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Changes in the occurrence of safe haven assets after Russian aggression on Ukraine

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***Abstract*— Two years ago, on 24 February 2022, Russia launched a multi-front attack against Ukraine, which was the largest military action against a European country since World War II. Russia's war on Ukraine has without doubt shocked the European security order. Nowadays, Ukraine's economy has not only stopped the free fall it experienced in the early days of the war but grew by more than 5 percent last year. Companies are beginning to recover, and international investment is returning, with $2.5 billion in foreign direct investment entering the country in the first half of 2023 alone. The economic impact of the war in Ukraine will remain an important issue in 2024. The aim of this paper is to compare the performance of safe haven assets after Russian aggression on Ukraine. We investigate the dynamic relationship between the countries: France, Germany, Great Britain, Japan, Poland, and the United States of America, and popular instruments: gold, silver, natural gas, crude oil, U.S. dollar (or Euro), Swiss franc, and Bitcoin. By choosing different countries we want to compare the influence of Russian aggression in Ukraine on the various market economies. We considered the period after Russian aggression in Ukraine, to be from 01.02.2022 – 01.03.2024. We estimate the parameters of DCC or CCC models to compare the dynamic relationship between the above-mentioned stock markets and financial instruments. The result shows that mostly, natural gas can be considered as a safe haven instrument during that time sample. For investors from Germany, Great Britain, and the USA we can observe that four out of seven instruments were able to act like safe haven assets. Surprisingly, only Bitcoin was not identified as a safe haven instrument for any country.**

Keywords— safe haven instruments, gold, silver, natural gas, Bitcoin, dynamic correlation, Russian aggression in Ukraine

I. INTRODUCTION

Two years after Russian aggression on Ukraine we still have to fight with a huge shock to the global economy. The economic recovery following the COVID-19 pandemic has been slower than expected because of the war in Ukraine. That unprovoked invasion was a turning point moment for Europe. The prices of energy and food rose very fast. Compared with other economic regions, the euro area has been more affected by the economic consequences of Russia's invasion of Ukraine. It might be caused by dependence on the import of energy. We have to remember that Russia was the main energy supplier to the euro area before the war. Two years later European Union dependency on Russian energy, especially for gas has fallen significantly. According to Eurostat, the value of exports to Russia fell by 62% between February 2022, and September 2023, while imports from Russia fell by 81% in this period.

During this period energy inflation reached a high level and the price of energy rose sharply, which first of all might be caused by increasing demand after COVID-19 lockdowns, and also by an unusually hot and dry summer of 2022. Moreover, the consequence of the high energy prices was the growth in the price of food and other goods. Before the war, Russia provided 24.4% of the European Union's gross available energy, which meant that Europe was heavily dependent on Russian energy and Russia had the potential to use this situation to its advantage. After two years, the situation is stabilizing in terms of energy prices and inflation.

If we want to protect investments before losses, we added to the portfolio a safe haven asset which is a type of financial instrument likely (but not guaranteed) to retain or increase value

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during market turbulence. Gold is perhaps the most commonly perceived safe haven investment. As a physical commodity, it cannot be printed like money, and its value usually will not be seriously impacted by the macroeconomic environment. Gold serves as a form of insurance against adverse economic events, given that its value has remained stable for many years. Other commodities, such as silver, and copper are generally negatively correlated with stocks and can also serve as safe havens for investors.

Moreover, the US dollar (USD) is considered a safe haven currency. It typically has a history of stable interest and exchange currency rates. Also, the Swiss franc is considered a safe haven currency. Switzerland has a large, safe, and stable banking industry, a low-volatility capital market, tax-friendly policies, near-zero unemployment, a high standard of living, and positive trade balance figures. Switzerland's independence from the European Union also somewhat shields it from any adverse political and economic events in the region.

We have to remember that the economic impact of the war in Ukraine will remain an important issue in 2024. The aim of this paper is to compare the performance of safe haven assets after Russian aggression on Ukraine. We investigate the dynamic relationship between the countries: France, Germany, Great Britain, Japan, Poland, and the United States of America, and popular instruments: gold, silver, natural gas, crude oil, U.S. dollar (or Euro), Swiss franc, and Bitcoin.

