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Is Bitcoin the 'Digit Gold'——A Potential Safe-haven Asset?

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Abstract: In this paper, we examine whether bitcoin has the potential to become safe-haven asset that can rival gold in the future. We observed, compared and analyzed and the performance of bitcoin and gold in face of a falling market and inflation pressure. We can see if investors can rely on bitcoin to reduce risk exposure significantly through empirical tests. At the end of our research, we found that bitcoin did not perform as well as gold did when faced with market crash and inflation. Therefore, we conclude that bitcoin does not yet show the potential to possess risk-proof merits as gold, the traditional high-quality hedge asset. Gold would probably remain the preferred hedge asset against cryptocurrency for now.

Keywords: Bitcoin, Sharpe ratio, portfolio, gold.

1. Introduction

In the view of a segment of investors, holding physical assets may all be at risk in the future, even gold, which is traditionally considered the most safe-haven asset. For this group of investors, some of the attributes of virtual currencies such as bitcoin are deeply favored. For example, Bitcoins are not subject to national monetary policies, meaning they are not influenced or controlled by governments. Also, as virtual property, bitcoins are not at risk of being destroyed or lost in a war or natural disaster. So, is it possible that virtual currencies could become a more desirable asset for investors in a potentially volatile time in the future?

In the last two years, our world has experienced an event unlike anything before in this century, an worldwide epidemic that continues today. In fact, it has changed our world in many ways during last two years, including our ways of thinking, and has allowed us to observe and interpret the performance of different assets in the financial markets differently. In response to our questions, we gathered several articles which were published at different times, and their proposals differ from each other. Wong's paper argues that virtual currencies bring higher portfolio risk because of their high intrinsic volatility but bring higher Sharpe ratios to gold and stock portfolios at the same time [1]. While Corbet's research suggested that virtual currencies could provide investors with many benefits and safety during an epidemic [2]. Conlon argued that virtual assets like bitcoin could not protect investors' assets during critical times[3]. And Hasan's paper suggested that safe-haven assets may vary over time [4]. So, how has the situation changed since then?

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The first quarter of 2022 has been a very turbulent period for international financial markets, immediately following a wave of worldwide outbreaks of the new omicron epidemic at the beginning of the year, a military conflict broke out in Eastern Europe, which has continued to this day (late May). Markets worldwide suffered a harsh test under double pressure of epidemic and geopolitical events.

The general result is a series of market shakes and inflation spikes. When the world enters a period of uncertainty, the prices of commodities such as food and oil rise, stock markets fall, and gold prices rise. But what is interesting is that most virtual currencies have seen their prices up and down to a greater or lesser extent during this period. In order to investigate whether bitcoin can be considered as 'digit gold' through empirical evidence, we gathered weekly data sets covering a five-year period on bitcoin price, gold price, S&P 500 index, US 10-year treasury yields, and US 1-month treasury yields. We aim to combine them into portfolios and observe, compare the performance of gold and bitcoin in different market situations.

2. Data

To conduct the whole research we used several data sets, including weekly bitcoin prices in US dollars, weekly gold price in US dollars as two manipulated variables. Values of S&P 500 were attained as the representatives of the stock market, while the yield of US 10-year treasury act as a typical sample of the general bond market. In addition, the yield of US 1-month treasury was set as the risk-free rate. Bitcoin was chosen as the representative of the cryptocurrency market because the market capacity makes up nearly 40% of the total cryptocurrency market and hence should give a powerful indication of the overall characteristics of the whole cryptocurrency market. As gold is widely acknowledged as an ideal hedge or safe haven asset against economic recession or inflation, it is anchored to be the comparison object.

Data for bitcoin are collected from Blockchain.com, a leading platform for cryptocurrency exchange.Data for gold price are collected from LBMA (London Bullion Market Association). Data for S&P 500 are collected from WSJ (The Wall Street Journal). Data for the US 10-year treasury(US10Y) and the US 1-month(US1M) treasury are sourced from FRED.

Table 1: Summary statistics of research data.

