

# Gold, Bitcoin, and Portfolio Diversification: Lessons from the Ukrainian War

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## CEBRIG Working Paper N°22-008

June 2022

# **Gold, Bitcoin, and Portfolio Diversification: Lessons from the Ukrainian War\***

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\*This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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## **Abstract**

How do major disruptive events, such as wars, affect the correlations between gold, Bitcoin, and financial assets? We address this question by estimating a dynamic conditional correlation (DCC) model before and during the 2022 Russian invasion of Ukraine. The results show that, after the outbreak of the war, the correlation between gold and stock markets dropped, confirming the diversification potential of gold during crises. The correlation between Bitcoin and oil declined as well. Meanwhile, the gold/Bitcoin correlation slightly decreased. Overall, our preliminary evidence suggests that gold and Bitcoin act as complements—rather than substitutes—for diversification purposes during international crises.

# 1 Introduction

Wars are massively disruptive. A major impact of wars on financial markets stems from the increased desirability of portable assets, such as gold and pieces of art (Oosterlinck, 2017). During World War II, portable assets proved to be attractive for both occupation forces and people willing to flee combat zones (Gallais-Hamonno et al., 2019). By modifying investors' preferences, even in countries not directly involved in the conflict (Verdickt, 2020), wars challenge cross-market correlations, and therefore portfolio diversification, which sits at the core of asset management theory and practice (Briere et al., 2012).

Peculiarities of wartime asset correlations can also concern less traditional assets, such as cryptocurrencies. Tut (2022) argues that Bitcoin (BTC), which allows transferring large amounts of funds across borders, should increase financial protection during wars. The portability of BTC is undeniable, and yet its short lifespan (since 2009) implies that little is known about its sensitivity to international conflicts. For this reason, the wartime correlations of BTC with gold and other financial assets is uncharted territory. This paper scrutinizes these correlations by estimating the dynamic conditional correlations (DCC) between BTC, gold, stock markets, and the crude oil market before and during the Russian invasion of Ukraine that started on February 24, 2022.

Like all cryptocurrencies, BTC is highly volatile (Quang et al., 2022). This intrinsic risk is, however, partly compensated by distinctively low correlations with other assets, thereby driving significant diversification benefits (Briere et al., 2015). This remarkable characteristic of BTC is reported in various settings (Bouri et al., 2017; Urquhart and Zhang, 2019, Wu et al., 2019). Yet Conlon and McGee (2020) question the diversification potential of BTC during crises by observing an increase in the correlation between BTC and the S&P500 stock index during the COVID-19 pandemic.

Regarding the 2022 Ukraine war, Bounbou and Yatie (2022) confirm the worldwide drop of stock prices. Adekoya et al. (2022) report an increase in interconnectedness across asset classes. By scrutinizing the markets during the 24 hours before and after the Russian invasion, Mohamad (2022) uncovers that flight-to safety took place during this short period of time. In sum, the emerging literature on the 2022 Russian invasion points to changes in investors' preferences, and subsequently in asset correlations, which are in line with previous work on the safe haven properties of gold (Baur and Lucey, 2010; Bredin et al., 2015). This paper takes further steps to check whether BTC exhibits a diversification potential like gold does and, if so, whether holding the two assets together for diversification purpose is redundant during wartime. The main takeaway of our estimation exercise is that both BTC and gold can deliver diversification benefits during wartime, but they act in different directions. Therefore, from a portfolio management perspective, gold and BTC should be viewed as complements rather than substitutes.

## **2 Data and Methods**

Russia invaded Ukraine on February 24, 2022. For estimation purposes, we recorded the daily prices of BTC, gold, two stock-market indices (S&P 500 for the US, and EuroStoxx 50 for Europe), and crude oil, starting three years before the invasion, in March 2019.<sup>1</sup> The full observation period includes 771 days and stops in May 2022. The asset returns are computed as the log differences of prices.

The DCC model, originally proposed by Engle (2002) has successfully been used to study correlations between several assets, including BTC (Bouri et al., 2017). Let us consider the

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<sup>1</sup> All prices are retrieved from Marketwatch, except for the Bitcoin series which comes from Yahoo Finance. We left out the BTC prices observed when the other markets were closed (e.g., during weekends).

daily returns,  $r_t$ , of  $k$  assets and assume that these returns are conditionally normal with a zero mean and conditional covariance  $H_t$ :

$$r_t/I_t \sim N(0, H_t)$$

$$H_t = D_t R_t D_t$$

where  $R_t$  is the conditional correlation matrix and  $D_t$  is a  $k$ -dimensional diagonal matrix with  $i$ -th element being the conditional standard deviation of the return of asset  $i$  ( $\sqrt{h_{it}}$ ).

