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Hedge and Safe Haven Properties of Gold, US Treasury, Bitcoin, and Dollar/CHF against the FAANA Companies and S&P 500

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ABSTRACT

The sudden market crash of 20 February 2020 arising from the COVID-19 pandemic has accelerated the digitalization phenomenon and revived the interest for risk mitigation during stress periods. In this paper, we examine the hedging, diversifying, and safe haven properties of gold, U.S. treasury bonds, Bitcoin, and Dollar/CHF for the FAANA (Facebook, Apple, Amazon, Netflix, and Alphabet) stocks and the S&P 500 index. FAANA exhibited positive returns with remarkable resilience throughout the pandemic period, suggesting a change in their investing character from risk to riskless assets. In our approach we examine both an extended sample period and an alternate focused evaluation of heightened uncertainty periods during the recent pandemic period. Furthermore, we estimate the optimal weights, hedge ratios, and hedging effectiveness for the pairs of stock and alternative assets (gold, US treasury, Bitcoin, and Dollar/CHF) during the full sample period and the COVID-19 pandemic period. Our empirical findings suggest that FAANA, once thought as risky high growth tech stocks, have matured and become a safe blanket during the latest turbulent period.

Keywords: Safe haven assets; Hedging; Diversification; FAANA stocks; COVID-19 outbreak

JEL Codes: C32, G15

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1. Introduction

A common feature across all stock markets during the COVID-19 pandemic and its repetitive waves, is the extreme market turbulence fueled by a consumer/enterprise spending "abyss". Amidst stormy periods, the majority of investors seek "safe-shelters" while waiting patiently for the financial markets to regain tranquility. During such turbulent and crisis periods, the typical securities that are considered uncorrelated or negatively correlated with stocks and bonds in case of a market crash (safe havens) reported in the literature are gold, treasury bonds and safe haven currencies (see Baur and Lucey, 2010 and Connor et al., 2015 among others).

The voluminous literature on safe-havens and market risk diversification suggests that the hedging behavior of a security changes over time. While the most common hedging instruments are low-risk (low-volatility) securities, the COVID-19 era has highlighted the role of high growth tech stocks (Facebook, Apple, Amazon, Netflix, and Alphabet - FAANA) as an investing vehicle that secured high yields with relative consistency; previously considered as risky investment positions. The shift to a "digital-world" during the period of the pandemic's lockdowns has shifted demand and interest to digital services and thus increased the business activities and revenues of tech firms. This change in demand for digital services induced a virtuous cycle of revenues and thus superior market performance for FANAA, with the selected big 5 stocks representing almost half of the S&P 500 annual gains by September 2020. The concentration of US stock market on a handful of stocks with high capitalizations and high returns lured investors to FANAA, boosting their returns further more. This phenomenon has established FANAA as low risk investment vehicle during the pandemic and potentially a safe haven for future resurgences of the pandemic.

The earlier studies in the hedging literature date back to the work of Markovitz and modern portfolio theory based on simple quadratic optimization. Since then, the introduction of more sophisticated models and methodologies have boosted the field, producing a voluminous literature. Nevertheless, the securities used as low-risk hedging instruments are common across studies. Traditionally, gold (Baur and Lucey, 2010; Baur and McDermott, 2010), bitcoins (Bouri et al., 2017b; Urquhart and Zhang, 2019), and foreign exchange currencies (Grisse and Nitschka, 2015) are all considered safe-haven investments during times of financial turmoil. Unlike hedging, the lack of a theoretical model for safe havens makes definition controversial. The consensus among researchers is that a diversifier is a security that is uncorrelated to other

assets in a given portfolio and this extends to market crashes when it comes to safe havens, mitigating downside market risk. Thus, the concept of a safe haven asset (Baur & McDermott, 2010) is clearly different from that of a safe asset (Gorton, Lewellen, & Metrick, 2012), given that the need to hedge or diversify a portfolio applies at all times, while safe-haven assets are mainly relevant during times of market crash or crisis (Baur & Lucey, 2010).

Under this strand of research, gold has typically been considered as a safe haven (Bouri et al., 2020) given its role throughout history as a commodity with high intrinsic value. The role of gold as a diversifier in the literature is also warranted, with numerous applications. For example, Baur and McDermott (2010) provide empirical evidence in favor of gold acting as a risk diversifier for the U.S. and major European stock markets, but not for other markets. Reboredo (2013) and Beckmann et al. (2015) argue that gold can act both as a hedge and an effective safe haven, while Hood and Malik (2013) conclude that gold is a hedge for the U.S. stock market return, but not for its volatility [measured by the volatility index (VIX)]. Li and Lucey (2017) find that gold can be used effectively as a safe haven in 11 stock markets, but the role changes over time. Yousaf et al. (2021) provide evidence on the hedging effectiveness for the pair of crude oil-gold during the pandemic.

In tandem with gold, various currencies and commodities have also been examined as potential safe havens. Ranaldo and Söderlind (2010) and Grisse and Nitschka (2015) suggest that the Swiss franc and the Japanese yen can be used effectively as safe havens during turbulent financial periods, while other currencies appear to be highly correlated to the stock market. On a different approach based on commodities, crude oil (Xia et al., 2019; Creti et al., 2013) and food commodities (e.g., soybeans) are found to be successful risk diversifiers only episodically and for limited time periods, especially after the 2008 global financial crisis (Wu et al., 2020). In fact, commodity indices are found to be weak risk diversifiers (Shahzad et al., 2019).

The emergence of the crypto market and its unique characteristics regarding the lack of administrative regulations have spurred a novel literature on the examination of bitcoin as a risk diversifier. Bouri et al., (2017a) argue that bitcoin can be used to hedge market risk, but only for limited time periods and with heterogenous characteristics across markets, examining a variety of assets across alternate markets. Stensas et al. (2019) evaluate the hedging attributes of bitcoin on equity markets in the U.S., the U.K., Japan, Italy, Germany, France, Canada, Brazil, Russia, India, China, South Korea and Zimbabwe, concluding that the hedging behavior

of bitcoin exists in most of the developing economies, but is merely a risk diversifier for investors in the developed markets. Similarly, Popper (2015) argue that bitcoin has many similarities to gold in terms of its hedging capabilities and a potential to act as a risk diversifier, while Dyhrberg (2016) show that bitcoin could hedge successfully downside risk in the FTSE 100 index and the U.S. dollar in the short term.

In this study, we examine the safe haven, hedge and risk diversification abilities of FANAA stocks against the alternative investments proposed in the literature. In doing so, our analysis comprises of four steps; first we estimate the time-varying correlations between alternative investments (gold, US treasury, bitcoin, and Dollar/CHF) and stocks (FAANA and S&P 500) using the DCC-GARCH model proposed by Engle (2002), secondly, we perform a regression analysis to detect hedge and safe-haven features of the alternate assets against stocks following the approach of Ratner and Chiu (2013). Thirdly, we estimate optimal portfolio weights, hedge ratios, and hedging effectiveness using the time-varying conditional covariances and variances of a DCC-GARCH model. Fourthly, we conduct an economic portfolio evaluation.

Our empirical findings suggest that FANAA exhibited a stable performance during the pandemic period, gaining a role as a viable risk diversifier among gold and exchange rates, especially during the pandemic period.

