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Gold, bitcoin and the financial fear gouge

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Abstract
Our study investigates the hedging ability of Gold and Bitcoin to hedge against financial market crashes. We also examined the ability of the VIX fear gouge to improve the ability of those financial assets to hedge financial risks. We found a positive dependency between the current daily prices of Gold and Bitcoin with a stronger impact of Gold on Bitcoin than vice versa. We also find that in recent years (2021-2023), Gold price changes are negatively correlated to yesterday's price change of the S&P500 a day before and positively correlated to yesterday's NASDAQ price change. In comparison, the same phenomenon is valid for Bitcoin in prior years (2018-2020). These results emphasize that Gold has replaced Bitcoin as the primary hedging tool. We attribute this change to the recent rise in interest rates and inflation expectations, coupled with the increasing involvement of institutional investors in the cryptocurrency market. Additionally, technological advancements have similarly influenced both the cryptocurrency and stock markets. Moreover, we documented that the best hedging ability of Gold is when the VIX gouge index is between 20-30, indicating a high fear in the market. However, its ability as a hedging tool deteriorated when the daily VIX score was extremely high (above 30) and lower than 20. The VIX score did not contribute anything to the ability of Bitcoin to hedge against financial market crashes.

Keywords: Gold, Bitcoin, VIX
JEL Classification Codes: G14, G15

1. Introduction

Gold and Cryptocurrencies are known to serve as a hedging tool against economic uncertainty. Hedging financial risk is aimed to reduce or mitigate the potential losses that can arise from adverse movements in financial markets or investment prices. It involves using financial instruments or strategies to offset the risk of unfavorable price changes. The goal of hedging is

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not to eliminate risk completely, but to manage it in a way that limits potential losses. The reason that GOLD and Cryptocurrencies are identified as such is their negative price correlation to specific financial market movements that occurred in the past. However, their ability to do so is still controversial since prior research has come to conflicting results that depended on the specific financial market or the time frames in which the study was conducted.

Gold and Bitcoin are known as "safe havens" which means in financial terms an asset that is expected to retain or increase its value during times of market turbulence or economic downturns. Wang and Lee (2022) tested whether gold can hedge the exchange rate risks of five major world currencies and concluded that gold hedge effectively the dynamic risk of the euro, dollar, and pound. Shahzad et al. (2022) compared the hedging abilities of Bitcoin and Gold against the crashes of stock indices of BRICS countries and found that Gold and Bitcoin are weak hedges. However, their results show that Gold contributes diversification benefits in China. Nedved and Kristoufek (2023) found that Bitcoin moves together with the stock markets but oil and gold can serve as "safe havens". Researchers have also examined the role of Gold during the Covid-19 pandemic and found that investors increased their investment in Gold during the crisis (Akhtaruzzman et al., 2021; Wen et al., 2022; Cheema et al., 2022). Kristoufek (2020) investigated the correlations between Bitcoin and the S&P 500 and VIX and compared them with Gold as the traditional "safe haven" asset during the Covid-19 pandemic period. He concluded that Gold was superior in that sense, even when considering a broader cryptocurrency index (CRIX). Our study has also found that Gold has regained its superiority over Bitcoin as the preferred financial hedging tool in recent years, as the correlation between Bitcoin prices and stocks has increased in an economy characterized by rising interest rates and inflation expectations.

Elsayed et al. (2022) studied returns and volatility spillovers among cryptocurrency, Gold, and uncertainty measures and concluded that Gold reacts to both the returns and the volatilities spillovers under all market conditions. Zhichao et al (2022) studied ways to forecast stock volatility by selecting dynamic thresholds of the VIX. They find that selecting thresholds for the VIX can significantly improve the forecast accuracy. Hui (2019) investigated the linkages between the VIX and stock market volatility and found that a large VIX has a stronger explanation ability to the international stock market volatility. Like Hui (2019) we also found that large VIX has stronger support for Gold hedging ability but not for Bitcoin. This is true for VIX larger than 20 but lower than 30 and it is not true for extreme VIX (higher than 30) and relatively low VIX (lower than 20). Lopez-Cabarcos et al. (2021) suggested that Bitcoin volatility is more unstable in speculative periods. In stable periods, S&P 500 returns, VIX returns, and sentiment influence Bitcoin volatility.