The return series are represented by univariate GARCH (1,1) specifications:

$$h_{iit}^2 = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{i,t-1}^2 \quad (1)$$

where  $\omega_i$ ,  $\alpha_i$  and  $\beta_i$  are non-negative parameters, with  $\alpha_i + \beta_i < 1$  and the  $\varepsilon_{it}$ 's are iid random variables, with a zero mean and unit variance. We use the two-stage procedure, in which we estimate first the  $h_{i,t}$ 's with the univariate volatility model, and then the conditional correlation matrix  $Q_t$  using normalized residuals ( $u_{it} = \frac{\varepsilon_{it}}{\sqrt{h_{i,t}}}$ ):

$$Q_t = (1 - A - B)E(u_t u_t') + A u_{t-1} u_{t-1}' + B Q_{t-1} \quad (2)$$

where  $A$  and  $B$  are non-negative parameters satisfying  $A + B < 1$ . The final conditional correlation matrix is:

$$R_t = (\text{diag}(Q_t))^{-\frac{1}{2}} Q_t (\text{diag}(Q_t))^{-\frac{1}{2}} \quad (3)$$

### 3 Results

Table 1 provides the estimation results for the univariate GARCH (1,1) specifications in Equation (1) and the DCC model in Equation (2). The GARCH (1,1) results suggest that all assets exhibit time-varying and persistent conditional volatility<sup>2</sup> signaled by values of

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<sup>2</sup> To estimate the DCC model on a consistent sample, we had to remove the weekend observations. This removal could be the reason why the  $\alpha$ 's of gold and BTC are not significant. We tested for this possibility by estimating a GARCH(1,1) for gold and BTC including weekend observations.

$(\alpha_i + \beta_i)$  close to 1. The significance of the DCC coefficients ( $A$  and  $B$ ) and the fact that their sum is smaller than, but close to, one suggest that our modeling choices are appropriate.

**Table 1: Two-Step Estimation of GARCH (1,1) and DCC**

	GARCH (1,1)		DCC	
	$\alpha$	$\beta$	$A$	$B$
BTC	0.120	0.735***	-	-
Gold	0.091	0.756***	-	-
S&P 500	0.254***	0.729***	-	-
EuroStoxx 50	0.171***	0.810***	-	-
Crude Oil	0.256***	0.743***	-	-
	-	-	0.024***	0.920***

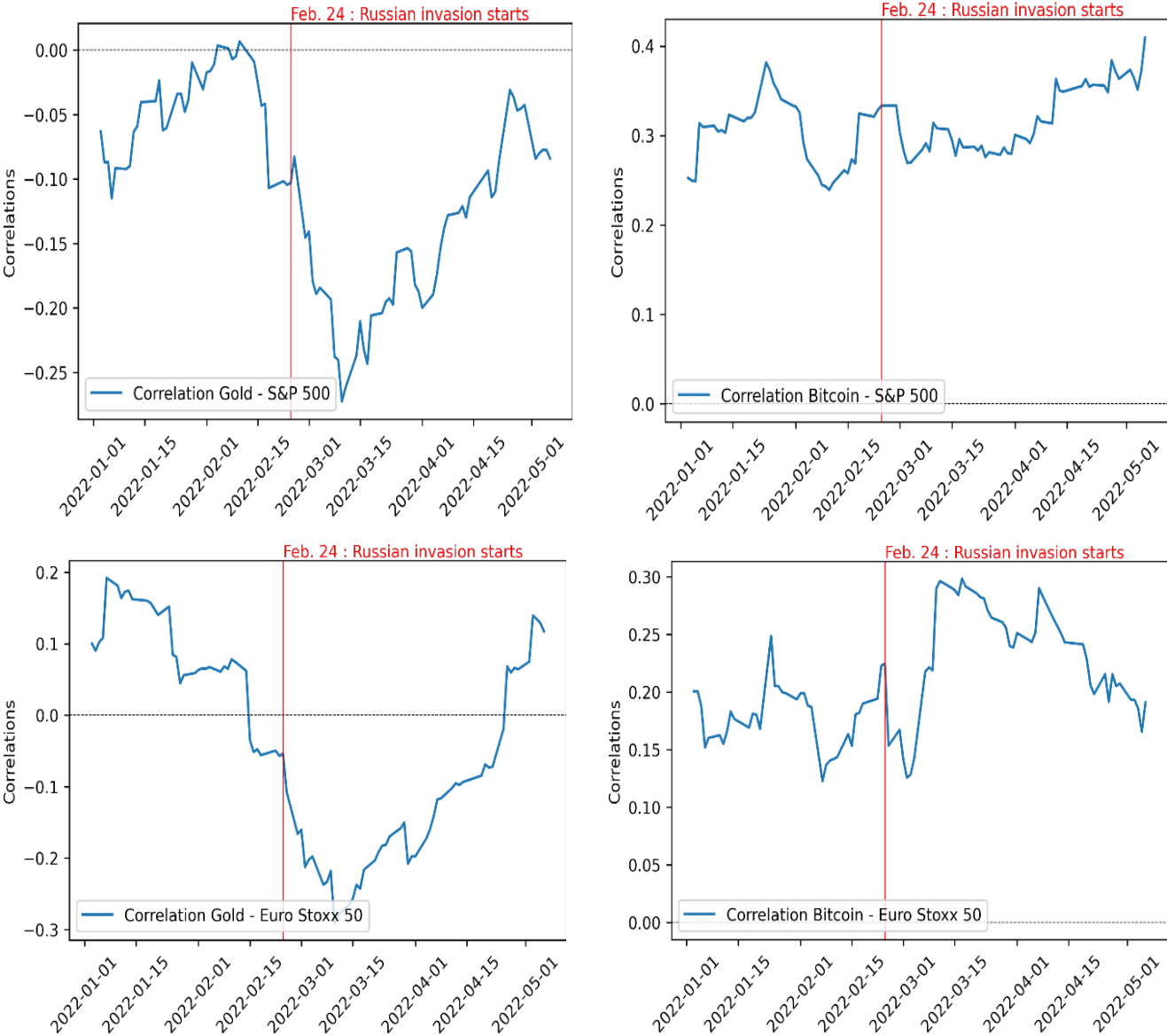
\*\*\*/\*\*/\*: significant at the 1%/5%/10% level