2. Methodology and Data

2.1. Time-varying correlations

The dynamic correlations ($\rho_{ij,t}$) of our portfolios are estimated between alternative investment stock options following Ratner and Chiu (2013). We use DCC-GARCH model to estimate dynamic conditional correlations (Bouri and Roubaud, 2016; Akhtaruzzaman et al., 2021), following are specifications of the conditional mean of the DCC-GARCH model:

$$r_t|\Omega_{t-1} \sim N(0, H_t)$$

$$H_t = D_t R_t D_t \qquad (1)$$

$$e_t = D_t^{-1} r_t$$

where r_t is a vector of returns for a pair of stock and alternative assets at time *t* and e_t is a vector of residuals. Ω_{t-1} is the information set at time *t-1*, while H_t denotes the conditional-covariance matrix with D_t = diag $\{\sqrt{h_t}\}$ indicating the diagonal matrix of conditional standard

deviations for the return series at time *t*. We use the common in literature symmetric GARCH (1,1) model to estimate the conditional standard deviation of the return series.

$$h_t = c + a\, e_{t-1}^2 + b\, h_{t-1} \quad (2)$$

where *c* is a constant, h_t is the conditional variance, and parameters *a* and *b* capture ARCH and GARCH effects, respectively. Finally, we formulate the dynamic conditional correlation matrix $R_t = [\rho_{ij,t}]$ as:

$$R_t = diag\,\{Q_t\}^{-1} Q_t diag\,\{Q_t\}^{-1} \quad (3)$$

where $Q_t = [q_{ij,t}]$ is the unconditional-correlation matrix of e_t being a symmetric positive-definite matrix. The dynamic correlation estimator is obtained by:

$$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha e_{t-1}\acute{e}_{t-1} + \beta Q_{t-1} \quad (4)$$

$$\rho_{ij,t} = \frac{q_{ij,t}}{(\sqrt{q_{ii,t}}\sqrt{q_{jj,t}})} \quad (5)$$

where the correlation matrix of residuals is denoted by $\bar{Q}$. This model suggests that the series are mean-reverting if α+β <1.

2.2. Assessing diversification, hedge and safe-haven properties

The diversification approach between different investing choices follows Ratner and Chiu (2013), who extend Baur and McDermott (2010), to estimate hedge and safe-haven properties of alternative assets (*j*) against stocks (*i*) as follows:

$$\rho_{ij,t} = \gamma_0 + \gamma_1 D(r_{Stock} q_{10}) + \gamma_2 D(r_{Stock} q_5) + \gamma_3 D(r_{Stock} q_1) \quad (6)$$

where the dummy variable *D(.)* captures the extreme downturns of the stock index, r_{Stock}, based on the 10% (q_{10}), 5%(q_5), or 1%(q_1) quantiles, respectively. The signs and statistical significance of γ_0, γ_1, γ_2, and γ_3 are used as measures of diversification, hedging, and ultimately as safe-haven alternative assets to stocks (Yousaf et al, 2022; Peng 2020; Ren and Lucey, 2022). Specifically, if γ_0 is found to be positive (negative) and significant then it reflects the role of alternate asset as diversifier (strong hedge). However, insignificant γ_0 indicates the role of alternate asset as weak hedge against stocks. If γ_1, γ_2, or γ_3 are found to be insignificant (negatively significant) the alternate assets act as weak (strong) safe-haven against downturns in stocks.

Furthermore, motivated by the COVID-19 pandemic (Albuquerque et al., 2020), we also explore the hedge and safe haven characteristics of the alternative assets against large equity market fluctuations driven by the health crisis. For this reason, we estimate:

$$\rho_{ij,t} = \gamma_0 + \gamma_1 D(Infectious\ diseases) \quad (7)$$

where the dummy variable *D* indicates that the COVID-induced uncertainty developed by Baker et al. (2020), lies in the upper 90% quantile of the empirical distribution and zero otherwise (Yousaf et al., 2022). The positively (negatively) significant γ_0 indicates the role of alternate assets as diversifier (strong hedge), whereas insignificant negative γ_0 show the weak hedge feature of the alternate assets against stocks (Bouri et al., 2017a, b). Finally, insignificant (negatively significant) γ_1 indicates the weak (strong) safe-haven feature of alternate assets against stocks during the COVID-19 pandemic.

2.3. Portfolio analysis

Thirdly, we compute the optimal weights, hedge ratios, and hedging effectiveness for the alternative asset-stock portfolios using the conditional covariances and variances from the DCC-GARCH model. Kroner and Ng (1998) suggest the following specification to estimate optimal weights for x (Stock) and y (alternative) asset-based portfolios:

$$w_t^{x/y} = \frac{h_t^y - h_t^{x/y}}{h_t^x - 2h_t^{x/y} + h_t^y} \quad (8)$$

$$w_t^{x/y} = \begin{cases} 0, & if \quad w_t^{x/y} < 0 \\ w_t^{x/y}, & if \quad 0 \le w_t^{x/y} \le 1 \\ 1, & if \quad w_t^{x/y} > 1 \end{cases}$$

where $w_t^{x/y}$ describes the weight of asset *x* in a one-dollar portfolio of the two assets (x, y) at time t and $h_t^{x/y}$ is the conditional covariance between the two assets. Clearly, the corresponding weight of the second asset *y* in this portfolio is $1 - w_t^{x/y}$."

Kroner, and Sultan (1993) propose the following equation to compute the hedge ratio for the alternative asset (y) and stock (x):

$$\beta_t^{x/y} = \frac{h_t^{x/y}}{h_t^y} \quad (9)$$

where ($h_t^{x/y}$) is the conditional covariance between asset pairs (x,y) and h_t^y is the conditional variance for asset y (alternative asset) at time t.

The effectiveness of the hedging strategy is measured by the percentage drop in the variance of the optimal portfolio compared to the unhedged portfolio. Following Balcilar et al. (2016), we compute the hedging effectiveness (HE) as follows:

$$HE = \left[\frac{Variance_{unhedged} - Variance_{hegde}}{Variance_{unhedged}}\right] \quad (10)$$

where $Variance_{unhedged}$ is the variance of the unhedged portfolio returns (i.e. stock) and $Variance_{hed}$ is the variance of the optimal portfolio returns complemented by a position in the alternative asset. The higher HE scores reveals the bigger risk reduction enabled by the optimal portfolio.

2.4. Economic portfolio evaluation

While the statistical evaluation of asset allocation has its own merit, the true interest of an investor during turbulent periods lies with the ability to consider safe haven investments in the portfolios to hedge downside risk. In other words, a model of low forecasting errors does not necessarily mean that its forecasts can be exploited in building profitable trading strategies. So, in order to measure the economic performance of each portfolio, we build a trading strategy where a mean- variance investor allocates her wealth in every period to a portfolio consisting of a FANAA stock and the typically selected by the literature safe haven assets (gold, US treasury, Bitcoin, and Dollar/CHF), where $w_t^{x/y}$ describes the weight of asset *x* in a one-dollar portfolio of the two assets. In Figure 4, we depict the time-varying weights of the portfolios formed with the Apple stock and one of the four assets (gold, US treasury, Bitcoin, and Dollar/CHF) during the COVID pandemic period.