The main contribution of this study is its inclusion of daily Gold and Bitcoin data alongside the VIX fear gauge, the U.S. bond market, and the world's major stock indices. Previous research has primarily focused on the U.S. stock markets, using the S&P 500 or Nasdaq as benchmarks, and has not incorporated U.S. bond market data into their analysis. We found in our study a positive dependency between the current daily prices of Gold and Bitcoin with a stronger impact of Gold on Bitcoin than vice versa. We also find that in recent years (2021-2023) Gold price changes are negatively correlated to yesterday's price change of the S&P500 a day before and positively correlated to yesterday's NASDAQ price change. In comparison,

the same phenomenon is valid for Bitcoin in prior years (2018-2020). These results emphasize that Gold has replaced Bitcoin as the prior hedging tool. We attribute this change to the recent rise in interest rates and inflation expectations, coupled with the increasing involvement of institutional investors in the cryptocurrency market.

2. Methodologies and results

Our data contains the daily price returns of Gold, Bitcoin, world-leading stock indices, and the VIX fear gouge, from the beginning of 2018 till the end of October 2023 along with the world's leading stocks indices and U.S. 10-year bond yields. We start our analysis with correlation matrixes between Gold Bitcoin and the VIX of the entire sample and year by year (Table 1).

Table 1. Correlation matrix

	Gold	**Bitcoin**	**VIX**	**Gold**	**Bitcoin**	**VIX**	**Gold**	**Bitcoin**	**VIX**
		All Sample			2023			2022	
Gold	1	0.113	-0.012	1	0.169	0.053	1	0.088	-0.113
Bitcoin	0.113	1	0.006	0.169	1	-0.025	0.088	1	0.018
VIX	-0.012	0.006	1	0.053	-0.025	1	-0.113	0.018	1
		2021			2020			2019	
Gold	1	-0.061	0.053	1	0.282	-0.083	1	0.125	-0.019
Bitcoin	-0.061	1	0.006	0.282	1	0.000	0.125	1	0.050
VIX	0.053	0.006	1	-0.083	0.000	1	-0.019	0.050	1
		2018							
Gold	1	0.042	0.087						
Bitcoin	0.042	1	-0.012						
VIX	0.087	-0.012	1						

From Table 1 we learn that for the entire sample, Gold has a negative correlation to the VIX fear gouge while Bitcoin has a positive correlation to it. These results may insinuate that Gold can better hedge financial risk than Bitcoin, however, they are not consistence over the examined years. Results also indicate a relatively strong correlation between Gold and Bitcoin (0.113). However, that correlation is volatile and change over time. The highest correlation between the pair occurred in 2020 (0.282) while the lowest occurred in 2021 (-0.061).

To better explore the dependencies between Gold and Bitcoin we constructed the following lagged Equations 1 and 2 and the results appear in Table 2:

$$\Delta Gold_i = \alpha_i + \beta_1 \Delta BTC_i + \beta_2 \Delta BTC_{i-1} + \beta_3 \Delta BTC_{i-2} + \beta_4 \Delta BTC_{i-3} + \varepsilon_i \quad (1)$$

$$\Delta BTC_i = \alpha_i + \beta_1 \Delta Gold_i + \beta_2 \Delta Gold_{i-1} + \beta_3 \Delta Gold_{i-2} + \beta_4 \Delta Gold_{i-3} + \varepsilon_i \quad (2)$$

Table 2. Lag regressions between gold and bitcoin

	α_i	β_1	β_2	β_3	β_4
$\Delta Gold_i$	0.000	0.026**	0.010*	0.009	0.001
	(1.08)	(4.40)	(1.70)	(1.51)	(0.28)
		$F = 6.07, R^2 = 0.15$			
ΔBTC_i	0.001	0.483**	0.027	0.030	-0.138
	(1.03)	(4.39)	(0.25)	(0.27)	(-1.25)
		$F = 5.14, R^2 = 0.13$			

Notes: ** 95% significance level, * 90% significance level.

