

**The 2008 Global Financial Crisis and COVID-19 Pandemic: How  
Safe are the Safe Haven Assets**

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## **Abstract**

This paper compares the performance of safe haven assets from stock market losses during the 2008 Global Financial Crisis (GFC) and COVID-19 pandemic across the ten largest economies in the world. The results show that the traditional safe haven asset, gold, acts a safe haven during the 2008 GFC but fails to protect investor's wealth during the COVID-19 pandemic. Our results suggest that investors might have lost trust in gold as a stable asset after losing 45% of its value between 2011 to 2015. Furthermore, silver does not serve as a safe haven during both crises, while U.S. Treasuries, Swiss Franc generally act as strong safe havens from the stock market losses during both crises. The U.S. dollar acts as a safe haven during the 2008 GFC for all the countries except for the United States, but only for China and India during the 2008 GFC. Finally, Bitcoin does not serve as a safe haven for all the countries during the COVID-19 pandemic; however, stablecoin, Tether, that is pegged to the U.S. dollar serves as a strong safe haven. Thus, our results suggest that, during a pandemic, investors prefer liquid and stable assets rather than gold.

## **Introduction**

The spread of COVID-19 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 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), U.S. Treasury bills and bonds (e.g. Chan et al., 2011; Fleming et al., 1998;

Hartmann et al., 2004; Noeth and Sengupta, 2010), and U.S. dollars and Swiss Franc (e.g. Grisse and Nitschka, 2015; Kaul and Sapp, 2006; Ranaldo 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.

Few studies argue that cryptocurrencies act as a safe haven during market turmoil (e.g. Stensås et al., 2019; Urquhart and Zhang, 2019); however, other studies consider cryptocurrencies as a risky asset instead of a safe haven (e.g. Bouri et al., 2017; Smales, 2019). Moreover, 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 as a safe haven against Bitcoin during extreme market movements. Stablecoins are cryptocurrencies that are pegged to stable assets such as gold and the U.S. dollar.

The COVID-19 crisis provides a strong motivation to examine whether the traditional safe assets such as gold, U.S Treasury bills and bonds, U.S. dollar, and Swiss Franc provide protection from stock market losses during the COVID-19 pandemic. Furthermore, it also provides an opportunity to compare the performance of safe haven assets between the 2008 GFC and the COVID-19 pandemic. For instance, traditional assets that were safe havens during the 2008 GFC (e.g. Baur and McDermott, 2010; Low et al., 2016) maintain their safe haven status during the COVID-19 pandemic or not. Furthermore, the COVID-19 pandemic provides an opportunity to examine whether the largest traditional cryptocurrency, Bitcoin, and the largest stablecoin, Tether, serve as a safe haven against stock market losses because cryptocurrencies were never involved in any major market turmoil since the inception of Bitcoin in 2010. Therefore, Bitcoin and Tether are examined as a safe haven from stock market losses in this paper.

A growing number of studies have examined the impact of the COVID-19 epidemic 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 pandemic on the stock markets. Conlon et al. (2020) show that Tether acts as a safe haven for several stock indices; whereas Bitcoin and Ethereum do not serve as a safe haven for the majority of the stock indices examined in their study. Nonetheless, no study has compared the performance of safe haven assets between the 2008 GFC and COVID-19 pandemic.

In this paper, we examine the safe haven efficacy of metals (gold and silver), currencies (U.S. dollar and Swiss Franc), U.S. Treasuries (T-bill and T-bond), and cryptocurrencies (Bitcoin and Tether) from the stock market losses during the 2008 GFC and COVID-19 pandemic. We select the stocks markets of the ten largest economies; namely, U.S., China, Japan, Germany, U.K., 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 results show that gold serves as a strong, safe haven for six countries and as a weak safe haven for the other four countries during the 2008 GFC. However, gold loses its safe haven status during the COVID-19 pandemic since its prices move in tandem with the stock markets of all ten countries. We suggest that gold loses its safe haven status because investors might have lost trust in gold as a stable asset after losing 45% of its value between 2011 to 2015. Silver does not function as an effective, safe haven during both the crises. The U.S. dollar acts as a safe haven for all the countries except the U.S. during the 2008 GFC but a safe haven only for China and India during the COVID-19 pandemic. The Swiss Franc and both Treasuries, T-bill and T-bond, act as a safe haven during both the 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, we compare the performance of the traditional safe haven assets across stock markets of the world's largest ten economies and show that gold does not protect the investor's wealth during the COVID-19 pandemic. Second, we show that investors from both developed and emerging markets choose the same safe haven assets during both crises. Third, our results suggest that investors prefer liquid and stable assets such as U.S. Treasuries, Tether and Swiss Franc rather than gold during a pandemic.