As we observe, Apple stock dominates Bitcoin, but has a smaller part on the other three assets, with the largest appearing on the portfolio with gold. The use of the time varying portfolios leads to the portfolio returns in every period

$$r_t = w_t^{x/y} * r_x + \left(1 - w_t^{x/y}\right) * r_y, \quad (11)$$

where r_t are the portfolio returns, r_x returns of the FANAA stock on time t and r_y the returns of the alternative asset. To construct a measure of economic significance that is independent of the forecasted period, we measure the Certainty Equivalent Return (CER), which is the risk-

free rate that the investor is willing to accept instead of investment in a portfolio as in (11), depending on the mean return μ_r and the variance σ_r^2 of the portfolio.

$$CER = \mu_r - \frac{1}{2} * g * \sigma_r^2 \tag{12}$$

The risk-averse parameter g is set to 3, as in Rapach et al. (2016) and Campbell & Thompson (2008).

2.5. Data and preliminary analysis

The dataset is at the daily frequency, comprising the closing levels of the S&P 500 composite index, five major tech stocks (Facebook, Apple, Amazon, Netflix, Alphabet), gold bullion against the US Dollar, the US Benchmark 10 Year Government Bond Index, Bitcoin in exchange rate against the US Dollar[1], the exchange rate of the US Dollar against the Swiss Franc (USD/CHF). Data are sourced from Refinitiv DataStream for the period May 18, 2012 to December 13, 2021, yielding 2,497 daily observations. Notably, the beginning of the sample period is dictated by the price data availability of Meta Platforms A: Facebook. Interestingly, the sample period is long enough and informative to cover a rich period of bullish (tranquil) and bearish (turbulent) states. The sub-sample period of the COVID-19 starts from January 01, 2020 and ends on December 13, 2021. In Figure 1 we display the level series. Overall, the FAANA and S&P 500 indices show a clear uptrend whereas for the rest of indices the price patterns are mixed, in the sense that we do not observe any clear positive or negative price patterns.

All variables are expressed in logarithmic returns. Table 1 provides the summary statistics of the financial market. The highest average returns are observed in Bitcoin and Netflix whereas the lowest in Dollar/CHF and US treasury markets. The average unconditional volatility is the highest in Bitcoin and Netflix whereas the lowest is in the US treasury and Dollar/CHF markets.

Except of four FAANA stocks, the skewness value is negative in all markets. The Kurtosis value is substantially larger than 3, especially for Dollar/CHF. Jarque-Berra statistics are significant in all series, indicating the normality of all return series. ARCH test statistics provide evidence of heteroscedasticity in all return series, which suggests the suitability of

[1] It is traded on Bitstamp Exchange, one of the well-established and largest exchanges for cryptocurrencies.

applying GARCH-based models. The results of the Augmented Dicky Fuller test reveal that all return series are stationary.

Figure 2 illustrates the returns series over time. Return clustering can be noticed at various point of time in almost all series, especially around Q1- 2020 which coincides with the peak of the COVID-19 outbreak. As for the unconditional correlations (Table 2) they indicate a strong correlation between FAANA and S&P 500. Moreover, Gold, Bitcoin, and Dollar/CHF are comparatively weakly associated with the FAANA+S&P 500 markets, indicating potential diversification benefits when adding gold, Bitcoin, and Dollar/CHF in the stock-based portfolios.

Besides the above-mentioned wide array of dataset, we use infectious disease equity market volatility index of Baker et al. (2020) to capture equity market uncertainty induced by the pandemic[2], which has recently been used in many research papers (e.g., Bouri et al., 2021; Gupta et al., 2021).

3. Results

Figure 3 shows the time-varying DCCs for pairs of stock stock/alternative asset. The results reveal that the DCC between all pairs vary over time, further these DCCs hugely changed at the start of the COVID-19 for almost all pairs of stock stock/alternative asset. Notably, we notice a transitory decline in the correlation to negative territories around the peak of the start of the pandemic for S&P500-gold, whereas a transitory spike in the correlation to positive territories is noticed between US treasury and most of FAANA stocks.

First, we examine the hedging, diversifying, and safe haven properties of the alternative assets (gold, US treasury, Bitcoin, and Dollar/CHF) against the FAANA stocks and S&P 500 during extreme market downturns (1 percent, 5 percent, and 10 percent), see details in Table 3. We differentiate the weak hedge, strong hedge, and diversifier through the coefficient γ_0. Panels A-D indicate that the coefficient γ_0 is negative and significant in US treasury against all stocks, indicating that US treasury is the strong hedge against the FAANA stocks and S&P 500. Gold serves as strong hedge against Facebook, Amazon, Alphabet, and S&P 500, as the coefficient γ_0 is found to be significantly negative. The positive and significant γ_0, in the case of Bitcoin and Dollar/CHF, indicates that Bitcoin and Dollar/CHF play the role of diversifier against the

[2] More information on this index and its data are available at https://www.policyuncertainty.com/infectious_EMV.html.

FAANA stocks and S&P 500. Finally, gold serves as diversifier against the Apple and Netflix stocks.

If γ_1, γ_2, or γ_3 are found to be insignificant (significant), the alternate assets play the role of weak (strong) safe havens against downturns in stocks (Peng, 2020). Panel A reveals that gold and Dollar/CHF serve as strong safe havens, whereas US treasury and bitcoin are weak safe havens against the Facebook stock. Panel B shows that the US treasury is the only strong safe haven against Apple stock, whereas the rest of the alternate assets act as weak safe havens. Panel C indicates that gold, US treasury, and Dollar/CHF serve as strong safe haven against the downturns of Amazon stock. Referring to Panel D, the US treasury bonds are a strong safe haven against the extreme downturns in Netflix stock, whereas all the remaining alternate assets are weak safe haven against Netflix stock. Panel E reveals that only US treasury plays the role of strong safe haven whereas the rest of the alternate assets serve as weak safe haven against the extreme downfall in Alphabet stock. Finally, Panel E show that gold and US treasury (Bitcoin and Dollar/CHF) serve as strong (weak) safe haven against the S&P 500. Overall, the US treasury serves as strong hedge and strong safe haven against all five FAANA stocks and S&P 500, whereas gold serves strong safe haven against two stocks and the S&P 500.

Second, we discuss about the hedge, diversifier, and safe haven properties of alternate assets (gold, US treasury, Bitcoin, and dollar/CHF) against the FAANA stocks and S&P 500 during the days of high uncertainty in the equity markets due to infectious diseases. Panel A-D show that the coefficient γ_0 is negative and significant in US treasury against all FAANA stocks and S&P 500, showing that US treasury is the strong hedge against FANNA and S&P 500 during the periods of heightened pandemic uncertainty. Furthermore, Gold serves as strong (weak) hedge against the Facebook, Amazon, Alphabet, and the S&P 500 (Netflix), whereas gold is a diversifier against Apple stock during the heightened pandemic uncertainty days. Bitcoin and Dollar/CHF are the diversifier for the FAANA and S&P 500 in the infectious disease days, as the coefficients γ_0 are positive and significant in Bitcoin and Dollar/CHF against FAANA and the S&P 500. Panel A reveals that the coefficient γ_1 is negative and significant in US treasury and Dollar/CHF, indicating that US treasury and Dollar/CHF are the strong safe haven against Facebook stock in the heightened infectious disease uncertainty days. Moreover, gold and Bitcoin do not serve as a safe haven for Facebook in the heightened infectious uncertainty days. Panel B indicates that only Dollar/CHF serves as the weak safe haven against the Apple stock.

