3 shows the parameter estimate,

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[12] While the guidelines outlined in this paragraph are based on arbitrarily chosen divisions, we argue that it is a more nuanced and intuitive characterization than the simple binary approach that currently exists in the literature. As such, the characterization provides more helpful indicative markers for investors, investment professionals and practitioners on how to approach the question of safe haven assets.

Table 4

Estimation Results for US Dollars and Swiss Francs as Safe Haven Assets during the 2008 GFC and COVID-19 Pandemic.

Panel A: US Dollar Index

Coefficients	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
	(0.32)	(−0.07)	(1.05)	(0.78)	(1.15)	(0.25)	(0.48)	(0.11)	(0.86)
Hedge (b_1)	−0.0048	−0.0023	−0.1089	−0.1033	−0.1182	−0.0222	−0.0926	−0.0150	−0.0955
	(−2.33)	(−0.72)	(−55.60)	(−27.31)	(−53.51)	(−6.18)	(−52.51)	(−9.06)	(−23.79)
ΔGFC (b_2)	−0.1016	−0.1519	−0.0465	0.0064	0.0090	−0.0047	−0.0436	0.0091	0.0310
	(−3.66)	(−6.60)	(−1.29)	(0.18)	(0.25)	(−0.13)	(−1.74)	(0.76)	(0.98)
Total GFC ($b_1 + b_2$)	−0.1064	−0.1542	−0.1554	−0.0969	−0.1092	−0.0269	−0.1362	−0.0059	−0.0645
	(−3.83)	(−6.77)	(−4.30)	(−2.68)	(−3.08)	(−0.74)	(−5.45)	(−0.50)	(−2.05)
ΔCOVID (b_3)	0.0191	0.0028	0.0814	0.0878	0.0980	0.0281	0.0921	0.0317	0.1042
	(1.00)	(0.19)	(6.75)	(7.70)	(9.12)	(2.30)	(13.08)	(6.66)	(12.75)
Total COVID ($b_1 + b_3$)	0.0143	0.0005	−0.0275	−0.0155	−0.0202	0.0059	−0.0005	0.0167	0.0087
	(0.75)	(0.04)	(−2.30)	(−1.43)	(−1.92)	(0.50)	(−0.10)	(3.73)	(1.22)

Panel B: Swiss Franc Index

Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001
	(0.81)	(0.47)	(2.33)	(0.80)	(1.32)	(0.83)	(0.79)	(0.98)	(0.71)	(1.66)
Hedge (b_1)	−0.0090	0.0070	−0.0531	−0.0145	−0.0309	−0.0159	−0.0077	−0.0241	−0.0077	−0.0323
	(−2.74)	(2.64)	(−20.34)	(−5.44)	(−11.35)	(−5.81)	(−3.44)	(−11.35)	(−4.07)	(−8.80)
ΔGFC (b_2)	0.0045	−0.0694	−0.1017	−0.0959	−0.0717	−0.0833	−0.1305	−0.0793	−0.0121	−0.0196
	(0.14)	(−1.87)	(−4.98)	(−3.13)	(−3.08)	(−3.34)	(−3.46)	(−3.25)	(−0.80)	(−0.62)
Total GFC ($b_1 + b_2$)	−0.0045	−0.0624	−0.1548	−0.1104	−0.1026	−0.0992	−0.1382	−0.1034	−0.0198	−0.0519
	(−0.14)	(−1.68)	(−7.65)	(−3.61)	(−4.45)	(−4.03)	(−3.68)	(−4.25)	(−1.31)	(−1.66)
ΔCOVID (b_3)	−0.0435	−0.1291	−0.0228	−0.0410	−0.0297	−0.0402	−0.0654	−0.0212	−0.0222	−0.0145
	(−4.46)	(−4.66)	(−1.79)	(−3.88)	(−2.85)	(−3.92)	(−4.68)	(−2.98)	(−3.41)	(−1.50)
Total COVID ($b_1 + b_3$)	−0.0525	−0.1221	−0.0759	−0.0555	−0.0606	−0.0561	−0.0731	−0.0453	−0.0299	−0.0468
	(−5.52)	(−4.42)	(−6.09)	(−5.41)	(−5.99)	(−5.66)	(−5.32)	(−6.63)	(−4.80)	(−5.11)

This 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 period ends 20 trading days after the start of the crisis. The GFC starts on September 12, 2008, while the COVID-19 Pandemic starts on February 20, 2020. Asset i is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically intermediate, or negative and economically strong, respectively. We use the cutoff of 0.05 [−0.05, +0.05] to assess whether an estimated coefficient is economically "small". The estimated coefficient is deemed as economically "moderate" ("large") if the estimated coefficient is between −0.05 to −0.20 (lower than −0.20). Parameter b_2 is the incremental safe-haven asset beta for the GFC. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven asset beta for the GFC. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i serves as a weak safe haven from stock market losses during the GFC. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i serves as an intermediate (strong) safe haven from stock market losses during the GFC. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID. The respective t-statistics are provided in the parentheses.

b_1 is "economically small" (i.e. betas lying between −0.05 to +0.05) for nine countries, whereas positive, significant and economically "not small" (i.e. beta > +0.05) for Canada, showing that it acts as a weak hedge for all the sample countries except Canada. These results are generally consistent with Choudhry, Hassan, and Shabi (2015) and Low et al. (2016).