The rest of the paper is organised 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 U.S. index, SSE composite index China, Tokyo Stock Price Index Japan (TOPIX), MSCI Germany Index, FTSE100 Index U.K., 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 the U.S. dollar, which is the preferred currency of international investors. Furthermore, returns denominated in the U.S. dollar allow a direct comparison between stock market indices and safe haven assets.

The safe haven assets include metals (gold and silver), currencies (U.S. Dollar Index and Swiss Franc Index), Treasuries (S&P U.S. Treasury bill index (T-bill) and S&P U.S. Treasury bond index (T-bond)), and cryptocurrencies (Bitcoin and Tether). U.S. dollar index and Swiss Franc index represents the value of the U.S. dollar and Swiss Franc relative to a basket of foreign currencies, respectively. DataStream International provides data of all stock market

indices and safe haven assets except the Swiss Franc index and cryptocurrencies. The data of Swiss Franc index is collected from the online database of Swiss National Bank, while [coinmarketcap.com](https://coinmarketcap.com) 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 the asset  $i$  such as gold, silver, T-bill) and T-bond, U.S. dollar index, Swiss Franc index, Bitcoin, and Tether.  $RS_j$  denotes the daily log returns in U.S. dollars of a stock market index  $j$  of the ten largest economies in the world. The GFC is a dummy variable, which takes the value one from the start date and the subsequent 20 trading days of the 2008 GFC, and zero otherwise. The dummy variable, COVID, is similarly constructed to the GFC variable.<sup>1</sup> The residual term  $\varepsilon_t$  is modelled as a GJR-GARCH process introduced by Glosten et al. (1993) as defined in Equation (2). The  $\gamma I_{t-1}$  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.

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<sup>1</sup> We do not utilize GFC and COVID dummies without their interaction with stock market returns since it would capture the change in the price of safe haven assets during 2008 GFC and COVID-19 pandemic period compared to the normal periods. However, those dummies would not indicate any relation of the safe haven asset with stock market changes.

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 2008 GFC and COVID-19 pandemic. It is evident from Figure 1 that the 2008 GFC stock market crisis intensified in September 2008 with the collapse of Lehman Brothers; whereas, the stock market crisis from COVID-19 intensified in February 2020. Therefore, we define the start date for GFC on September 12, 2008, and COVID-19 pandemic on February 20, 2020.<sup>2</sup>

Estimating Equations (1) – (2) check whether asset  $i$  serves as a safe haven during the 2008 GFC and COVID-19 pandemic. Asset  $i$  is a weak (strong) hedge for the stock market  $j$  if the parameter  $b_1$  is zero (negative and significant). 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 2008 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-19 pandemic.

### **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.

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<sup>22</sup> 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).

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.

The average returns of stock market indices range between -0.012% (Italy) to 0.027 (India) per day. The standard deviation of all 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 indicate that the U.S. Treasuries, U.S. 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 metals move in tandem. The correlation between gold and U.S. dollar is negatively correlated (-0.34) and indicates that these assets move in the opposite direction; thus, 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 move in the same or opposite direction. The stock market indices of all the ten countries are positively correlated to each other with strong positive correlations between the U.S. 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 of 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 U.S. Nonetheless, we find similar results for the stock markets of other nine countries as well.<sup>3</sup> We

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<sup>3</sup> 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.