Variable	Obs	Mean	Std. Dev.	Min	Max	Sharpe
BTC price	256	18,306	17820.2	1,448	66,954	
Gold	256	1,542	261.52	1,182	2,048	
S&P500	256	3,262	711.64	2,357	4,793	
US10Y	256	1.93%	0.75%	0.55%	3.22%	
US1M	256	1.00%	0.90%	0.00%	2.45%	
Ln(BTC)	256	9.37	0.94	7.28	11.11	
Ln(Gold)	256	7.33	0.17	7.07	7.62	
Ln(S&P500)	256	8.07	0.21	7.77	8.47	
Re(BTC)	255	1.28%	11.01%	-38.65%	32.83%	0.83
Re(Gold)	255	0.16%	2.00%	-9.88%	6.91%	0.11
Re(S&P500)	255	0.22%	2.48%	-13.38%	10.72%	0.14
Re(US10Y)	255	0.02%	0.86%	-3.43%	2.92%	0.01
Re(US1M)	255	0.02%	0.02%	0.00%	0.05%	0.01

The data are all weekly observed back from 03/05/2017 to 27/04/2022, yielding 256 observations after processing. Table 1 provides a summary report of the whole dataset, including price of cryptocurrency(bitcoin),gold,and stocks(S&P500).The top part shows the statistics about closing

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price in US dollars of bitcoin,gold and stocks(S&P 500), and yields of US 10-year treasury as well as 1-month treasury.The middle part shows the log price of bitcoin,gold and stocks(S&P500).The bottom part shows the log return of all five distinct assets. All the data transformations are intended for further calculation of optimal portfolio maximising the Sharpe ratio, which is shown in Table 2.

Table 2: Optimal Sharpe portfolios, weight add to 100%.

	Bitcoin	Gold	S&P500	US 10Y
S&P500/10Y	0%	0%	44%	56%
S&P500/10Y/Gold	0%	82%	71%	-53%
S&P500/10Y/Gold/BTC	24%	81%	46%	-51%

3. Methodology

In this section methodologies used to conduct our research will be described. To analyze whether bitcoin, the so-called 'digit gold', has the potential to be as good as gold when considered as a safe-haven investment, especially in when stock market is down and inflation worsen. We tried to separate the data into four sets--weeks both S&P500 and 10Y went up, weeks when both went down, weeks when S&P500 went up and 10Y went down, weeks when S&P500 went down and 10Y went up, that is, we considered all four possible market situations. Next we calculate the optimal Sharpe ratio portfolios for each of the four sets individually, initially the portfolio only consists of stocks(S&P500) and bonds(US 10-year treasury), then adding gold, then adding bitcoin, so that it would be convenient to compare the amount of bitcoin and gold we would like to hold if we knew what the stock and bond market would do. Especially if stock and bond market dropped, compare between gold and bitcoin, specifically, compare how much do gold and bitcoin improve the Sharpe ratios of the portfolio, to verify which is the ideal safe-haven asset.

The specific data analysis is carried out in following steps.First step is the demeaning processing, where the mean equation is:

$$Rd = \left(R - \overline{R}\right) - (r - \overline{r}) \tag{1}$$

where Rd is the demeaned excess returns, R is the return of the asset and $\overline{R}$ is the mean return, r is the risk-free ratio while $\overline{r}$ is the mean risk-free ratio.

The second step is to calculate the optimal portfolio based on maximizing Sharpe ratio. Sharpe ratio is originally developed by Nobel laureate William F Sharpe [5], an indicator of calculating risk adjusted return. It is defined as

$$\frac{(R(x)-r)}{\sigma} \tag{2}$$

where R(x) is the expected return of portfolio, r is the risk-free ratio, σ is the standard deviation of R(x).

Normally, a higher Sharpe ratio indicates better investment performance, given the risk. If a Sharpe ratio is negative, it means the risk-free return is greater than expected return of portfolio, and Sharpe ratio conveys nothing meaningful.

The mathematical model for the Sharpe Ratio based Portfolio optimization is given by

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$$\max \left(\frac{\sum_{i=1}^{N} W_{i'} \cdot \mu_i - r}{\sqrt{\sum_i \sum_j W_i \cdot W_j \cdot \sigma_{ij}}} \right) \tag{3}$$

subject to

$$\sum_{i=1}^{N} W_i = 1 \tag{4}$$

where

$$0 \leq W_i \leq 1 \tag{5}$$

W_i is the weight of each asset.The numerator of the objective function denotes the excess returns of the investment over that of a risk-free asset r and the denominator the risk of the investment. The objective is to maximize the Sharpe Ratio. The basic constraints indicate that this is a fully invested portfolio, in other words, weights adds to 100%.