Most importantly, with no cases of positive and significant incremental betas, at a minimum, gold serves as an improved safe-haven prospect across our sample countries during the GFC. Indeed, the improvement in gold as a safe haven is significant for the US; China; Brazil; and Canada, in which the incremental GFC betas are negative, significant and economically either "moderate" for the US and Brazil or "large" for China and Canada. Furthermore, the total safe-haven gold GFC betas (i.e. sum of $b_1 + b_2$) are negative, significant and economically "moderate" for Brazil and "large" for US and China indicating that gold serves as a moderate to large safe haven during these settings. For the other seven countries, the total safe-haven gold GFC betas are insignificant showing them to be weak safe havens. These findings are generally consistent with the literature (e.g. Baur & McDermott, 2010; Bredin, Conlon, & Potì, 2015; Low et al., 2016).

As already tentatively signalled in the preliminary results in Table 2, gold fails to act as a COVID safe haven against the stock market losses from all countries, since the total safe-haven betas (i.e. sum of $b_1 + b_3$) across the sample countries are positive, statistically significant and not economically small. Indeed, it is particularly notable that the total gold betas for China and Japan during COVID are large at 0.73, and 0.49,

respectively. The total gold betas for other eight countries are also at least 0.10 or above indicating that gold does not serve even as a weak safe haven in any of the sample countries. These results support Baur and Dimpfl (2021) who find that their proposed safe haven index fell briefly during the COVID-19 pandemic.

Panel B of Table 3 shows the counterpart analysis for silver. We see that hedge coefficients except for US, China and Brazil, b_1, are positive, significant and economically "not small" (i.e. beta > +0.05) for seven countries, ranging from the smallest estimate of 0.06 for Japan, through to the highest of 0.36 for Canada. Nonetheless, the hedge coefficients for other three countries are also positive, significant but economically "small" indicating that silver acts as a weak hedge for US, China and Brazil. As such, these results indicate strongly that silver does not act as a hedge for seven out of ten countries, consistent with the findings of Low et al. (2016). However, all the total GFC betas except for Japan and Canada are insignificant indicating that silver serves as a weak safe haven in these settings during the GFC. The total GFC betas are positive, significant and economically "large" for Japan and Canada indicating that silver does not even serve as a weak safe haven in these settings during the GFC. Further, the incremental silver GFC betas are statistically insignificant which indicates no material improvement in silver as a safe haven for any of our sample countries during the GFC.

Much more telling are the counterpart silver results for COVID. The total safe-haven COVID betas are positive, significant at the 5% level; and not economically small for any of sample countries which indicates that silver does not serve as a safe haven (not even weakly) against losses

Table 5

Estimation Results for T-bills and T-bonds as Safe Haven Assets during the 2008 GFC and COVID-19 Pandemic.

Panel A: US Treasury Bill Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(24.09)	(23.08)	(23.70)	(22.30)	(23.88)	(23.96)	(17.72)	(23.89)	(23.55)	(23.64)
Hedge (b_1)	−0.0004	0.0000	−0.0001	−0.0001	−0.0003	−0.0002	0.0000	−0.0002	0.0000	−0.0001
	(−4.01)	(−0.67)	(−2.17)	(−3.29)	(−3.23)	(−2.69)	(−0.64)	(−2.54)	(−0.35)	(−1.85)
ΔGFC (b_2)	0.0004	−0.0087	0.0001	−0.0019	0.0001	0.0003	−0.0023	0.0004	−0.0001	−0.0006
	(0.56)	(−4.21)	(0.16)	(−2.01)	(0.12)	(0.67)	(−2.97)	(0.70)	(−0.32)	(−0.83)
Total GFC ($b_1 + b_2$)	0.0001	−0.0087	0.0000	−0.0021	−0.0002	0.0001	−0.0023	0.0002	−0.0001	−0.0007
	(0.10)	(−4.23)	(0.00)	(−2.15)	(−0.34)	(0.26)	(−2.99)	(0.38)	(−0.36)	(−1.00)
ΔCOVID (b_3)	−0.0006	−0.0049	−0.0047	−0.0023	−0.0019	−0.0023	−0.0024	−0.0012	−0.0007	−0.0015
	(−1.49)	(−3.62)	(−4.47)	(−2.83)	(−2.39)	(−2.33)	(−4.77)	(−1.34)	(−1.94)	(−1.20)
Total COVID ($b_1 + b_3$)	−0.0010	−0.0049	−0.0048	−0.0024	−0.0022	−0.0025	−0.0024	−0.0014	−0.0007	−0.0017
	(−2.42)	(−3.65)	(−4.58)	(−2.99)	(−2.70)	(−2.54)	(−4.81)	(−1.52)	(−1.97)	(−1.29)