Panel C, D, and E show that only Dollar/CHF is the strong safe haven for Amazon, Netflix, and alphabet stocks during heightened infectious uncertainty days. Refers to the Panel F, Dollar/CHF and gold play the role of weak safe haven for the S&P 500 in the heightened infectious uncertainty days. Overall, Dollar/CHF is best safe haven asset, compared to other alternate assets, against FAANA stock and S&P 500 during the heightened infectious uncertainty days.

Third, we present in Table 5 the optimal weights, hedge ratios, and hedging effectiveness for the pairs of stock/alternative asset in the full sample period and the COVID-19 subsample period. The optimal weight of Facebook/Gold is 0.17 in the full sample period, showing that, for the $1 portfolio of Facebook/Gold, investor should allocate 17 cents in Facebook and 83 cents in gold during the full sample period. Starting with the stock/alternative asset pairs, the optimal weights of stock/Bitcoin pairs are observed to be higher in the COVID-19 pandemic suggesting that investors should increase investment in stocks (i.e., FAANA and S&P 500) to the detriment of Bitcoin during the COVID-19. For the all pairs of stock/Gold, stock/US treasury, and stock/Dollar/CHF, the optimal weights are low in the COVID-19 sub-sample compared to the full sample period, suggesting that investors should decrease the investment FAANA stock and S&P 500 (in other words, increase the investment in gold, US treasury, and Dollar/CHF) during the COVID-19 pandemic. The hedging effectiveness score of the stock/US treasury pairs is highest compared to other pairs during the full sample period, indicating that the largest risk reduction is observed for the optimal weight-based portfolios of stock/US treasury therefore investors are suggested to add US treasury in the undiversified portfolios of FAANA and S&P 500 to get maximum benefit of diversification during the full sample period. Moreover, the highest hedging effectiveness scores are noticed for the pairs of stock/US treasury and stock/Dollar/CHF during the COVID-19 pandemic period, proposing that investors can get maximum benefit of diversification by adding the Dollar/CHF and US treasury into the undiversified stocks of FAANA and S&P 500 during the COVID-19 pandemic. The hedge ratio of Facebook/Bitcoin pair is 0.02 during the full sample period, indicating the $1 long position in Facebook can be hedged with short position of 0.02 cents in Bitcoin during the full sample period. The hedge ratio scores of stock/gold and stock/Bitcoin pairs are higher in the COVID-19 period compared to the full sample period, suggesting that hedging FAANA and S&P 500 stocks with gold and Bitcoin is expensive in the COVID-19 pandemic. However, the hedging ratios of Facebook/US treasury, Apple/US treasury, Netflix/US treasury, Alphabet/US treasury, and S&P 500/US treasury are negative during the

COVID-19, indicating that hedging of Facebook, Apple, Netflix, Alphabet, and S&P 500 is cheap through US treasury during the COVID-19 pandemic. Moreover, the hedging effectiveness scores of the Dollar/CHF/stocks pairs are low during the COVID-19 pandemic compared to the full sample period, suggesting that the hedging of FAANA and S&P 500 through Dollar/CHF is cheap during the COVID-19 pandemic compared to the full sample period. The hedging effectiveness scores of optimal weight-based pairs are much higher than the hedging effectiveness scores of hedging strategy-based pairs, suggesting that optimal portfolio weight-based strategy is better than the optimal hedge-based strategy. We propose the optimal weight-based strategy to the investors to get maximum benefit of diversification during full sample period and sub-sample period of the COVID-19 pandemic.

Fourth, we evaluate the aforementioned weight strategy in economic terms and present the results in Table 6. Notably, we estimate the annualized Sharpe ratios (SR) and the annualized CER for the FANAA and alternative assets portfolios for the full sample and the COVID period, respectively. As we observe, the SRs are only marginally higher in the full sample than the COVID period but overall, the SRs are very small and close to zero. The CER is zero in all instances, suggesting that there is no motive to change to a risk-free asset. Overall, all portfolios behave closely to the risk-free rate, suggesting that FANAA can be used to hedge risk – a first of a kind finding by our work in relation to the existing literature.

4. Conclusions

In this paper we evaluate the use of FANAA stocks and the S&P 500 as diversifiers, hedge, and safe around the pandemic period. In doing so, we compile a dataset comprising the five most important tech stocks, the S&P 500 index and the usual safe havens reported in the literature (gold, Bitcoin, the 10-year U.S. Treasury bond, Bitcoin and the USD/CHF exchange rate) over the period May 18, 2012 to December 13, 202. Examining both the statistical properties and the economic aspect in shaping a trading strategy we conclude over a heterogeneous behavior of FANAA stocks over various safe haven assets in portfolio allocation. Overall, the U.S. Treasury bonds and gold seem to be more effective in hedging downside the risk of FANAA stocks, while all portfolios have very small Sharpe ratios and CER, suggesting a low-risk trading policy for investors and policymakers. But whether this finding will continue to hold in the future needs to be closely monitored, as these stocks seemed to have been hit hard recently by a slew of macroeconomic headwinds -- the war in Ukraine,

COVID-19 lockdowns in China, snarled supply chains, sky-high inflation, and slowing economic growth.[3]

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[3] See: https://fortune.com/2022/05/14/why-are-tech-stocks-down-end-faang-era/.

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Table 1. Summary Statistics.

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	ARCH	ADF
Facebook	0.00087	0.259	-0.210	0.023	0.327	18.328	24479.0[a]	8.426[a]	-51.721[a]
Apple	0.00089	0.113	-0.138	0.018	-0.417	10.276	5578.3[a]	114.166[a]	-53.510[a]
Amazon	0.00111	0.132	-0.117	0.018	0.152	9.866	4912.4[a]	31.724[a]	-50.731[a]
Netflix	0.00164	0.352	-0.288	0.028	0.764	23.625	44484.0[a]	21.424[a]	-49.355[a]
Alphabet	0.00091	0.151	-0.124	0.016	0.312	13.467	11434.0[a]	49.940[a]	-53.375[a]
S&P 500	0.00051	0.090	-0.128	0.010	-1.028	25.819	54595.0[a]	486.179[a]	-15.830[a]
Gold	0.00005	0.054	-0.102	0.009	-0.721	12.395	9396.0[a]	39.072[a]	-50.117[a]
US Treasury	0.00003	0.021	-0.025	0.004	-0.173	6.235	1101.0[a]	490.827[a]	-51.077[a]
Bitcoin	0.00366	0.485	-0.664	0.053	-1.076	23.531	44318.6[a]	283.399[a]	-51.623[a]
Dollar/CHF	-0.00001	0.025	-0.114	0.005	-4.297	87.096	743191.7[a]	312.038[a]	-45.557[a]

Note: The ARCH test refers to the LM-ARCH test of Engle (1982). ADF denotes the augmented Dickey-Fuller test. [a,b,c] indicate statistical significance at 1%, 5% and 10% respectively. Full sample period (May 18, 2012 to December 13, 2021).