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

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

Table 2, Panel B reports the results of safe haven assets on the ten days of largest losses of the S&P 500 during the COVID-19 pandemic from February 20, 2020, to May 19, 2020, the sample end date. The results show that gold returns generally move in tandem with the ten extreme stock market losses of S&P 500 during the COVID-19 pandemic with seven negative gold returns. For instance, gold lost its value by 4.90% on March 12, 2020, when the S&P500 index incurred a 10% loss. Silver also moved in tandem with extreme stock market losses during the COVID-19 pandemic, with eight negative silver returns. Five out of the ten U.S. dollar returns were negative, but only two Swiss Franc returns were negative on the days of largest losses of the S&P500. The T-bill recorded only one negative return while the T-bond recorded two negative returns. Bitcoin and Tether have five and six negative returns, but the magnitude of Bitcoin's negative returns is much larger than Tether returns. For example, Bitcoin dropped in value by 46.5% on March 12, 2020, while Tether recorded the maximum loss of 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 our results in Section

3.2, we expect gold to act as a safe haven asset during the 2008 GFC but not during the COVID-19 pandemic. Furthermore, we expect Treasuries and currencies to act as safe haven assets for both the 2008 GFC and the COVID-19 pandemic. Finally, Tether might act as a safe haven during the COVID-19 pandemic; however, we do not expect Bitcoin to act as a safe haven asset since it loses 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 U.S. 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 2008 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 the COVID-19 pandemic, where it serves as a weak safe haven. However, the estimate of the total effect is

positive, which indicates that the positive relationship between gold and Canada weakened during the COVID-19 pandemic.<sup>4</sup>

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,  $b_1$ , shows that silver generally moves in tandem with stock market returns. Furthermore, silver serves as a strong, safe haven only for the U.S. and Brazil during the 2008 GFC. However, the estimate of the total effect is positive for Brazil, which indicates that the positive relationship between silver and stock market index weakened during the 2008 GFC. Silver acted as a weak safe haven for the U.K. and Canada during the 2008 GFC; however, the total effect estimate is positive for both the U.K. and Canada, which implies that the positive relationship between silver and stock market indices weakened during the 2008 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 in the countries except the U.S., 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 U.S., Italy and Brazil weakened during the COVID-19 pandemic. In sum, the results in Table 3 strongly refutes the use of gold and silver as safe havens during the COVID-19 pandemic 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 the COVID-19 pandemic.

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<sup>4</sup> The total effects estimate is positive for Brazil implying that gold was not a safe haven despite the statistical insignificance. The non-significance ( $t$ -stat=1.57) of the positive coefficient estimate must be treated with care since it is based on observations of only 20 trading days.

### *3.3.2 Currencies*

Table 4, Panel A shows that the U.S. 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 U.S. and Brazil during the 2008 GFC; however, the total effect estimate is negative for Brazil indicating that the negative relationship between U.S. dollar and Brazilian stock market is weakened during the 2008 GFC. The U.S. 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 U.K. and Germany indicating a weakness in the negative relationship during the COVID-19 pandemic.

Table 4, Panel B shows that the Swiss Franc serves as a strong hedge for the ten countries except for China and the U.S., 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 2008 GFC and COVID-19 pandemic. In sum, the results in Table 4 indicate that the Swiss Franc has maintained its role as a safe haven asset during the COVID-19 pandemic. On the other hand, the U.S. dollar is less effective as a safe haven for the majority of the stock markets during the COVID-19 pandemic.

### *3.3.3 Treasuries*

Table 5, Panel A, shows that the T-bill is a strong hedge for the U.S., Germany, U.K., 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 2008 GFC for all the countries except the U.S. and China, where it serves a weak safe haven. Moreover, the T-bill has maintained its safe haven status during the COVID-19 pandemic 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 2008 GFC, where it serves as a weak safe haven. Although T-bond also serves as a safe haven for all the countries during the COVID-19 pandemic, 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 during both crises.

### *3.3.4 Cryptocurrencies*

Table 6, Panel A shows that the parameter estimate,  $b_1$ , 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.<sup>5</sup> Most importantly, the total effect estimates for COVID-19 pandemic 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-19 pandemic.

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-19 pandemic. Therefore, it is evident that Tether, the largest stablecoin, exhibits strong safe haven properties during a market turmoil because it is tied to the U.S. dollar. 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 2008 GFC but loses its safe haven status during the COVID-19 pandemic. Silver fails to exhibit safe haven characteristics during both

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

crises. For currencies, the Swiss Franc has acted as a safe haven during both the crises; whereas, U.S. dollar has served as a safe haven during the 2008 GFC but not for the majority of the countries during the COVID-19 pandemic. 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 the COVID-19 pandemic.