Panel B: US Treasury Bond Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002
	(8.86)	(8.02)	(8.23)	(8.65)	(8.44)	(8.63)	(5.10)	(8.41)	(8.17)	(8.48)
Hedge (b_1)	−0.0441	−0.0040	−0.0085	−0.0267	−0.0266	−0.0268	−0.0130	−0.0212	−0.0054	−0.0307
	(−22.85)	(−3.69)	(−5.70)	(−21.54)	(−15.03)	(−19.77)	(−7.65)	(−19.90)	(−7.36)	(−16.41)
ΔGFC (b_2)	−0.0525	−0.0914	−0.0043	−0.0713	−0.0642	−0.0704	−0.1130	−0.0629	−0.0514	−0.0807
	(−7.01)	(−6.93)	(−0.32)	(−9.08)	(−10.53)	(−11.3)	(−10.09)	(−10.55)	(−17.29)	(−12.15)
Total GFC ($b_1 + b_2$)	−0.0966	−0.0954	−0.0128	−0.0980	−0.0908	−0.0972	−0.1260	−0.0841	−0.0568	−0.1114
	(−13.20)	(−7.24)	(−0.95)	(−12.62)	(−15.58)	(−15.99)	(−11.38)	(−14.38)	(−19.71)	(−17.39)
ΔCOVID (b_3)	−0.0359	−0.1053	−0.0478	0.0075	−0.0013	0.0022	−0.0309	−0.0024	−0.0247	−0.0062
	(−4.53)	(−5.16)	(−3.32)	(0.77)	(−0.14)	(0.25)	(−2.95)	(−0.34)	(−4.68)	(−0.75)
Total COVID ($b_1 + b_3$)	−0.0800	−0.1093	−0.0563	−0.0192	−0.0279	−0.0246	−0.0439	−0.0236	−0.0301	−0.0369
	(−10.38)	(−5.36)	(−3.93)	(−1.96)	(−3.14)	(−2.83)	(−4.26)	(−3.44)	(−5.76)	(−4.56)

This table presents the estimation results of the role of T-bills and T-bonds 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 period ends 20 trading days after the start of the crisis. The GFC starts on September 12, 2008, while the COVID-19 pandemic starts on February 20, 2020. Asset i is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically intermediate, or negative and economically strong, respectively. We use the cutoff of 0.05 [−0.05, +0.05] to assess whether an estimated coefficient is economically "small". The estimated coefficient is deemed as economically "moderate" ("large") if the estimated coefficient is between −0.05 to −0.20 (lower than −0.20). Parameter b_2 is the incremental safe-haven asset beta for the GFC. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven asset beta for the GFC. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i serves as a weak safe haven from stock market losses during the GFC. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i serves as an intermediate (strong) safe haven from stock market losses during the GFC. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID. The respective t-statistics are provided in the parentheses.

Table 6

Estimation Results for AAA-grade Corporate Bonds as Safe Haven Assets during the 2008 GFC and COVID-19 Pandemic.

S&P500 AAA-Grade Bonds Index										
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002
	(6.78)	(5.97)	(6.03)	(6.70)	(6.40)	(6.39)	(5.47)	(6.11)	(6.03)	(6.40)
Hedge (b_1)	−0.0383	−0.0005	−0.0035	−0.0201	−0.0205	−0.0177	−0.0042	−0.0154	−0.0103	−0.0199
	(−34.50)	(−0.31)	(−2.03)	(−14.27)	(−12.54)	(−12.40)	(−2.37)	(−12.19)	(−10.75)	(−10.99)
ΔGFC (b_2)	−0.0961	0.2454	0.2127	0.1624	0.1507	0.1340	0.2946	0.1593	−0.0167	0.0920
	(−11.02)	(20.69)	(20.57)	(15.24)	(19.52)	(14.85)	(33.48)	(18.54)	(−1.73)	(7.12)
Total GFC ($b_1 + b_2$)	−0.1344	0.2449	0.2092	0.1423	0.1302	0.1163	0.2904	0.1439	−0.0270	0.0721
	(−15.43)	(20.68)	(20.56)	(13.40)	(17.16)	(12.98)	(33.30)	(16.83)	(−2.78)	(5.70)
ΔCOVID (b_3)	0.0090	0.0787	0.1030	0.0831	0.0751	0.0661	0.0575	0.0346	0.0179	0.0453
	(0.96)	(3.21)	(4.22)	(4.85)	(4.76)	(4.37)	(3.76)	(3.80)	(2.81)	(4.33)
Total COVID ($b_1 + b_3$)	−0.0293	0.0782	0.0995	0.0630	0.0546	0.0484	0.0533	0.0192	0.0076	0.0254
	(−3.15)	(3.20)	(4.08)	(3.68)	(3.47)	(3.21)	(3.50)	(2.12)	(1.21)	(2.46)