In the third step, since the optimal Sharpe portfolios of different combinations were attained, we computed the growth of $1 in all three portfolios, scaling each one to the same volatility(standard deviation mathematically), and visualize their growth to compare apples to apples. We will mainly focus on the situations where one of stock and bonds markets falls, so that we can compare bitcoin and gold to verify whether bitcoin also has the property to hedge against falling stock market or inflation as physical gold does.

4. Results

We calculated the weight matrices and optimal Sharpe portfolio statistics of four sets. The numbers are shown in following tables—Table 3(weeks both S&P500 and 10Y went up),Table 4(weeks when both went down),Table 5(weeks when S&P500 went up and 10Y went down), Table 6(weeks when S&P500 went down and 10Y went up). And growth of portfolios(value of $1) are visualized.

Table 3: Both S&P500 and 10Y went down.

	Bitcoin	Gold	S&P500	US 10Y	Mean	Std. Dev.	Sharpe
S&P500/10Y	0%	0%	-19%	-81%	1.05%	0.92%	8.04
S&P500/10Y/Gold	0%	13%	-21%	-93%	1.13%	0.89%	8.97
S&P500/10Y/Gold/BTC	2%	15%	-19%	-98%	1.10%	0.83%	9.49
Standard deviation	12.63%	2.47%	2.54%	0.71%			

(*Mean and standard deviation are weekly calculated while Sharpe ratio is annualized, same below.)

Table 3 considers the situation when both S&P500 and 10Y went down. As tables above shown, the portfolio improved when gold is introduced, Sharpe ratio increased by 0.93, as gold is a well-known classic hedge against stock market and inflation. Bitcoin also adds subtle improvement to the portfolio, thought it doesn't account for much in dollar size to the whole portfolio compared to gold, it makes a difference to the portfolio owing to its relatively high volatility, and the Sharpe ratio is raised by 0.52. Looking at the Figure 1, the growth trend of three different combinations basically follows the same mode, while combinations with more assets perform better in value over time.

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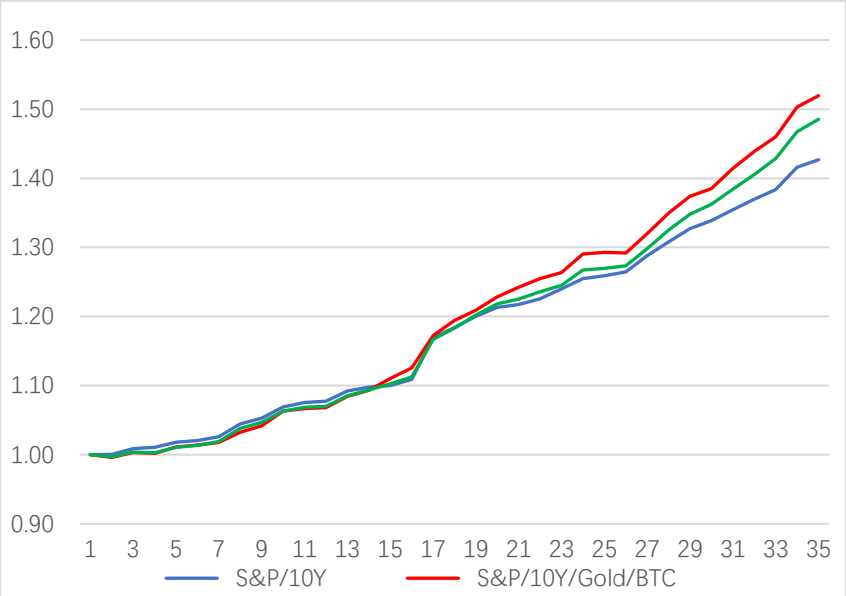

Figure 1: Growth of value $1 when both S&P500 and 10Y went down.

Table 4: Both S&P500 and 10Y went up.