There are a lot of papers devoted to the analysis of safe haven properties of various assets. Gold protects from inflation, it can diversify investors' portfolios, and it is typically resistant to financial and economic crises. These characteristics make gold a safe asset. Traditionally, investors have used gold as a safe haven or a hedge against inflation and the potential volatility of other asset prices (Baur and Lucey, 2010; Ji et al., 2020). Other precious metals like silver, palladium, and platinum are less chosen as their safe haven property are found to be essential only over a short time horizon (Bredin et al., 2017; Lahiani et al., 2021). Also, gold's safe haven property is found to be time-varying (Shahzad et al., 2019a, Akhtaruzzaman et al., 2021) and market-specific (Beckmann et al., 2015; Shahzad et al., 2019b). Moreover, some studies question gold's safe haven ability (Dee et al., 2013; Baur and Glover, 2016; Klein, 2017). Moreover, Lucey and Li (2015) found out that the strength of gold being a safe haven changes over time. Some research suggests that gold doesn't always follow inflation closely (Salisu et al, 2020), while others say that it can protect against inflation if investors are patient or depending on the economic situation (Aye et al, 2017).

Moreover, Baur and McDermont (2010) confirmed that gold acted as a hedge and a safe haven for major European and US stock markets, but not for other markets. Beckmann et al. (2015) suggested that gold has served as a hedge and an effective safe haven. Hood and Malik (2013) discovered that gold acts as a weak safe haven and strong hedge asset in the US stock markets. Although these studies mainly support the safe haven attitude of gold, its price has skyrocketed after 2008. Thus, it seems that investors have to pay a high premium for the feeling of security. Other metals (e.g., platinum, silver, copper) are also known for their hedging attributes through diversification coupled with higher returns and often are referred to as safe havens for equity investors (Hillier et al., 2006; Sadorsky, 2014).

Also, currencies and commodities can offer a safe haven role in financial markets. Ranaldo and Soderlind (2010) suggested that the Swiss franc and Japanese yen exhibited safe haven properties during a crisis period. Grisse and Nitschka (2015) suggested that the Swiss franc exchange rate can act as a safe haven currency in some cases. Moreover, currencies such as the US dollar and Swiss francs act as safe havens during periods of stock market turmoil (Grisse and Nitschka, 2015; Kaul and Sapp, 2006; Ranaldo and Soderlind, 2010). Bouri et al. (2020) showed that the commodity index is a weak safe haven for some stock indices. Commodities, such as crude oil (Xia et al., 2019) have behaved quite differently since the 2008 Global Financial Crisis (Wu et al., 2020). Farther, Będowska-Sójka, and Kliber (2021) compared the safe haven properties of Ether and Bitcoin during various market turbulences. In addition, Łęt and Siemaszkiewicz (2020), investigated the safe haven properties of Bitcoin, gold, and fine wine market against stocks.

When it comes to the current crisis, lots of recent studies show that Bitcoin lost its safe-haven property during the pandemic (Chemkha et al., 2021; Conlon et al., 2020; Conlon and McGee, 2020; Raheem, 2021; Rubbaniy et al., 2021).

Baur and Lucey (2010) define hedge, diversifier, and safe haven as follows:

Hedge: An asset that is uncorrelated or negatively correlated with another asset or portfolio on average. A strict hedge is (strictly) negatively correlated with another asset or a portfolio on average.

Diversifier: An asset that is positively (but not perfectly correlated) with another asset or portfolio on average.

Safe haven: An asset that is uncorrelated or negatively correlated with another asset or portfolio in times of market stress or turmoil.

The question arises if those safe haven instruments are still identified these days. If we can observe any changes in the occurrence of safe haven instruments after the Russian invasion of Ukraine. Therefore, we investigate the performance of safe haven assets after Russian aggression on Ukraine.

II. DATA DESCRIPTION AND METHODOLOGY

The research analysis was carried out with the main stock exchanges indices, the CAC40 from France, DAX – Germany, FTSE250 – Great Britain, NIKKEI225 – Japan, WIG – Poland and S&P 500 - USA, as well as gold, silver, natural gas, Crude Oil WTI, US Dollar, Swiss Franc, and Bitcoin. We considered the period after Russian aggression in Ukraine, be from 01.02.2022 – 01.03.2024. The metals and crude oil rates that come from the Thomson Reuters database are given in US dollars (these are continuous futures series), while the other data come from the web portal stooq.pl. The time series for the observations of the index and metals for the country concerned were date-adjusted after considering holidays during which there was no trading. All the calculations used daily percentage logarithmic returns defined as $r_t = 100 \cdot \ln \frac{P_t}{P_{t-1}}$, where P_t denotes price of an asset at time t.