Each graph in Figure 1 shows the evolution of the conditional correlation between a pair of asset returns that includes gold, BTC, or both. The starting day of the war is indicated on each graph. Even though the estimation is performed on the full sample, conditional correlations are presented, for readability, only for 2022.

Figure 1 shows that, as soon as the invasion started, the correlations between gold and stock markets dropped, reaching levels as low as -0.25 for S&P 500 and -0.30 for EuroStoxx 50 within a few days. This evolution suggests that gold kept its safe haven property (Baur and Lucey, 2010) by providing an efficient hedge against stock market risks. The correlations started declining even before the invasion, likely because of the market's war expectations. After mid-March, we observe a positive trend, suggesting that the market prices had already incorporated the risks associated with the Ukraine war.

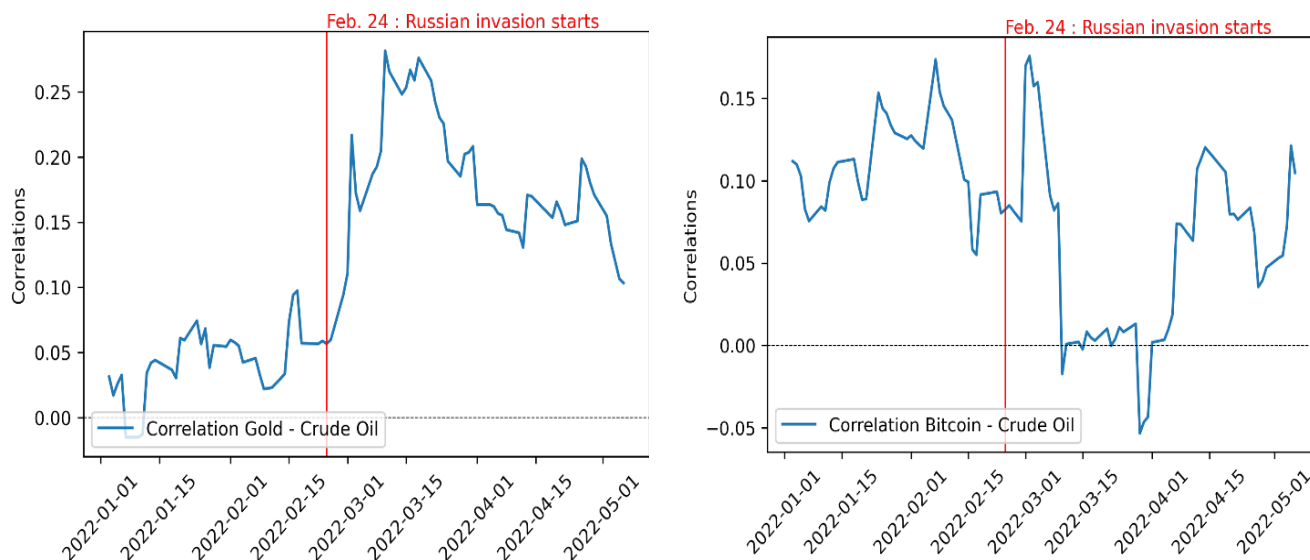
The right-side graphs in Figure 1 show the dynamic correlations between BTC and the stock market indices. These unexpected evolutions reveal that, as opposed to