#### 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 2008 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 hypothesise that gold does not act as a safe haven during extreme stock market movements. We estimate the following regression model first proposed and utilised 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

$\varepsilon_t$  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 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, U.S. Treasuries, U.S. 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 U.S. Treasuries and Swiss Franc protect investors from stock market losses during both crises, which indicate that investors trust U.S. Treasuries and Swiss Franc during both the 2008 GFC and the COVID-19 pandemic. For U.S. dollar, our results show that it acts as a safe haven during the 2008 GFC but does not act as an effective safe haven during the COVID-19 pandemic. The most surprising finding comes from the gold that has acted as a safe haven during the 2008 GFC but not during the COVID-19 pandemic. Silver does not exhibit safe haven characteristics during both crises. Our results show that Bitcoin does not protect

investors during the COVID-19 pandemic, but Tether that is pegged to the U.S. dollar acts as a strong 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 2008 GFC, but investors from those ten countries might have stayed away from gold as a safe haven during the COVID-19 pandemic.

We also explain why gold loses its value as a safe haven asset during the COVID-19 pandemic when, traditionally, it acted as a safe haven asset during the previous stock market crises of 1987 and the 2008 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 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 the COVID-19 pandemic.



**Table 1: Descriptive Statistics**

Panel A summarises the descriptive statistics for the daily returns (%) denominated in U.S. 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
<b>Safe Haven Assets</b>								
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
U.S. 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
<b>Stock Market Returns</b>								
U.S.	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
U.K.	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						
U.K. (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

**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	-9.47	0.9804	-8.292	0.8445	-0.0749	0.0285919	0.1385
01/12/2008	-9.354	-4.9181	-8.674	1.2182	0.6252	0.0205985	1.0559
29/09/2008	-9.20	1.0182	-3.592	0.6735	-0.0863	0.0382997	1.087
09/10/2008	-7.922	-1.7386	0.872	0.3085	0.0826	-0.0021904	-0.5695
20/11/2008	-6.948	0.1402	-3.143	0.7531	0.227	0.0219872	0.9694
19/11/2008	-6.311	1.3455	-2.547	-0.0687	-0.5902	0.0148988	0.5528
22/10/2008	-6.295	-3.352	-6.293	1.6297	1.1685	0.0144011	0.2707
07/10/2008	-5.911	1.6085	0.84	-0.873	0.3813	-0.0310701	-0.3689
20/01/2009	-5.426	3.188	-0.358	2.3589	-0.2508	0.0023612	-0.1339
05/11/2008	-5.412	-1.3494	3.159	-0.2007	-0.5405	0.0212085	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	-12.765	-1.893	-12.341	-0.671	0.674	0.018	1.549	-7.265	-0.499
12/03/2020	-9.994	-4.879	-4.704	0.990	0.523	0.018	-0.267	-46.473	5.339
09/03/2020	-7.901	-0.139	-1.209	-1.100	0.790	0.022	0.751	-2.301	-1.068
18/03/2020	-5.322	-3.224	-5.959	1.574	0.001	0.031	-1.061	0.245	-0.195
11/03/2020	-5.010	-0.312	-1.059	0.104	-0.203	0.013	-0.296	0.021	-0.291
27/02/2020	-4.517	0.521	-0.999	-0.567	0.078	0.022	0.375	-0.409	-0.433
01/04/2020	-4.515	-1.518	-1.222	0.725	0.180	0.003	0.320	2.578	0.171
20/03/2020	-4.433	0.777	2.049	0.058	-0.811	0.004	1.789	0.122	-0.564
05/03/2020	-3.451	1.176	0.852	-0.536	0.046	0.036	0.656	3.628	0.190
27/03/2020	-3.427	-0.247	-0.971	-1.062	0.353	-0.004	0.689	-3.741	1.475

**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	U.S.	China	Japan	Germany	U.K.	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	U.S.	China	Japan	Germany	U.K.	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)

**Table 4: Estimation results for U.S. Dollars and Swiss Franc as safe haven assets during the 2008 GFC and Covid-19 pandemic**

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

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

**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: U.S. Treasury Bills Index										
Coefficients	U.S.	China	Japan	Germany	U.K.	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: U.S. Treasury Bonds Index										
Coefficients	U.S.	China	Japan	Germany	U.K.	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)