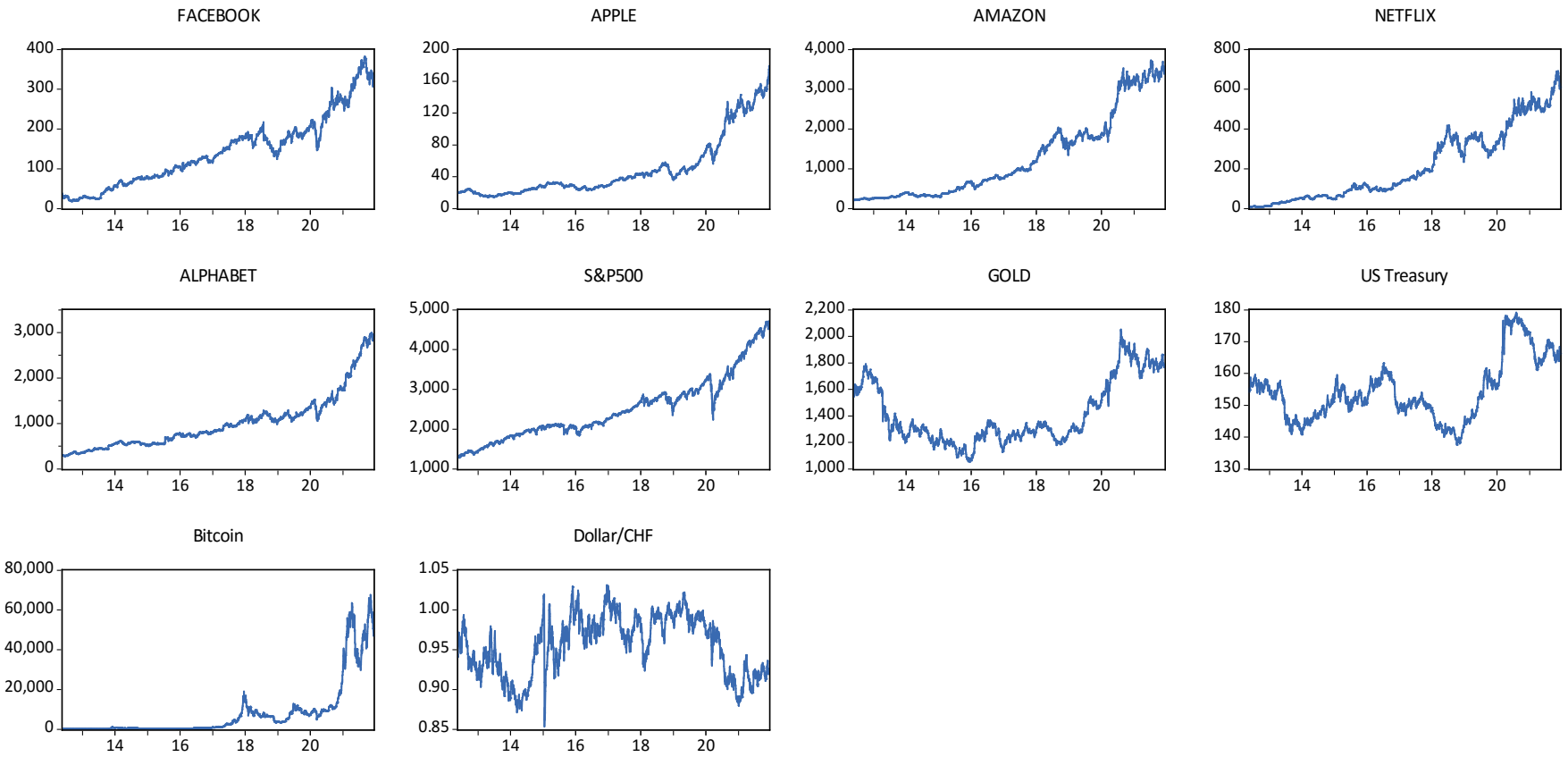


Figure 1. Prices

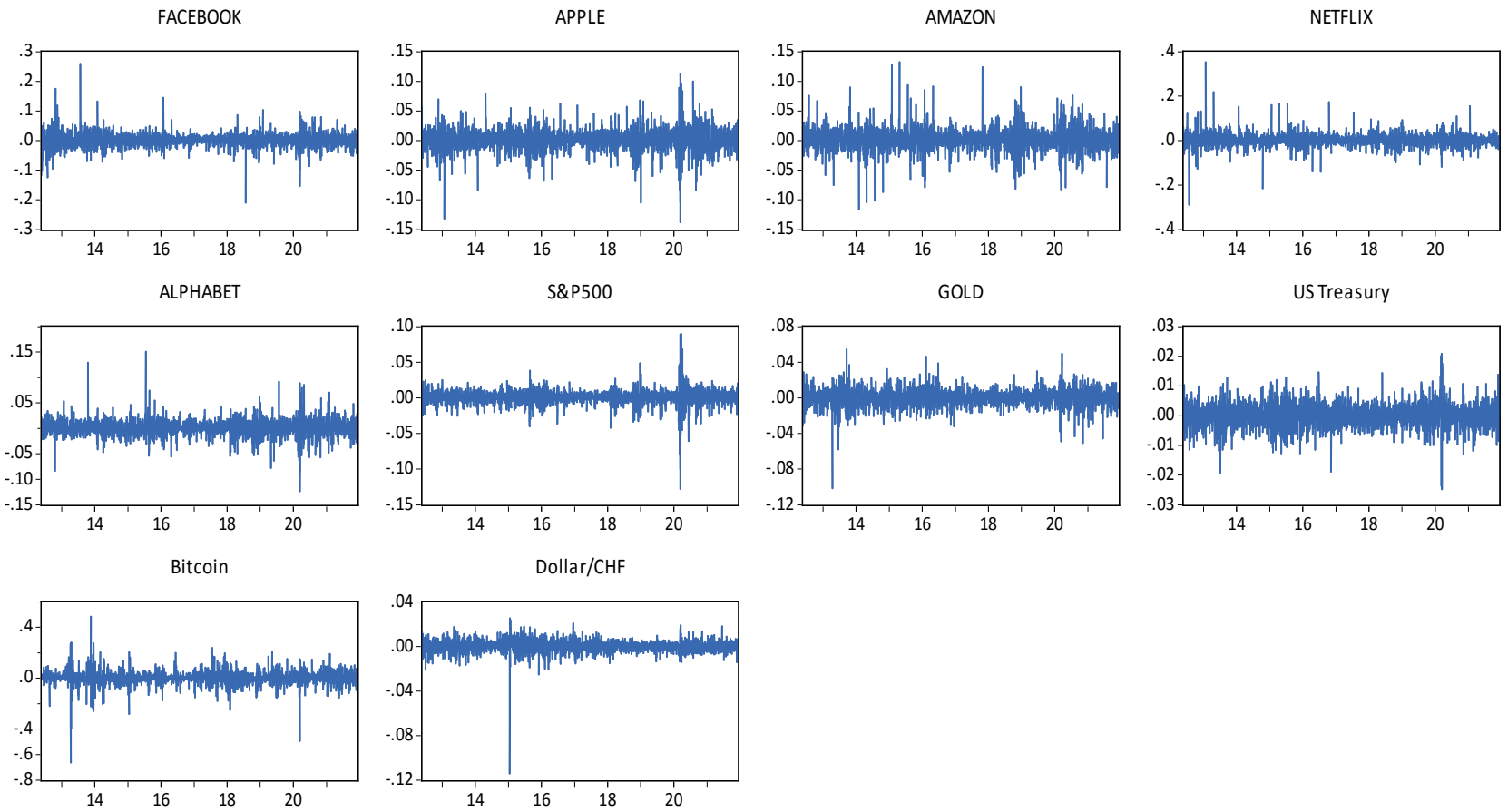


Figure 2. Returns

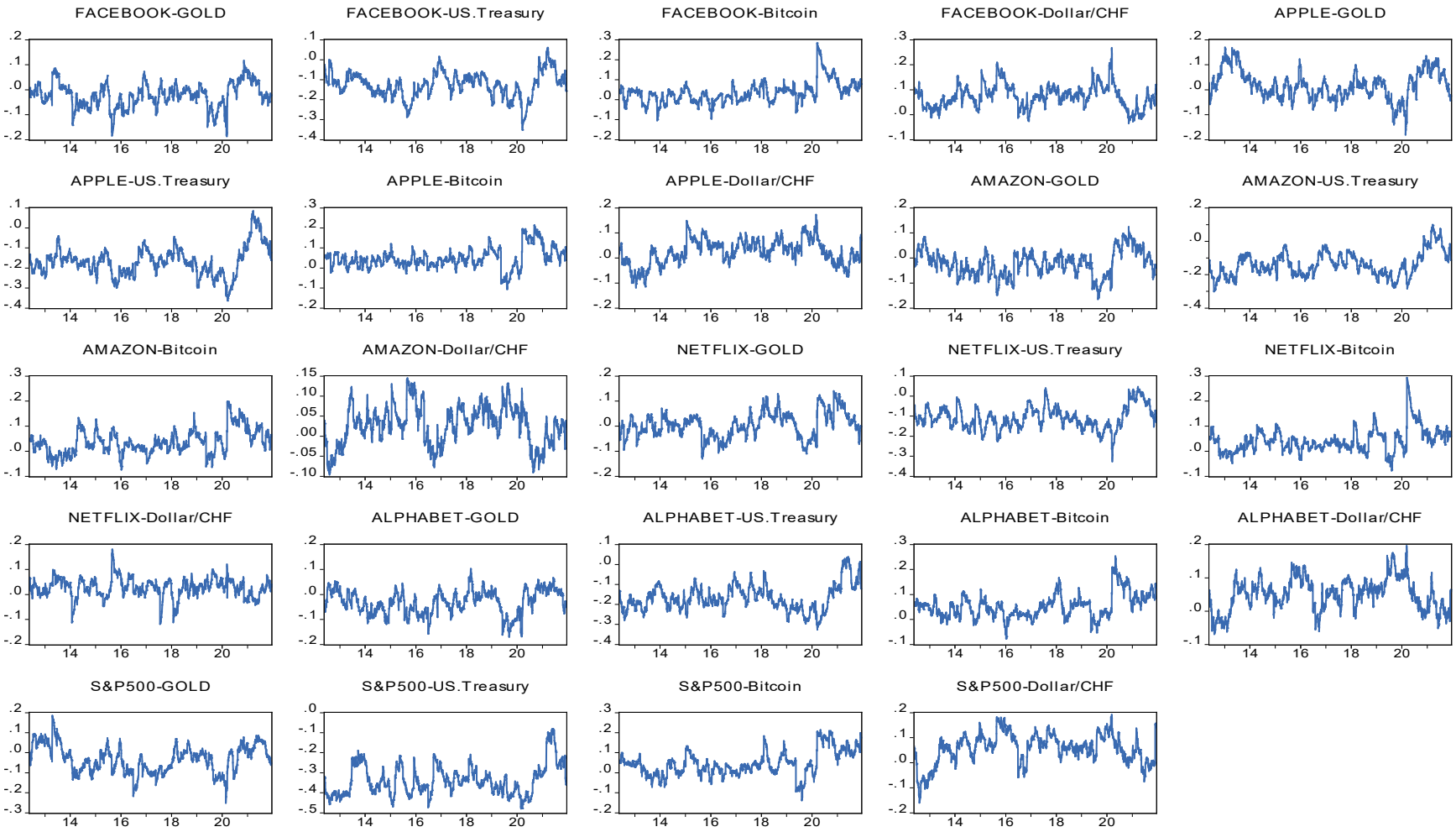