The results that are summarized in Table 2 prove the positive dependency between the current daily prices of Gold and Bitcoin with a stronger impact of Gold on Bitcoin than vice versa. In addition, a positive impact one day ago on Bitcoin Prices was found to affect the current Gold price but not the other way around. Moreover, two or three days ago Bitcoin/Gold price changes did not affect the current Gold/Bitcoin price. We now start our analysis of the ability of Gold and Bitcoin to hedge the world's leading stocks indices, using Equation 3, and the results are presented in Table 3:

$$\Delta Gold_i, \Delta BTC_i = \alpha_i + \beta_1 \Delta SP_{i-1} + \beta_2 \Delta NDX_{i-1} + \beta_3 \Delta DAX_{i-1} + \beta_4 \Delta FTSE_{i-1} + \beta_5 \Delta NKK_{i-1} + \beta_6 \Delta SSEC_{i-1} + \varepsilon_i \quad (3)$$

Table 3. The impact of major stocks indices on the gold and bitcoin prices

	α_i	$\beta_1 \Delta SP_{i-1}$	$\beta_2 \Delta NDX_{i-1}$	$\beta_3 \Delta DAX_{i-1}$	$\beta_4 \Delta FTSE_{i-1}$	$\beta_5 \Delta NKK_{i-1}$	$\beta_6 \Delta SSEC_{i-1}$
$\Delta Gold_i$	0.000	-0.178**	0.137**	-0.005	0.017	0.005	-0.020
	(1.36)	(-2.85)	(2.66)	(-0.28)	(0.69)	(0.228)	(-0.87)
			$F = 1.52, R^2 = 0.16$				
ΔBTC_i	0.001	0.009	0.091	-0.002	-0.186*	-0.061	0.080
	(1.60)	(0.03)	(0.43)	(-0.03)	(-1.84)	(-0. 73)	(0.85)
			$F = 0.98, R^2 = 0.14$				

Notes: SP=S&P500, NDX= Nasdaq, DAX=German DAX, FTSE=U.K FTSE100, NKK=Nikkei 225, SSEC=Shanghai Composite. T statistics are presented in the brackets. ** 95% significance level, * 90% significance level.

Table 3 shows that daily Gold price changes are negatively correlated to yesterday's price change of the S&P500 a day before and positively correlated to yesterday's NASDAQ price change. This result demonstrates that Gold can serve as a hedging tool for the S&P500 and a supporting tool for the NDX. Moreover, no significant impact of the DAX, FTSE, NKK, and

SSEC on Gold prices meaning that Gold cannot hedge against a crash in those financial markets. The main question that those results raised is why Gold prices are negatively affected by the S&P500 and positively by the NDX. The answer to this question probably lies in the U.S. bond yields. Since Gold and Tech stocks serve as hedgers to high inflation (see for example Adekoya et al. (2023)) they may rise together when yields are high and drop when they are low. To examine that assumption, we split the data into two subsamples. The first subsample includes the years 2018-2020 in which the US10-year bonds yield was below 1 and the second subsample includes 2021-2023 in which those yields topped 1 (Results are presented in Table 2). Regarding Bitcoin, its price was found to be negatively correlated only to the British FTSE but not to the other indices. This may be a result of the British tough regulation forcing crypto firms to ensure that people have the appropriate knowledge and experience to invest in crypto and are aware of the risks involved in such investment[1].