	Bitcoin	Gold	S&P500	US 10Y	Mean	Std. Dev.	Sharpe
S&P500/10Y	0%	0%	36%	64%	0.81%	0.50%	11.29
S&P500/10Y/Gold	0%	0%	36%	63%	0.83%	0.52%	11.32
S&P500/10Y/Gold/BTC	0%	0%	33%	67%	0.83%	0.52%	11.33
Standard deviation	10.92%	1.86%	1.12%	0.52%			

Table 4 considers the situation where both S&P500 and 10Y went up, bull market without inflation. It seems that when you are in a bull market and have no pressure from inflation, bitcoin and gold seldom be considered in your portfolio, as the portfolios basically remain the same structure, simply because you know you can make a lot of money out of stocks and bonds investment as they are going to be unstoppable, in reality, that is a big if.

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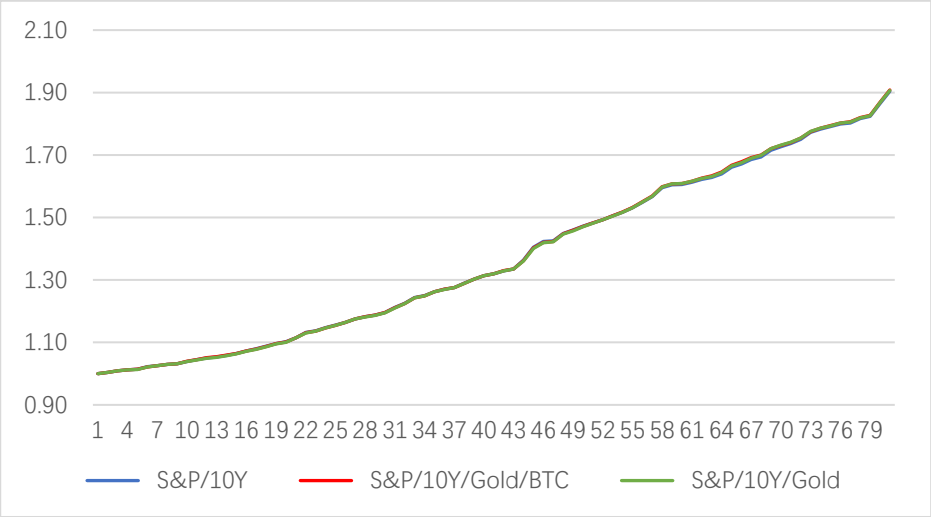

Figure 2: Growth of value $1 when both S&P500 and 10Y went up.

Table 5: S&P500 went up and 10Y went down.

	Bitcoin	Gold	S&P500	US 10Y	Mean	Std. Dev.	Sharpe
S&P500/10Y	0%	0%	28%	-126%	1.21%	0.82%	10.48
S&P500/10Y/Gold	0%	-6%	34%	-127%	1.32%	0.89%	10.57
S&P500/10Y/Gold/BTC	1%	-6%	32%	-128%	1.30%	0.87%	10.59
Standard deviation	9.87%	1.69%	1.48%	0.48%			

Table 5 considers the situation when S&P500 went up and 10Y went down. Considering the second portfolio combination, gold shows subtle negative correlation with stock markets, which could be the result of the offset between a rising stock market and deflation. From the statistics, Sharpe ratio hardly changes, we can conclude bitcoin didn't make much difference to the portfolio. Looking at the Figure 3, the claim is further supported.

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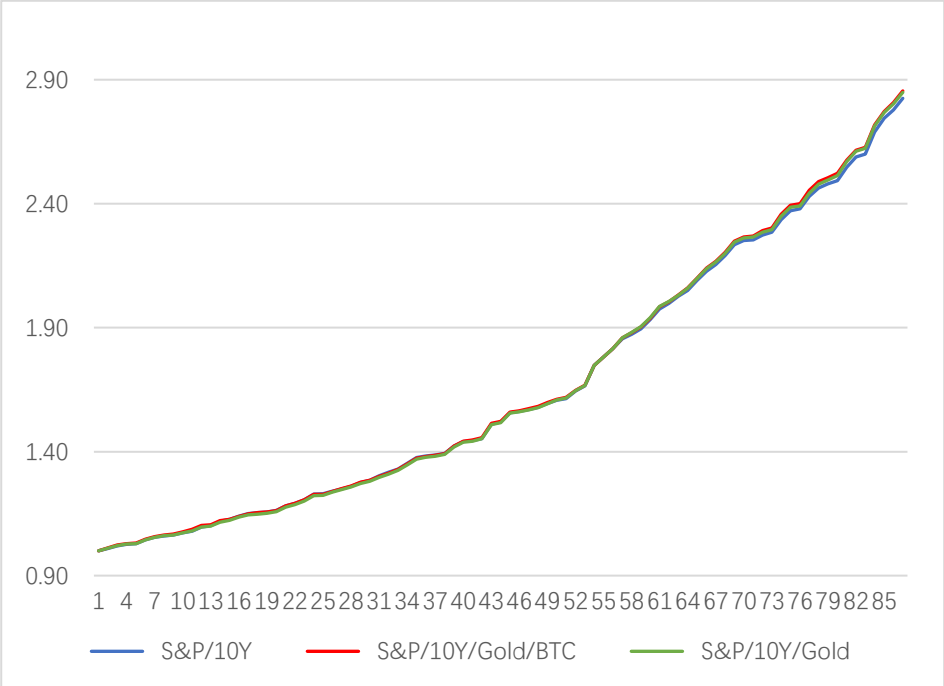