This table presents the estimation results of the role of S&P500 AAA-grade bonds 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 period ends 20 trading days after the start of the crisis. The GFC starts on September 12, 2008, while the COVID-19 pandemic starts on February 20, 2020. Asset i is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically intermediate, or negative and economically strong, respectively. We use the cutoff of 0.05 [−0.05, +0.05] to assess whether an estimated coefficient is economically "small". The estimated coefficient is deemed as economically "moderate" ("large") if the estimated coefficient is between −0.05 to −0.20 (lower than −0.20). Parameter b_2 is the incremental safe-haven asset beta for the GFC. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven asset beta for the GFC. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i serves as a weak safe haven from stock market losses during the GFC. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i serves as an intermediate (strong) safe haven from stock market losses during the GFC. Similar interpretations apply to b_3 and $b_1 + b_3$, with respect to COVID. The respective t-statistics are provided in the parentheses.

from stock markets during COVID. Of particular note is that for China, Japan, and India, the total silver safe-haven betas are all >1 (e.g. China shows an estimate of 1.82). Hence, during COVID, investment in silver perversely represents a systematic risk somewhat even higher than the stock markets in these settings, let alone being seen as any sort of safe-haven asset.

3.2. Currencies

Panel A of Table 4 reports results for the US dollar as a potential safe-haven asset.[13] The table shows that hedge coefficients, b_1, are negative, significant and: (a) economically "moderate" for five countries (Germany, the UK; France; Italy and Canada); (b) economically "small" for the other four countries (China; Japan; India and Brazil); indicating that the US dollar serves as a hedge against the stock market indices. Furthermore, the total safe-haven GFC betas (i.e. sum of $b_1 + b_2$) are negative, statistically significant and economically "moderate" (-0.05 to -0.20) for seven countries, indicating that the US dollar serves as an intermediate safe haven for stock markets in these countries during the GFC. The total safe-haven GFC betas for another two countries (India and Brazil) are insignificant indicating that the US dollar serves as a weak safe haven in these settings.

Interestingly, the safe-haven efficacy of the US dollar is somewhat weakened during COVID. More specifically, the total safe-haven COVID betas (i.e. sum of $b_1 + b_3$) are either insignificant or economically small indicating the US dollar as a weak safe haven in all of our sample countries during the pandemic. Indeed, with the exception of China, Japan, India and Brazil, all the incremental COVID betas are positive, statistically significant (at the 5% level), and not economically small (above $+0.05$), thereby suggesting that there has been change in the baseline safe-haven (b_1) relationship between the US dollar and these markets during COVID.

Panel B of Table 4 reports results for the Swiss franc as a potential safe-haven asset. At a very general level, collectively considering the sign, statistical significance and magnitude of the estimated coefficients, the Swiss franc results have a similar flavour as for the US dollar. The table shows that the parameter estimate, b_1 is negative and statistically significant for nine countries, but generally small in magnitude; and a positive but economically small estimate for China, thereby revealing a weak hedge in all cases. Further, the total safe-haven franc GFC betas (i.e. sum of $b_1 + b_2$) are negative, significant (at the 5% level), and economically "moderate" (-0.05 to -0.20) for six countries (Japan; Germany; the UK; France; India and Italy), indicating the Swiss franc as an intermediate safe haven in these settings. The total safe-haven franc GFC betas for the US, China, Brazil and Canada are insignificant, suggesting only weak GFC safe havens for the Swiss franc in these four countries.

The incremental franc COVID betas are negative, significant and economically "moderate" (-0.05 to -0.20) for China and India, suggesting that the Swiss franc offers a reasonable improvement in safe haven status in these settings during COVID. Moreover, the total safe-haven franc COVID betas (i.e. sum of $b_1 + b_3$) are negative, significant and economically "moderate" (-0.05 to -0.20) for seven countries. Alternatively, the total safe-haven franc COVID betas are negative, significant, but small for the remaining three countries: Italy, Brazil and Canada, indicating only a weak safe haven status for the Swiss franc.

3.3. Treasuries

Panel A of Table 5 reports results for T-bills as a potential safe haven asset. The table shows that hedge coefficients, b_1, are negative, significant (insignificant) but very small for the US, Japan, Germany, the UK,

France and Italy (China; India; Brazil; and Canada), indicating that the T-bill serves as a very weak hedge across the sample countries. While all the total safe-haven T-bill GFC betas (i.e. sum of $b_1 + b_2$) are economically "small" indicating that T-bills serve as a very weak safe haven in these settings during the GFC. The T-bills continue to serve as a very weak safe haven during COVID – the total safe-haven T-bill COVID betas are all economically "small".