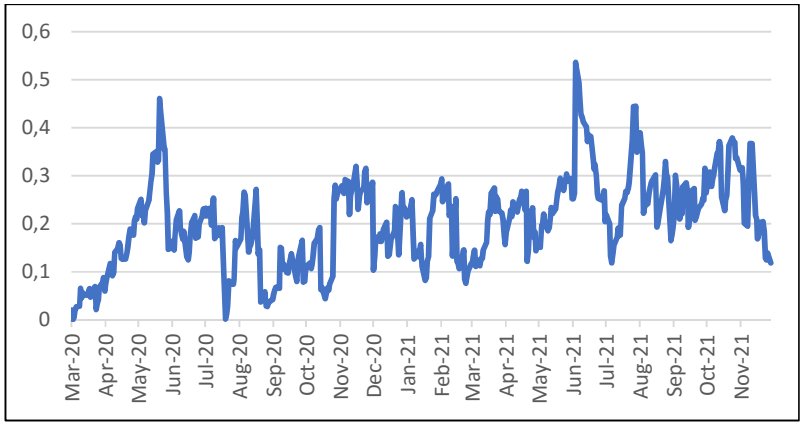
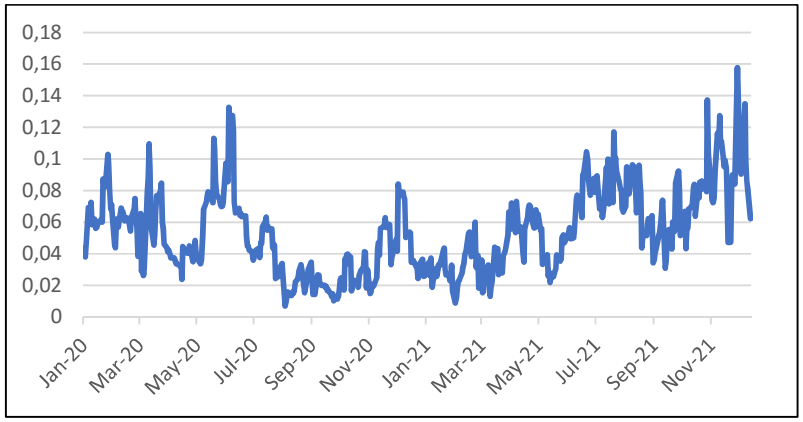


Figure 3. Dynamic conditional correlations (DCC)