Figure 3: Growth of value $1when S&P500 went up and 10Y went down.

Table 5: S&P 500 went down and 10Y went up.

	Bitcoin	Gold	S&P500	US 10Y	Mean	Std. Dev.	Sharpe
S&P500/10Y	0%	0%	-14%	114%	1.17%	0.95%	8.68
S&P500/10Y/Gold	0%	6%	-19%	114%	1.30%	1.05%	8.75
S&P500/10Y/Gold/BTC	0%	6%	-18%	112%	1.27%	1.03%	8.75
Standard deviation	11.38%	2.00%	2.46%	0.67%			

Table 6 considers when S&P500 went down and 10Y went up. As is well known, it is acknowledged when stocks did not perform well, gold should be introduced into the portfolio to make life easier. However, bitcoin does not function as gold helps, as the Sharpe ratio remains the same, indicating it is of trivial role to this situation.

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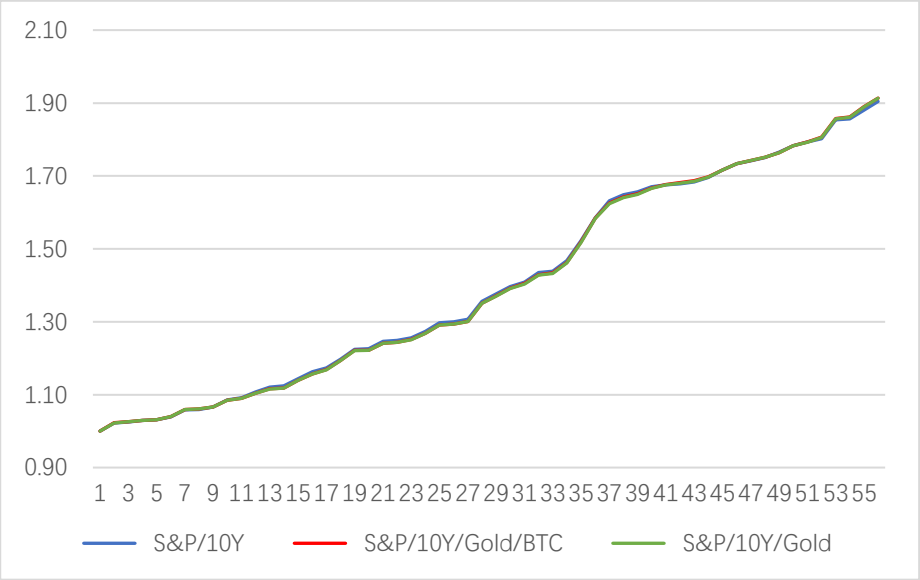

Figure 4: Growth of value $1 S&P500 went down and 10Y went up.

Table 6: The whole period.