Panel B of Table 5 reports results for T-bonds as a potential safe-haven asset. Similar, to T-bills, Panel B shows that T-bonds serve as a weak hedge in all sample countries. Furthermore, all the total safe-haven T-bond GFC betas except for Japan are negative, significant and economically "moderate" (-0.05 to -0.20), suggesting an intermediate safe haven status for T-bonds in these settings. Nonetheless, the total safe-haven T-bond GFC betas for Japan is insignificant indicating that T-bond acts as a weak hedge in this setting. The total safe-haven COVID betas are negative, significant and economically moderate (small) for the US, China and Japan (the remaining countries). As such, the overriding case for T-bonds is a weak safe haven asset during COVID. That said, if anything more definitive can be gleaned based on a comparison of magnitudes, the safe-haven status of T-bonds is better than the T-bills.

3.4. Corporate bonds

Table 6 reports results for AAA-grade corporate bonds as a potential safe-haven asset. The hedge coefficients, b_1, are negative significant (except for China), but economically small for all the countries indicating that AAA-bonds act as a weak hedge in these settings. Interestingly, the total safe-haven AAA-bond GFC beta for the US (Brazil) is significant, negative and economically "moderate" ("small"), showing corporate bonds as an intermediate (weak) safe haven asset for the US (Brazil). However, the total safe-haven AAA-bond GFC betas for the remaining countries are positive and economically not "small" (above $+0.05$) indicating that AAA-bonds does not serve even as a weak safe haven in these settings during the GFC. The total safe-haven AAA-bonds COVID betas are positive, significant and economically not "small" (beta $> +0.05$) for five countries (China; Japan; Germany; the UK and India), indicating the AAA-bonds do not act as safe haven in these settings. The total safe-haven Swiss franc GFC betas for the US, France, Italy, Brazil and Canada are economically "small', suggesting only weak COVID safe havens for the AAA-bonds in these five countries.

3.5. Discussion

Table 7 presents a broad integrative summary of the performance of various potential safe-haven assets during the GFC and COVID pandemic financial crises, as analysed and reported in Tables 3–6. Three sets of interesting messages are evident in this table.

First, scanning down Column C1 relating to the GFC crisis, we observe that, intermediate (weak) [very weak] safe-haven evidence is on display for the US dollar, Swiss franc and T-bonds (Gold and Silver) [T-bills]. AAA-bonds is a standout failure in this regard, with most of its GFC safe-haven betas above $+0.1$.

Second, scanning down Column C2 relating to the COVID crisis, we observe that gold is very risky in some settings, especially in China and Japan. Notably, silver extremely risky, especially in China, Japan, and India, with COVID safe-haven betas above $+1$. Further, the US dollar, Treasuries and AAA-bonds show mostly weak or very weak safe-haven benefits during COVID. The Swiss franc continues to serve as an intermediate safe haven is most of the settings.

Third, scanning down Column C3 relating to whether the safe-haven character of different assets has changed during COVID compared to the GFC, we do observe general evidence of a weakening in COVID (compared to the GFC). This weakening is evident especially for the traditional safe-haven assets, gold and silver, but also in the case of the US dollar and T-bonds. However, AAA-grade corporate bonds have somewhat changed in character, they have strengthened a little as a safe

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[13] We do not examine the relationship between the US stock market and the US dollar since it is a domestic currency for US investors.

Table 7
Summary of Estimation Results for Various Potential Safe Haven Assets during the GFC and COVID Financial Crises.

	(A) GFC: $b_1 + b_2$					(B) COVID: $b_1 + b_3$					(C) Commentary		
	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(C1)	(C2)	(C3)
S-H asset	min	max	#0's	#int	#strong	min	max	#0's	#int	#strong	Safe-haven in GFC?	Safe-haven in COVID?	Safe-haven change?
Gold	−0.21	0	7	1	2	+0.10	+0.73	0	0	0	**Yes**, but mostly weak	**No**, some quite risky settings e.g. **China & Japan**	**Yes**, weakened
Silver	0	+0.38	8	0	0	+0.43	+1.82	0	0	0	**Yes**, but mostly weak	**Definitely not**, some extremely risky settings e.g. **China, Japan & India**	**Yes**, weakened
US dollar	−0.16	0	2	7	0	−0.03	0	9	0	0	**Yes**, mostly intermediate	**Yes**, all weak	**Yes**, weakened somewhat
Swiss franc	−0.15	0	4	6	0	−0.12	−0.03	3	7	0	**Yes**, mostly intermediate	**Yes**, mostly intermediate	No change
T-bills	−0.01	0	10	0	0	-0.00	0	10	0	0	**Yes**, but very weak	**Yes**, but very weak	No change
T-bonds	−0.13	0	1	9	0	−0.11	−0.02	7	3	0	**Yes**, mostly intermediate	**Yes**, mostly weak	**Yes**, weakened somewhat
AAA-bonds	−0.13	+0.29	1	1	0	−0.03	+0.10	5	0	0	**Only US and Brazil**	**Yes**, mostly weak	**Yes**, strengthened somewhat
Overall	na	na	33	24	2	na	na	34	10	0	Gold, Silver & T-bill (USD, SwF & T-bonds) generally offer weak (intermediate) safe havens during GFC	USD, T-bill, T-bonds & AAA-bonds (SwF) generally offer weak (intermediate) safe havens during COVID	General evidence of a weakening in COVID (cf GFC), esp. Gold, Silver, USD, T-bonds