Table 4. The impact of major stocks indices on the gold and bitcoin. Prices for different time periods

	α_i	$\beta_1 \Delta SP_{i-1}$	$\beta_2 \Delta ND X_{i-1}$	$\beta_3 \Delta DA X_{i-1}$	$\beta_4 \Delta FTS E_{i-1}$	$\beta_5 \Delta NK K_{i-1}$	$\beta_6 \Delta SSEC_{i-1}$
$\Delta Gold_i$ 2021-2023	0.000 (0.34)	-0.242** (-2.55)	0.173** (2.43)	0.011 (0.39)	0.055 (1.43)	0.026 (0.90)	-0.006 (-0.17)
				$F = 1.54, R^2 = 0.19$			
$\Delta Gold_i$ 2018-2020	0.000 (1.53)	-0.127 (-1.39)	0.106 (1.30)	-0.016 (-0.62)	-0.011 (-0.34)	-0.012 (-0.43)	-0.028 (0.93)
				$F = 1.34, R^2 = 0.09$			
ΔBTC_i 2021-2023	0.000 (0.55)	0.053 (0.14)	-0.187 (-0.63)	0.061 (0.49)	-0.292* (-1.81)	-0.057 (-0.47)	0.091 (0.63)
				$F = 2.01, R^2 = 0.11$			
ΔBTC_i 2018-2020	-0.002* (1.71)	-0.578* (1.75)	0.816** (2.53)	-0.045 (-0.43)	-0.137 (-1.03)	-0.062 (-0.51)	0.056 (0.46)
				$F = 2.48, R^2 = 0.18$			

Notes: SP=S&P500, NDX= Nasdaq, DAX=German DAX, FTSE=U.K FTSE100, NKK=Nikkei 225, SSEC=Shanghai Composite. T statistics are presented in the brackets. ** 95% significance level, * 90% significance level.

[1] See for example: https://www.fca.org.uk/news/press-releases/fca-introduces-tough-new-rules-marketing-cryptoassets.

Results presented in Table 4 indicate that there is a big difference between the two subsamples concerning the impact of the S&P500 and NDX on Gold prices. The negative/positive impact of the S&P500/NDX on Gold price did not exist significantly in 2018-2020 as opposed to 2021-2023. These results support the hypothesis that Gold better hedge the S&P500 and support the NDX only in times of high yields and inflation fears circumstances. Moreover, a negative impact of the British FTSE on the Bitcoin price occurred only in recent years (2021-2023) but not in the prior period.

Table 4 also demonstrates that Bitcoin behaved like Gold (hedging the S&P500 and supporting the NDX) during 2018-2021. These correlations faded away in more recent years (2021-2023). The main finding summarized here points out that Bitcoin has lost its ability to hedge against the S&P500 crash, while GOLD has regained its traditional position as the primary hedging tool against financial crises. In our opinion, the significant shift in Bitcoin's role as a hedging tool can be attributed to the following reasons: 1. Both Bitcoin and stocks are sensitive to changes in interest rates, inflation expectations, and overall economic conditions. In recent years, there has been a dramatic increase in interest rates worldwide, which has heightened investors' sensitivity to any news that could influence future interest rates, leading to an increased correlation between Bitcoin and stocks. 2. Bitcoin and other cryptocurrencies are subject to widespread technological innovation, which bolsters the stock prices of companies involved in their development. 3. In recent years, institutional investors have become more engaged in the cryptocurrency market, adopting similar trading strategies for both stocks and cryptocurrencies, thereby contributing to the correlation between these two financial assets.

The next step of our research is to examine the GOLD and Bitcoin hedging ability against financial crash, considering the relative financial market fear using the VIX fear gauge as a proxy. We again split our data into three subsamples: the first subsample includes days in which the VIX was traded above 30 which is considered very high representing a state of market panic. The second subsample included days in which the VIX was traded between 20-30 which represents a high fear of the financial markets (See for example Cohen, G., Qadan, M. (2010)) and the last subsample includes days in which the VIX wad traded below 20 representing a relatively calm market condition.