	Bitcoin	Gold	S&P500	US 10Y	Mean	Std. Dev.	Sharpe
S&P500/10Y	0%	0%	44%	56%	0.11%	1.13%	0.56
S&P500/10Y/Gold	0%	82%	71%	-53%	0.28%	2.57%	0.73
S&P500/10Y/Gold/BTC	24%	81%	46%	-130%	0.53%	3.73%	0.98
Standard deviation	11.01%	2.00%	2.48%	0.86%			

Table 7 gives the optimal portfolio statistics considering the whole dataset covering 256 weeks. As the numbers display, the Sharpe ratio rises from 0.56 to 0.73 when gold added, and increases to 0.98 after bitcoin added. Looking at the Figure 5, based on the blue line(S&P500/10Y), there are 2 obvious downturns across the period, the first happened around 03/05/2022, all three combinations fail to protect, the second happened near the end, compare the trend of green line(S&P500/10Y/Gold) and blue line(S&P500/10Y), one can notice that portfolio with gold reversed the falling trend of blue line and remains the general growing trend. However, bitcoin does not seem to protect in these downturns(compare red line and blue line), rather it helps by posting some spectacular returns during general good times.

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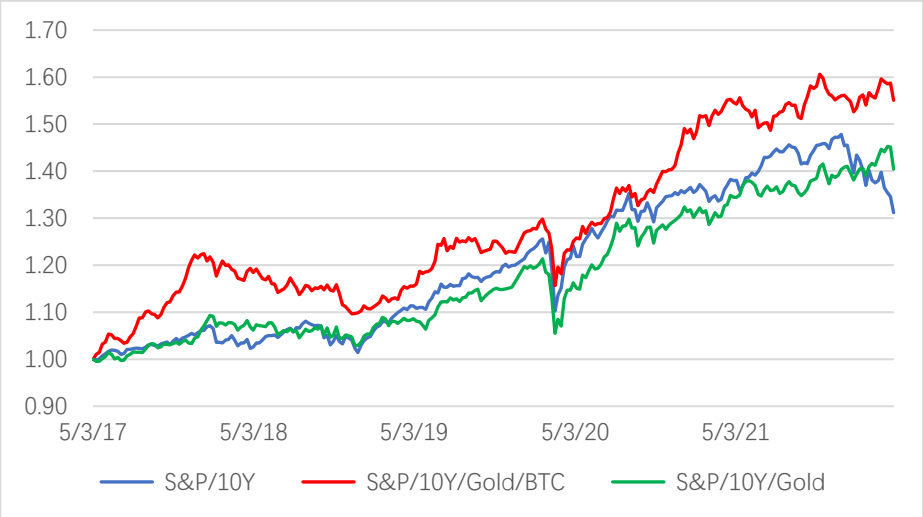

Figure 5: Growth of value $1.

5. Conclusion

This paper investigates the potential of bitcoin as ‘digit gold’, a safe-haven asset. We try to verify the usefulness of bitcoin in terms of hedging compared to physical gold. From the Results, we can conclude it is not that persuasive to view bitcoin as 'digit gold'. Compared to physical gold, bitcoin is not a better holding in down markets. Specifically, in all four possible situations, the contribution bitcoin made are not more significant than gold did. Further, from the charts we can see portfolio containing bitcoin does not generally outperform its counterparts significantly without bitcoin in volatility and return growth during hard times, and it hardly shows the potential to protect portfolio against bad times. However, from Figure 5, it implies that cryptocurrencies can be useful as a supplement asset to raise returns in a portfolio during general good times. Considering its hedging role is so limited that much less than gold, and basically it made no difference to the growth trend, we can reasonably conclude bitcoin is uncorrelated with stock and bond markets.

In summary, bitcoin's hedging role is deficient compared to gold in bear markets, while in bull markets, as the theory of diversification of portfolio indicates, it has more of a volatility-reducing effect than it does a significant increase in returns. Bitcoin can be used as a hedge against stocks in portfolio simply because it is uncorrelated to the stock market, but it is not plausible that bitcoin is as a good safe-haven asset as physical gold. Bitcoin is characterised by high volatility and high returns compared to gold though, risk-seeking investors can increase their risk reward by investing in cryptocurrencies.

Our research has limitations due to the narrow selection of data. Later we hope to examine a wider range of results and investment opportunities by combining more asset classes in portfolio.To date, there are still many uncertainty around cryptocurrencies. Regulators may further suppress cryptocurrencies, leading to the often predicted bursting of the cryptocurrency bubble, on the other hand, many investors view bitcoin as a speculative asset, which helps its widespread acceptance. Bitcoin may be still in its infancy but derivatives like crypto options are growing. It is unclear if bitcoin will be the cryptocurrency of choice in the future.

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