This table presents a broad summary of the performance of various potential safe haven assets during the GFC and COVID-19 Pandemic financial crises, as analysed and reported in Tables 3–6. There are three panels: Panel A – showing a summary of the total GFC safe-haven effect; Panel B – showing a summary of the total COVID safe-haven effect; and Panel C – providing a brief commentary. Panels A and B contain four columns each. Column (1): "min" – the minimum statistically significant (at the 5% level) country-based estimate of the safe-haven beta for the asset in question. Column (2): "max" – the maximum statistically significant (at the 5% level) country-based estimate of the safe-haven beta for the asset in question. In the case of (1) and (2), "min" and "max" 0 reflects either the estimate of the safe-haven beta that is insignificant or a significant estimate that is close to zero. Column (3): "#0's" – the number out of 10 cases (out of nine cases for the case of the US dollar), of effectively zero value estimates of country-based safe-haven betas for the asset in question. In the case of (3), "effectively zero" is taken to mean either an insignificant estimate or a significant estimate that is economically close to zero, deemed to be within the range [−0.05 to +0.05]. Column (4): "#int" – the number of statistically significant (at the 5% level) and negatively signed estimates of country-based intermediate safe-haven betas [−0.05 to −0.20] for the asset in question. Column (5): "#strong" – the number of statistically significant (at the 5% level) and negatively signed estimates of country-based strong safe-haven betas [< −0.20] for the asset in question. Panel C organises some brief commentary into three columns. Column (C1) gives an overall "call" on the safe-haven character for the asset in question during the GFC. Column (C2) gives an overall "call" on the safe-haven character for the asset in question during COVID. Column (C3) makes a "call" on whether the safe-haven character of the asset in question, has changed and, if so, how?, during COVID compared to the GFC.

Fig. 2. The figure displays the daily gold prices in US dollars from 1990 to 2020. The gold prices in USD are labelled on the vertical axis, and year on the horizontal axis. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

haven during COVID compared to the GFC.

4. Potential explanations

The most surprising finding from Section 3 is that the gold has lost its safe-haven status during COVID. 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 2008 GFC (e.g. Baur & Lucey, 2010; Baur & McDermott, 2010; Low et al., 2016).

Fig. 2 plots the gold price from January 1, 1990, to December 31, 2021. It is evident from Fig. 2 that gold attained a maximum price of $1898.25 on September 5, 2011 and then shed 45% of value by December 17, 2015. Therefore, investors might have lost trust in gold as a safe-haven asset, in light of losing almost half its value in only four years. In fact, several newspaper articles claim that gold is losing its role as a safe haven of first choice because of emergence of cryptocurrencies in recent years (e.g. Jones, 2021; Relli, 2021; Saieed, 2021). To the extent, gold has lost its status of a safe haven among investors in recent years; we expect to observe that gold does not act at least as a strong safe haven during extreme stock market movements. Therefore, we examine the performance of gold as a safe-haven asset during extreme stock market movements during COVID-19 pandemic. We choose January 30, 2020 as the start date of the COVID-19 pandemic when WHO declared COVID-19 pandemic a public health emergency of international concern.

We define extreme stock market movements as situations in which stock market returns at time t are in a low quantile, such as the 5%, and 1% quantile. We estimate the following regression model first proposed and utilised by Baur and Lucey (2010):

$$RGold_t = b_0 + b_1 \bullet RS_{j,t} + b_2 \bullet D_{q5} \bullet RS_{j,t} + b_3 \bullet D_{q1} \bullet RS_{j,t} + \varepsilon_t \qquad (3)$$

where *RGold* represents the daily log return of gold. *RS$_j$* denotes the daily

log returns in US dollars of a stock market index j, with j equal to one of the ten countries in our sample. The dummy variables, D, capture extreme stock market losses, taking a value of one if stock market return at time t is in the low quantile, such as 5% or 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 Eq. (2).