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

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

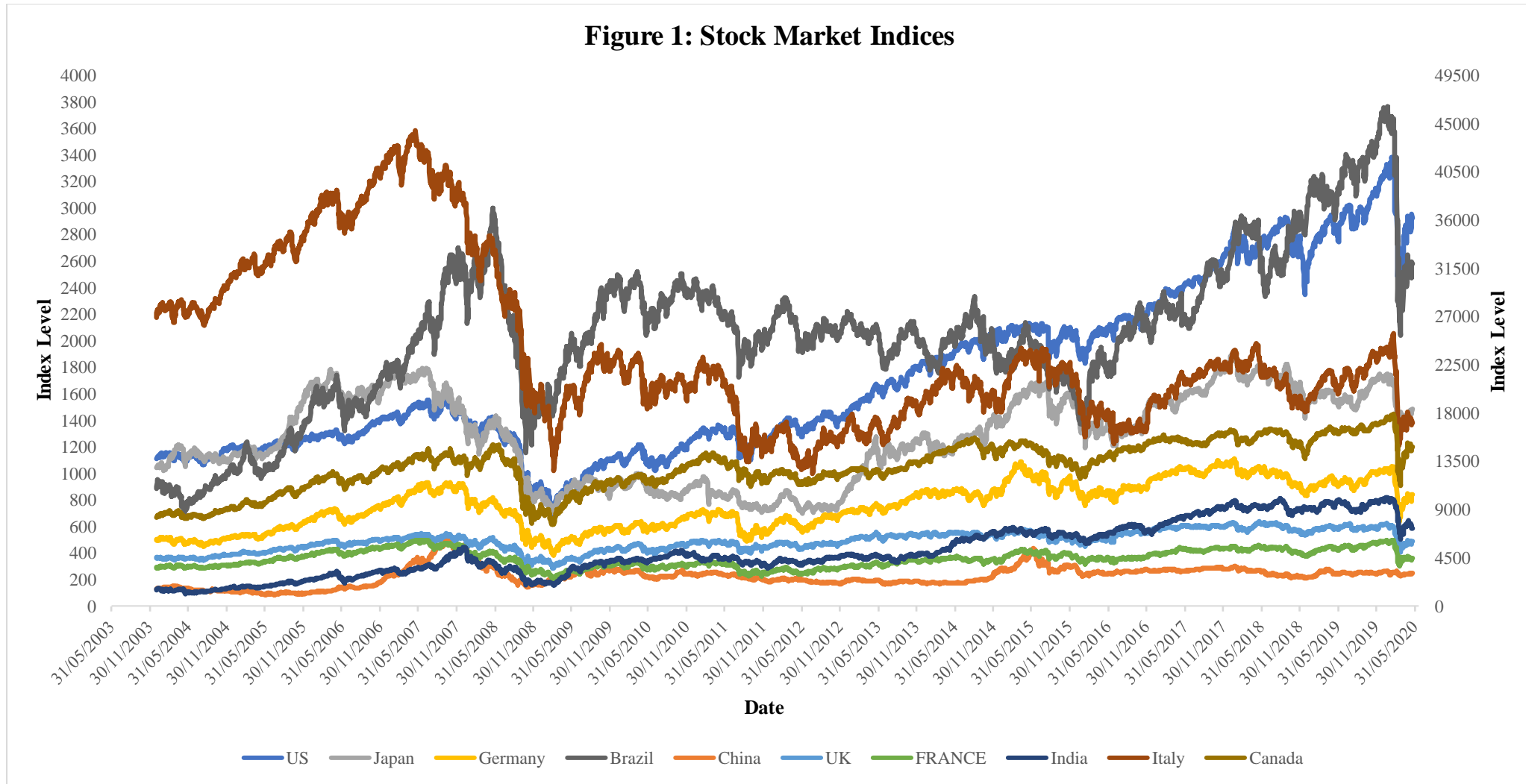
**Table 7: Estimation results for gold as a safe haven in extreme market conditions**

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.