gold, BTC kept positive correlations with stock markets throughout the entire period. A slight decline in the correlation with the European index is observed just after the invasion started, but the overall correlations remained positive and in similar ranges as before the war: between 0.20 and 0.40 for the S&P 500 and between 0.10 and 0.30 for the EuroStoxx50. As far as stock markets are concerned, gold seems to provide far better hedging than BTC.



**Figure 1: DCC for gold (left)/BTC (right) and stock market indices (S&P 500 above, Euro Stoxx 50 below)**

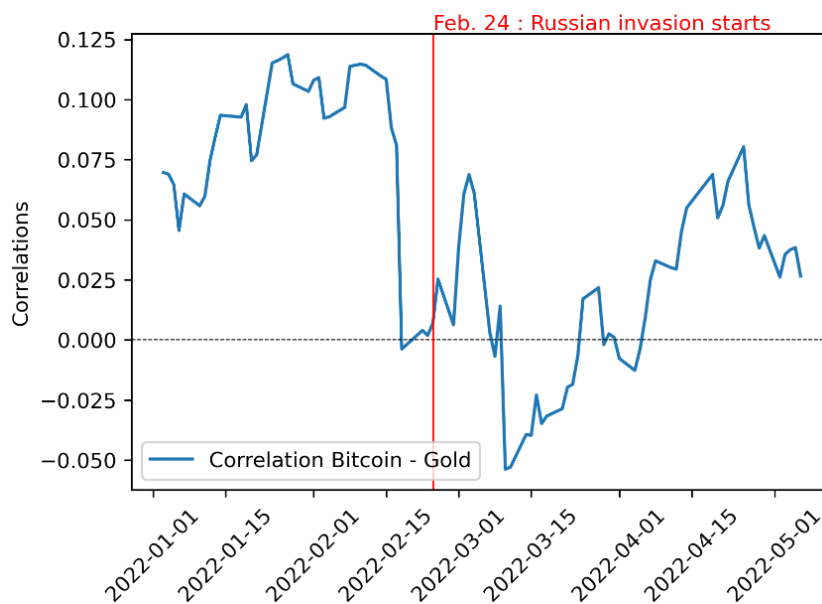




**Figure 2: DCC for gold (left)/BTC(right) and oil market**

The oil market was severely impacted by the Ukraine war for reasons pertaining to the Russian oil production and economic retaliations by Western countries. Figure 2 gives the dynamic correlations between gold and BTC, on the one hand, and crude oil, on the other. The gold/oil correlation boomed after the invasion while the BTC/oil correlation exhibits an erratic evolution with a negative global trend and a brief period of slightly negative values. Under the specific circumstances of the Ukraine war, oil risk was probably hard to hedge, but comparing gold and BTC to do so, clearly favors BTC.

Last, Figure 3 focusses on the gold/BTC correlation to assess the hypothesis of redundancy of the two assets during wartime. The correlation was low but positive before the war, but it declined shortly before the invasion. For the rest of the sample, the correlation fluctuated around zero, suggesting that gold and BTC are not redundant. Both assets seem to be useful in terms of diversification as their hedging capabilities concern distinct assets (stock markets for gold, oil for BTC).



**Figure 3: DCC for gold and BTC**

#### 4 Conclusion

Should investors prefer gold or BTC during wartime? Both assets enjoy portability, i.e. the possibility of easy and discrete transfer of large amounts of money across borders. In that respect, BTC does even dominate gold since it is easier to conceal, but it is also a much more volatile asset. Regarding diversification and hedging, our findings confirm that gold acts as a safe haven as it tends to evolve counter-cyclically and so provide (at least partial) hedge against falling stock market.

Previous evidence suggests that BTC is also a good diversifier, but evidence about the behavior of this newcomer during wartime is still missing. This paper lifts the veil on this issue. Confirming that both gold and BTC can be useful diversifiers during wartime, our preliminary results based on the Ukraine war period, show that the two assets tend to do so along different directions. Hence, the main takeaway is that diversification during wartime can be enhanced by combining gold and BTC.

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