Gold is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically "moderate", or negative and economically "large", respectively. We use the same cutoffs as in Section 3 to define a weak, intermediate and strong safe haven. Parameters, b_2, and b_3 are the incremental safe-haven gold beta for the lowest 5%, and 1% for the stock market j returns, respectively. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven gold beta for the lowest 5% stock market returns. If the sum, $b_1 + b_2$, is non-positive, statistically insignificant or significant of either sign, but economically "small", then gold serves as a weak safe haven for the lowest 5% stock market returns. If the sum, $b_1 + b_2$, is non-positive, statistically significant and economically "moderate" ("large"), then gold serves as an intermediate (strong) safe haven for the lowest 5% stock market returns. A similar interpretation applies to the sum $b_1 + b_2 + b_3$, with respect to the lowest 1% stock market returns.

Panel A of Table 8 presents the estimation results for gold against the lowest 5% and 1% stock market returns during the COVID-19 pandemic.[14] The total safe-haven 5% quantile betas (i.e. sum of $b_1 + b_2$) are positive, significant, and economically not small for the UK, India and Canada, indicating that gold does not even serve as a weak safe haven in these settings, against the lowest 5% stock market returns. Gold does serve as a weak safe haven for the other seven countries during the

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[14] For the sake of brevity, we do not discuss the hedge results since those are similar as in Section 3.1.

Table 8

Estimation Results for Gold as a Safe Haven during Extreme Market Conditions.

Panel A: Gold as a Safe Haven in Extreme Market Conditions from January 30, 2020									
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Const (b_0)	0.0005	0.0002	0.0006	0.0003	0.0006	0.0004	0.0006	0.0005	0.0006	0.0003
	(0.97)	(0.39)	(1.19)	(0.69)	(1.03)	(0.79)	(1.06)	(0.95)	(1.21)	(0.51)
Hedge (b_1)	0.0541	0.1241	0.0354	0.1354	0.0979	0.0866	0.0391	0.0665	0.0208	0.1721
	(1.61)	(2.02)	(0.88)	(4.49)	(2.67)	(3.21)	(0.83)	(2.56)	(1.14)	(4.92)
Quantile Δ5% ($b2$)	0.0549	−0.0916	0.0387	−0.1185	0.1190	−0.0466	0.2135	0.0015	0.0277	−0.0034
	(0.66)	(−0.68)	(0.46)	(−1.72)	(1.92)	(−0.74)	(2.82)	(0.02)	(0.69)	(−0.05)
Total ($b_1 + b_2$)	0.1090	0.0325	0.0741	0.0169	0.2169	0.0400	0.2526	0.0680	0.0485	0.1687
	(1.51)	(0.28)	(1.07)	(0.30)	(4.66)	(0.80)	(4.60)	(1.24)	(1.47)	(2.68)
Quantile Δ1% ($b3$)	0.1315	0.0626	0.4580	0.3646	−0.0593	0.2655	−0.2226	0.1462	0.1267	0.0084
	(1.61)	(0.47)	(4.66)	(4.68)	(−1.10)	(3.68)	(−3.71)	(2.00)	(3.37)	(0.12)
Total ($b_1 + b_2 + b_3$)	0.2405	0.0951	0.5321	0.3815	0.1576	0.3055	0.0300	0.2142	0.1752	0.1771
	(6.57)	(1.25)	(7.13)	(6.79)	(5.78)	(5.28)	(1.31)	(4.60)	(6.49)	(5.31)

Panel B: Gold as a Safe Haven in Extreme Market Conditions before January 30, 2020									
Coefficients	US	China	Japan	Germany	UK	France	India	Italy	Brazil	Canada
Sample start date	1964	1992	1964	1970	1984	1987	1991	1980	1988	1964
Const (b_0)	0.0001	0.0020	0.0001	0.0000	0.0001	0.0000	0.0003	0.0000	0.0001	0.0000
	(1.22)	(0.46)	(0.88)	(−0.09)	(0.85)	(−0.15)	(2.19)	(0.21)	(0.94)	(0.45)
Hedge (b_1)	−0.0375	0.0102	0.0000	0.0604	0.0368	0.0685	0.0437	0.0422	0.0085	0.1276
	(−3.87)	(1.09)	(0.00)	(10.07)	(4.35)	(14.44)	(4.95)	(8.99)	(2.51)	(14.35)
Quantile Δ5% ($b2$)	0.0034	−0.0109	−0.0063	−0.0495	0.0408	−0.0480	−0.0212	−0.0276	0.0062	−0.0068
	(0.17)	(−0.89)	(−0.44)	(−3.20)	(2.47)	(−3.17)	(−1.06)	(−2.11)	(0.98)	(−0.38)
Total ($b_1 + b_2$)	−0.0341	−0.0007	−0.0063	0.0109	0.0776	0.0205	0.0225	0.0146	0.0147	0.1208
	(−2.05)	(−0.05)	(−0.50)	(0.77)	(5.39)	(1.44)	(1.24)	(1.20)	(2.72)	(7.44)
Quantile Δ1% ($b3$)	−0.0079	0.0000	−0.0062	−0.0446	−0.1791	−0.0404	0.0239	−0.0447	−0.0218	−0.0349
	(−0.34)	(7.45)	(−0.36)	(−2.91)	(−10.8)	(−2.4)	(0.92)	(−3.13)	(−3.48)	(−1.69)
Total ($b_1 + b_2 + b_3$)	−0.0420	−0.0007	−0.0126	−0.0337	−0.1015	−0.0199	0.0464	−0.0301	−0.0071	0.0859
	(−2.56)	(−0.06)	(−1.00)	(−4.53)	(−8.34)	(−2.20)	(2.38)	(−3.56)	(−1.92)	(6.63)