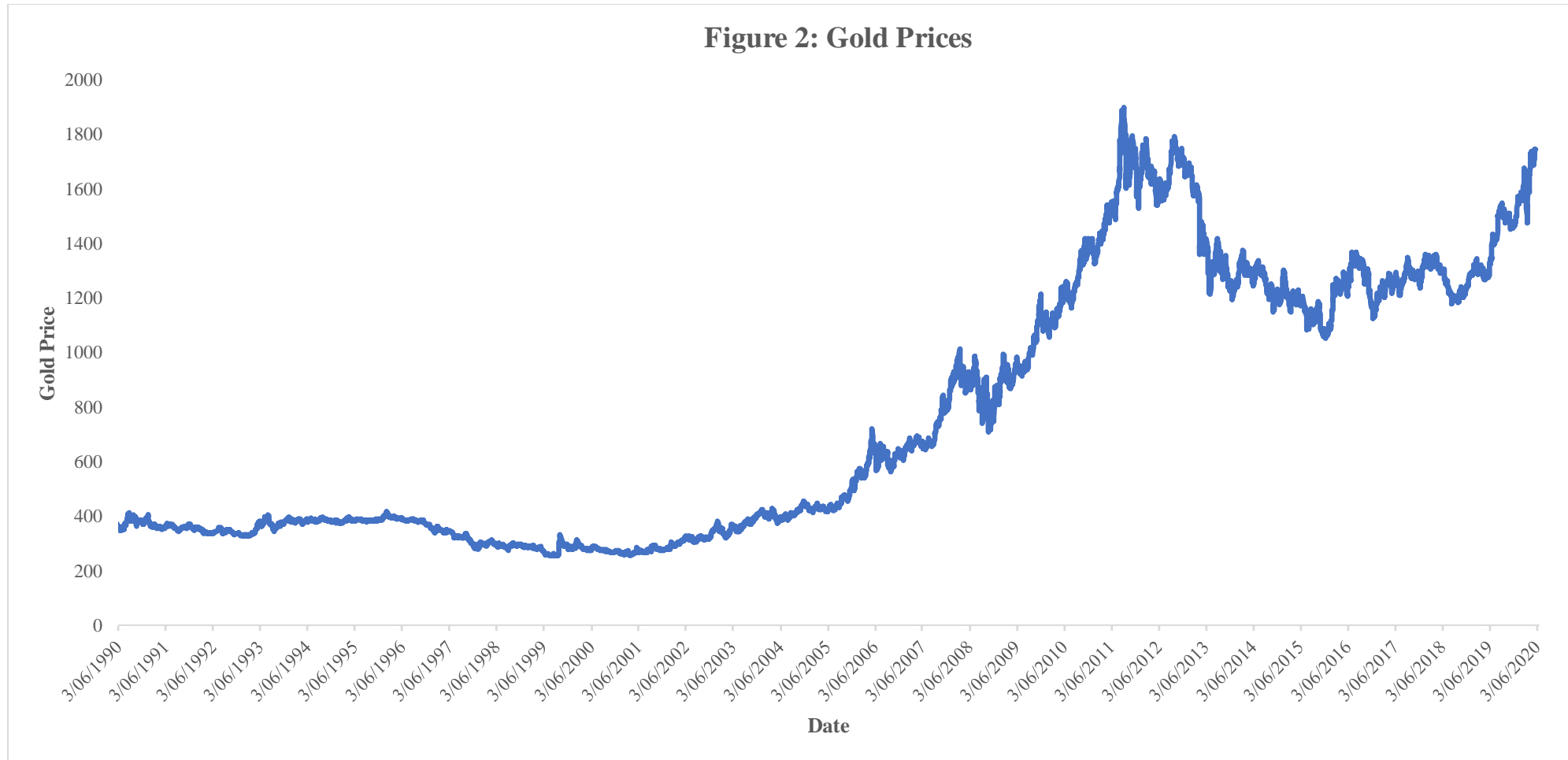
Coefficients	U.S.	China	Japan	Germany	U.K.	France	India	Italy	Brazil	Canada
Const ( $b_0$ )	-0.018	-0.011	-0.013	-0.001	-0.009	-0.011	-0.017	0.007	0.001	-0.019
	(-0.95)	(-0.54)	(-0.63)	(-0.05)	(-0.47)	(-0.57)	(-0.89)	(0.37)	(0.08)	(-0.99)
Hedge ( $b_1$ )	3.390	4.130	2.370	-2.650	2.540	-1.190	1.220	-2.870	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)



**Figure 1: Stock Market Indices**



**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 U.S., 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.



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

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