The results described in Table 5 indicate that the VIX categories mainly contribute to the Gold price prediction for the medium VIX category (between 20 and 30). At that range of VIX, the negative impact of the S&P500 on Gold price reaches its peak along with the positive impact of the NDX on Gold price. These results show that at this medium category of the VIX, Gold prices serve the best as S&P500 hedgers and NDX supporters. The VIX categories did not improve at all the prediction power of the world's main stock indices of the Bitcoin price, meaning that the VIX score does not provide any merits in terms of the role of Bitcoin as a hedging tool against a stock financial crash.

Table 5. The impact of major stocks indices on the gold and bitcoin. Prices for different VIX subsamples

	α_i	$\beta_1 \Delta SP_{i-1}$	$\beta_2 \Delta ND X_{i-1}$	$\beta_3 \Delta DA X_{i-1}$	$\beta_4 \Delta FTS E_{i-1}$	$\beta_5 \Delta NK K_{i-1}$	$\beta_6 \Delta SSEC_{i-1}$
$\Delta Gol d_i$ VIX>30	0.000 (0.13)	-0.022 (-0.10)	0.046 (0.23)	-0.030 (-0.58)	-0.049 (-0.60)	0.022 (0.25)	-0.024 (-0.23)
				$F = 0.17, R^2 = 0.007$			
$\Delta Gol d_i$ VIX>20 <30	0.000 (0.93)	-0.326** (-3.12)	0.247** (3.03)	0.024 (0.72)	-0.003 (-0.06)	0.020 (0.60)	0.004 (0.10)
				$F = 2.86, R^2 = 0.21$			
$\Delta Gol d_i$ VIX<20	0.000 (1.15)	-0.136 (-1.40)	0.072 (0.97)	-0.009 (-0.28)	0.063* (1.67)	-0.015 (-0.58)	-0.032 (-1.26)
				$F = 1.23, R^2 = 0.09$			
ΔBTC_i VIX>30	0.008 (2.34)	-0.298 (-0.48)	0.569 (1.01)	0.180 (1.25)	-0302 (-1.30)	-0.231 (-0.91)	-0.387 (-1.33)
				$F = 1.36, R^2 = 0.07$			
ΔBTC_i VIX>20 <30	0.001 (0.94)	0.028 (0.09)	0.026 (0.11)	-0.064 (-0.63)	-0.176 (-1.46)	-0.016 (-0.18)	0.140 (1.40)
				$F = 0.83, R^2 = 0.03$			
ΔBTC_i VIX<20	-0.001 (-0.53)	0.398 (0.90)	-0.393 (-1.16)	0.212 (1.38)	-0.067 (-0.38)	0.070 (0.59)	0.133 (1.08)
				$F = 0.87, R^2 = 0.04$			

3. Summary and conclusions

Our study uses daily data of prices from the beginning of 2018 until the end of October 2023 of Gold, Bitcoin, VIX, and the world's major stock indices. Moreover, we created subsamples according to the yields of U.S 10-year bonds and according to the daily traded VIX. We investigate the hedging ability of the described financial assets along with the interdependence among them. Moreover, we created subsamples according to the yields of U.S 10-year bonds and according to the daily traded VIX to investigate the hedging ability of the described financial assets along with the interdependence among them.

We found a positive dependency between the current daily prices of Gold and Bitcoin with a stronger impact of Gold on Bitcoin than vice versa. We also find that in recent years (2021-2023) Gold price changes are negatively correlated to yesterday's price change of the S&P500

a day before and positively correlated to yesterday's NASDAQ price change. In comparison, the same phenomenon is valid for Bitcoin in prior years (2018-2020). These results emphasize that Gold has replaced Bitcoin as the primary hedging tool. We attribute this change to the recent rise in interest rates and inflation expectations, coupled with the increasing involvement of institutional investors in the cryptocurrency market. Additionally, technological advancements have similarly influenced both the cryptocurrency and stock markets. We also documented that the best hedging ability of Gold is when the VIX gouge index is between 20-30 indicating a high fear in the market. However, its ability as a hedging tool deteriorated when the daily VIX score was extremely high (above 30) and lower than 20. The VIX score did not contribute anything to the ability of Bitcoin to hedge against financial market crashes.

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