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 5% (b_2), and 1% (b_3). Asset i is deemed a weak, intermediate or a strong hedge for the stock market j if the parameter b_1 is economically "small" (zero or close to zero), negative and economically intermediate, or negative and economically strong, respectively. We use the cutoff of 0.05 [−0.05, +0.05] to assess whether an estimated coefficient is economically "small". The estimated coefficient is deemed as economically "moderate" ("large") if the estimated coefficient is between −0.05 to −0.20 (lower than −0.20). Parameters, b_2, and b_3 are the incremental safe-haven gold beta for the lowest 5%, and 1% for the stock market j returns, respectively. Further, the sum of the two parameters, $b_1 + b_2$, is the total safe-haven gold beta for the lowest 5% stock market returns. If the sum, $b_1 + b_2$, is negative, statistically insignificant or significant of either sign, but economically "small", then asset i serves as a weak safe haven from stock market losses during the lowest 5% stock market returns. If the sum, $b_1 + b_2$, is negative, statistically significant and economically "moderate" ("large"), then asset i serves as an intermediate (strong) safe haven from stock market losses during the lowest 5% stock market returns. Similar interpretation applies to $b_1 + b_2 + b_3$, with respect to the lowest 1% stock market returns. The respective t-statistics are provided in the parentheses.

lowest 5% stock market returns, in which the total safe-haven 5% quantile betas are insignificant. Further, gold does not serve even as a weak safe haven for eight countries (the US; Japan; Germany; the UK; France; Italy; Brazil and Canada) during the lowest 1% stock market returns, in which the total safe-haven 1% quantile betas (i.e. sum of $b_1 + b_2 + b_3$) are positive, significant and economically not small. Gold serves as a weak safe haven for the other two countries (China and India) where betas are insignificant.

In sum, the results in Table 8 suggest that gold does not serve as a safe haven during the COVID-19 pandemic, especially for the lowest 1% stock market returns. This weakening of gold is reflected by gold betas that are generally more significant and negative in the period prior to COVID-19 pandemic, as reported in Panel B of Table 8. For example, the total safe-haven 1% quantile beta (i.e. sum of $b_1 + b_2 + b_3$) for the US (UK) is −0.04 (−0.10) in Panel B versus +0.24 (+16) in Panel A.

5. Conclusion

In this paper, we perform a coordinated comparative examination of the safe haven efficacy of precious metals (gold and silver); currencies (US dollar and Swiss franc); US Treasuries (T-bills and T-bonds); and corporate bonds (AAA-grade) from stock market losses during the 2008 GFC and COVID-19 pandemic. Regarding the GFC, our findings show that the US dollar, the Swiss franc and T-bonds (Gold, Silver and T-bills) serve as an intermediate (weak) safe haven. Regarding COVID, we find

that gold becomes very risky in some settings, especially in China, and Japan, which indicates that gold could lose its safe-haven status during a pandemic. Silver has become much riskier in all the countries during COVID. However, AAA-grade corporate bonds have strengthened a little as a safe haven during COVID compared to the GFC. In summary, our main findings indicate that that the safe-haven character of traditional assets such as gold and silver; as well as for the US dollar and T-bonds have all weakened during COVID compared to the GFC.

We also seek to shed light on why gold loses its "aura" as a safe haven asset during COVID when, traditionally, it acted as a safe haven asset – e. g. 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 it lost almost half of its value between 2011 and 2015. Furthermore, investors now have access to additional safe haven assets for financial shelter during crises, such as financial derivatives.

Our findings are useful for investors and fund managers searching for the best safe haven, across the potential choices of gold, silver, currencies, the US Treasuries, and corporate bonds to offset large stock market losses. Specifically, our results suggest that while no strong financial shelter seems to exist, investors seeking some form of safe haven during a pandemic should seriously consider liquid and stable assets such as currencies and Treasuries rather than the traditional choice of precious metals. Therefore, central banks, financial institutions and regulatory authorities should continue supporting such financial assets to retain liquidity during stock market crises.

CRediT authorship contribution statement

Muhammad A. Cheema: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Robert Faff:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Kenneth R. Szulczyk:** Methodology, Writing – original draft, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.irfa.2022.102316.

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