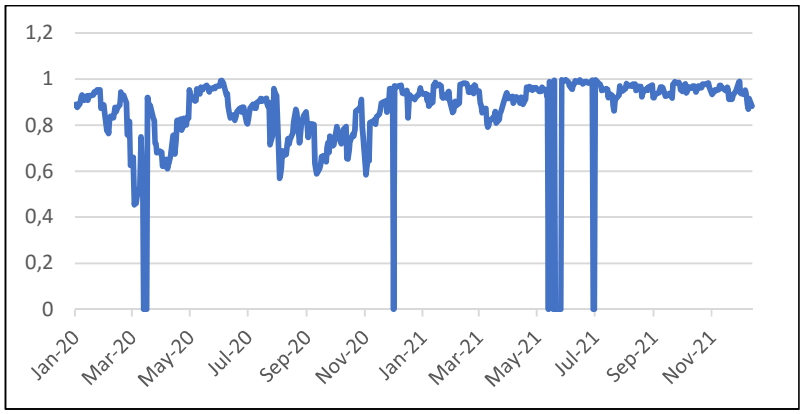
Apple/Gold



Apple/U.S. Treasury



Apple/Bitcoin



Apple/USD/CHF

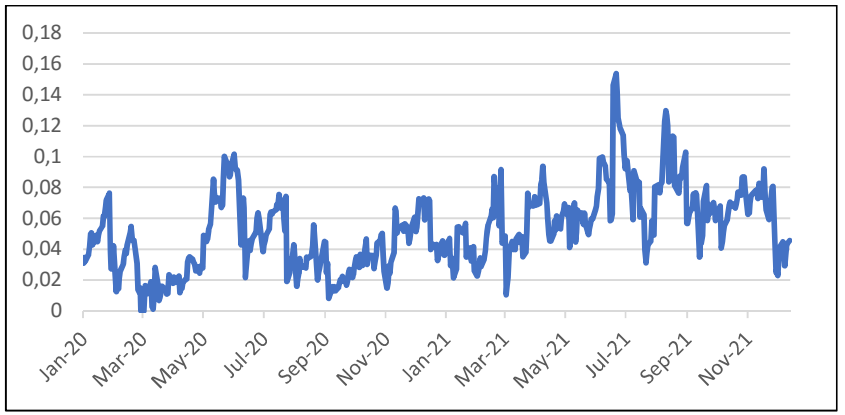


Figure 4. Time-varying weights

Table 2. Unconditional Correlations.

	Facebook	Apple	Amazon	Netflix	Alphabet	S&P 500	Gold	US Treasury	Bitcoin	Dollar/CHF
Facebook	1.000									
Apple	0.406	1.000								
Amazon	0.461	0.461	1.000							
Netflix	0.304	0.280	0.445	1.000						
Alphabet	0.512	0.525	0.601	0.400	1.000					
S&P 500	0.490	0.667	0.563	0.380	0.705	1.000				
Gold	0.013	0.063	0.005	0.010	0.002	0.033	1.000			
US Treasury	-0.145	-0.210	-0.160	-0.115	-0.200	-0.361	0.224	1.000		
Bitcoin	0.035	0.076	0.046	0.041	0.085	0.110	0.070	-0.006	1.000	
Dollar/CHF	0.053	0.028	0.026	0.021	0.045	0.044	-0.386	-0.160	-0.025	1.000

Note: The table presents the unconditional correlations among the stocks and alternate markets during the full sample period (May 18, 2012 - December 13, 2021).

Table 3. Estimation results for the hedge, diversifier, and safe-haven properties of the gold, US treasury, Bitcoin, and Dollar/CHF against FAANA stocks and S&P 500 during extreme market downturns.

	Panel A. Facebook				**Panel B.** Apple				**Panel C.** Amazon			
	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)
Gold	-0.022[a]	0.008[c]	-0.014[b]	0.000	0.018[a]	0.011[b]	-0.001	-0.017	-0.021[a]	0.012[b]	-0.012[c]	-0.023[b]
	(0.000)	(0.057)	(0.030)	(0.977)	(0.000)	(0.040)	(0.872)	(0.195)	(0.000)	(0.012)	(0.077)	(0.044)
US Treasury	-0.126[a]	0.001	-0.002	-0.008	-0.167[a]	-0.001	-0.007	-0.047[a]	-0.138[a]	-0.005	0.001	-0.037[b]
	(0.000)	(0.925)	(0.789)	(0.596)	(0.000)	(0.931)	(0.489)	(0.004)	(0.000)	(0.436)	(0.922)	(0.023)
Bitcoin	0.035[a]	0.004	-0.002	0.008	0.048[a]	0.001	0.014[b]	0.014	0.035[a]	0.013[a]	-0.002[a]	0.005
	(0.000)	(0.397)	(0.761)	(0.510)	(0.000)	(0.888)	(0.037)	(0.229)	(0.000)	(0.005)	(0.711)	(0.675)
Dollar/CHF	0.074[a]	-0.006	0.009	0.018[c]	0.024[a]	-0.002	0.003	0.009	0.028[a]	-0.009[b]	0.006	0.027[b]
	(0.000)	(0.176)	(0.130)	(0.079)	(0.000)	(0.634)	(0.660)	(0.415)	(0.000)	(0.049)	(0.374)	(0.016)
	Panel D. Netflix				**Panel E.** Alphabet				**Panel F.** S&P 500			
	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)	(γ_0)	10% (γ_1)	5% (γ_2)	1% (γ_3)
Gold	0.006[a]	-0.005	0.002	-0.017	-0.030[a]	0.004	-0.008	-0.013	-0.032[a]	0.015[b]	-0.011	-0.057[a]
	(0.000)	(0.271)	(0.732)	(0.150)	(0.000)	(0.329)	(0.211)	(0.216)	(0.000)	(0.015)	(0.237)	(0.000)
US Treasury	-0.107[a]	-0.010[c]	-0.003	-0.006	-0.167[a]	-0.003	0.005	-0.035[b]	-0.337[a]	-0.004	-0.001	-0.053[a]
	(0.000)	(0.056)	(0.667)	(0.622)	(0.000)	(0.572)	(0.608)	(0.016)	(0.000)	(0.617)	(0.908)	(0.002)
Bitcoin	0.042[a]	0.001	0.007	-0.007	0.053[a]	0.002	0.009	0.021[c]	0.044[a]	0.008	0.012	0.027[c]
	(0.000)	(0.898)	(0.299)	(0.500)	(0.000)	(0.650)	(0.157)	(0.059)	(0.000)	(0.161)	(0.154)	(0.057)
Dollar/CHF	0.026[a]	0.006[c]	-0.003	0.012	0.050[a]	-0.003	0.015[b]	0.020[c]	0.055[a]	0.002	0.010	0.032[b]
	(0.000)	(0.070)	(0.606)	(0.154)	(0.000)	(0.554)	(0.017)	(0.069)	(0.000)	(0.758)	(0.213)	(0.017)

Note: Extreme downturns on the Stock index are captured by the 10% (q_{10}), 5%(q_5), or 1%(q_1) quantiles. [a], [b], and [c] denote statistical significance at 1%, 5% and 10% respectively.

Table 4. Estimation results for the hedge and safe-haven properties of the gold, US treasury, bitcoin, and Dollar/CHF against the FAANA stocks and the S&P 500 during the days of high uncertainty in equity markets due to infectious diseases.

	Panel A. Facebook		**Panel B.** Apple		**Panel C.** Amazon	
	(γ_0)	Infectious diseases (γ_1)	(γ_0)	Infectious diseases(γ_1)	(γ_0)	Infectious diseases(γ_1)
Gold	-0.024[a]	0.004[b]	0.015[a]	0.007[a]	-0.027[a]	0.011[a]
	(0.000)	(0.029)	(0.000)	(0.001)	(0.000)	(0.000)
US Treasury	-0.123[a]	-0.007[a]	-0.173[a]	0.011[a]	-0.150[a]	0.023[a]
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)
Bitcoin	0.021[a]	0.031[a]	0.036[a]	0.025[a]	0.023[a]	0.027[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dollar/CHF	0.076[a]	-0.005[a]	0.025[a]	-0.003	0.033[a]	-0.011[a]
	(0.000)	(0.005)	(0.000)	(0.159)	(0.000)	(0.000)
	Panel D. Netflix		**Panel E.** Alphabet		**Panel F.** S&P 500	
	(γ_0)	Infectious diseases (γ_1)	(γ_0)	Infectious diseases (γ_1)	(γ_0)	Infectious diseases (γ_1)
Gold	0.000	0.011[a]	-0.031[a]	0.002	-0.033[a]	0.003
	(0.917)	(0.000)	(0.000)	(0.344)	(0.000)	(0.243)
US Treasury	-0.111[a]	0.007[a]	-0.172[a]	0.010[a]	-0.343[a]	0.010[a]
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Bitcoin	0.030[a]	0.026[a]	0.041[a]	0.026[a]	0.026[a]	0.041[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dollar/CHF	0.027[a]	-0.001[a]	0.053[a]	-0.006[a]	0.057[a]	-0.003
	(0.000)	(0.656)	(0.000)	(0.003)	(0.000)	(0.167)

Note: [a,b,c] denote statistical significance at 1%, 5% and 10% respectively. The sub-sample period of the COVID-19 starts from January 01, 2020, and ends on December 13, 2021.

Table 5. Portfolio analysis for the full sample and COVID-19 sample periods.

	Full Sample Period				COVID-19 Sample			
	Optimal weights		Hegde ratios		Optimal Weights		Hedge Ratios	
	Mean	HE	Mean	HE	Mean	HE	Mean	HE
FACEBOOK/GOLD	0.17	0.85	-0.06	0	0.16	0.82	0.2	0.01
FACEBOOK/US.Treasury	0.06	0.97	-0.73	0.04	0.05	0.97	-0.52	0.07
FACEBOOK/Bitcoin	0.79	0.22	0.02	0	0.86	-0.01	0.09	0.06
FACEBOOK/Dollar/CHF	0.06	0.95	0.32	0	0.04	0.97	-0.13	-0.01
APPLE/GOLD	0.24	0.78	0.03	0.01	0.2	0.81	0.22	0.01
APPLE/US.Treasury	0.09	0.96	-0.75	0.06	0.05	0.97	-0.31	0.06
APPLE/Bitcoin	0.87	0.05	0.02	0	0.88	-0.1	0.09	0.07
APPLE/Dollar/CHF	0.1	0.91	0.08	0	0.05	0.97	-0.13	-0.01
AMAZON/GOLD	0.22	0.8	-0.05	0	0.2	0.75	0.23	0.02
AMAZON/US.Treasury	0.07	0.96	-0.68	0.04	0.04	0.96	0.11	0.05
AMAZON/Bitcoin	0.85	0.11	0.02	0	0.9	0	0.07	0.07
AMAZON/Dollar/CHF	0.09	0.92	0.1	-0.01	0.06	0.96	-0.34	-0.01
NETFLIX/GOLD	0.1	0.9	0.01	0	0.13	0.83	0.31	0.02
NETFLIX/US.Treasury	0.03	0.98	-0.79	0.02	0.03	0.97	-0.03	0.04
NETFLIX/Bitcoin	0.72	0.3	0.03	0.01	0.84	0.08	0.09	0.05
NETFLIX/Dollar/CHF	0.04	0.96	0.15	0	0.03	0.97	-0.05	-0.02
ALPHABET/GOLD	0.29	0.75	-0.05	0	0.26	0.77	0.12	0.01
ALPHABET/US.Treasury	0.1	0.95	-0.67	0.05	0.07	0.96	-0.29	0.06
ALPHABET/Bitcoin	0.9	0.01	0.02	0.01	0.93	-0.15	0.08	0.07
ALPHABET/Dollar/CHF	0.11	0.89	0.17	0	0.06	0.96	-0.1	0
S&P500/GOLD	0.56	0.64	-0.03	0	0.49	0.74	0.07	0.01
S&P500/US.Treasury	0.27	0.92	-0.76	0.14	0.19	0.95	-0.72	0.13
S&P500/Bitcoin	0.96	-0.16	0.01	0.01	0.98	-0.35	0.07	0.09
S&P500/Dollar/CHF	0.31	0.81	0.1	0	0.16	0.94	0	0

Note: We consider two investment approaches, i.e. the optimal weight and hedge portfolio strategy of Kroner and Ng (1998) and Kroner and Sultan (1993), respectively. HE is the hedge effectiveness value computed as the percentage reduction in return volatility compared to the undiversified strategy. All values are percentages of risk reduction. Zero HE suggests zero risk reduction. The full sample period is May 18, 2012 to December 13, 2021. The sub-sample period of the COVID-19 starts from January 01, 2020, and ends on December 13, 2021.

Table 6. Economic portfolio evaluation for the full sample and COVID-19 sample periods.

	Full Sample		COVID period	
	SR	CER	SR	CER
FACEBOOK/GOLD	0.06	0.00	0.04	0.00
FACEBOOK/US.Treasury	0.04	0.00	0.04	0.00
FACEBOOK/Bitcoin	0.14	0.00	0.06	0.00
FACEBOOK/Dollar/CHF	0.03	0.00	-0.01	0.00
APPLE/GOLD	0.08	0.00	0.07	0.00
APPLE/US.Treasury	0.05	0.00	0.06	0.00
APPLE/Bitcoin	0.14	0.01	0.09	0.00
APPLE/Dollar/CHF	0.04	0.00	0.00	0.00
AMAZON/GOLD	0.08	0.00	0.05	0.00
AMAZON/US.Treasury	0.05	0.00	0.05	0.00
AMAZON/Bitcoin	0.15	0.01	0.08	0.00
AMAZON/Dollar/CHF	0.06	0.00	0.00	0.00
NETFLIX/GOLD	0.06	0.00	0.05	0.00
NETFLIX/US.Treasury	0.04	0.00	0.04	0.00
NETFLIX/Bitcoin	0.17	0.00	0.09	0.00
NETFLIX/Dollar/CHF	0.05	0.00	-0.01	0.00
ALPHABET/GOLD	0.08	0.00	0.06	0.00
ALPHABET/US.Treasury	0.05	0.00	0.05	0.00
ALPHABET/Bitcoin	0.14	0.01	0.09	0.00
ALPHABET/Dollar/CHF	0.05	0.00	0.00	0.00
S&P500/GOLD	0.08	0.00	0.06	0.00
S&P500/US.Treasury	0.06	0.00	0.06	0.00
S&P500/Bitcoin	0.10	0.00	0.04	0.00
S&P500/Dollar/CHF	0.05	0.00	0.01	0.00

Note: SR (Sharpe ratio). CER (Certainty Equivalent Return). Full sample period (May 18, 2012 to December 13, 2021). COVID-19 sub-sample period (January 01, 2020 and ends on December 13, 2021).