Figure 1 presents normalised quotations of indices CAC40, DAX, FTSE250, NIKKEI225, PX, SAX, WIG, and S&P500 from 1st February 2022 to 1st March 2024. We can observe that the possible highest value for investment was in the NIKKEI225 index at the end of the considered period. Also, we could observe the lowest value in FTSE250, and it was even smaller than at the beginning of the considered period.

FIGURE 1. NORMALISED QUOTATIONS OF CAC40, DAX, FTSE250, NIKKEI225, PX, SAX, WIG, AND S&P500 DURING CONSIDERED PERIOD.

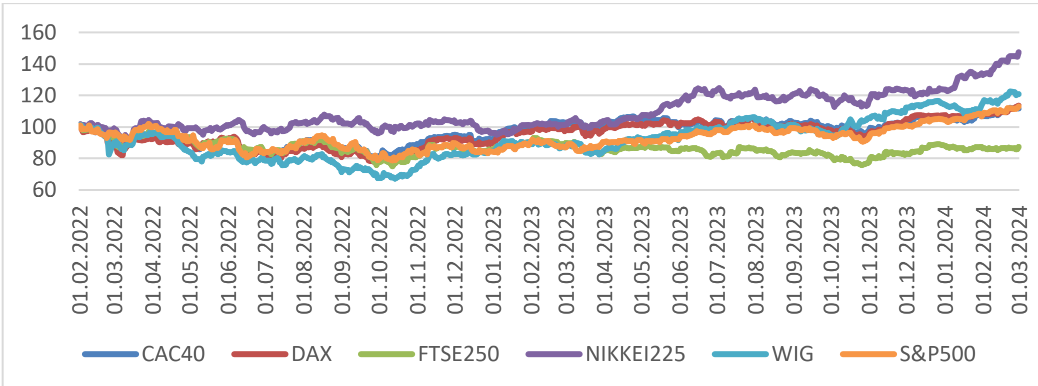

FIGURE 2. NORMALISED QUOTATIONS OF THE GOLD, NATURAL GAS, CRUDE OIL WTI, EURO, SWISS FRANC, BITCOIN, AND S&P500 DURING CONSIDERED PERIOD.

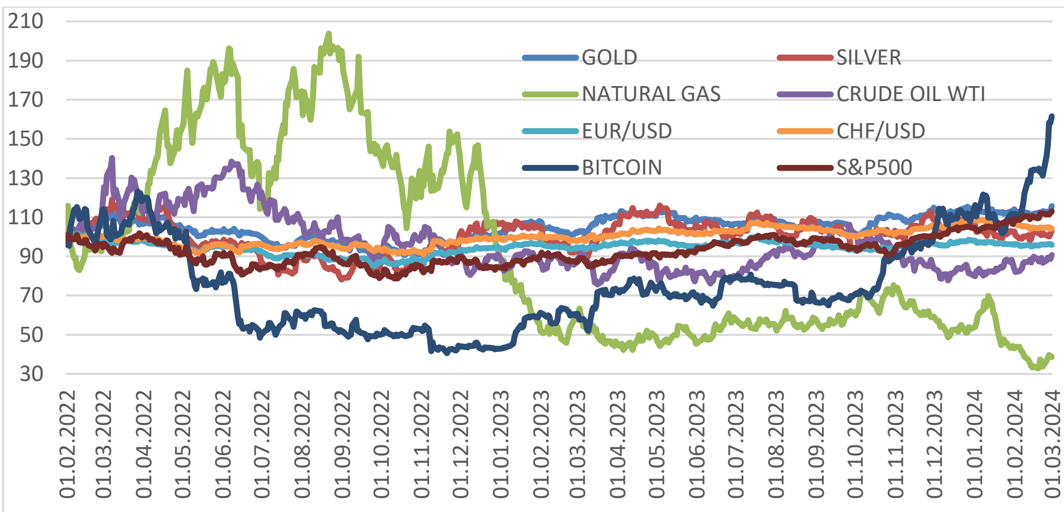

FIGURE 3. NORMALISED QUOTATIONS OF THE GOLD, NATURAL GAS, CRUDE OIL WTI, US DOLLAR, SWISS FRANC, BITCOIN, AND WIG DURING CONSIDERED PERIOD.

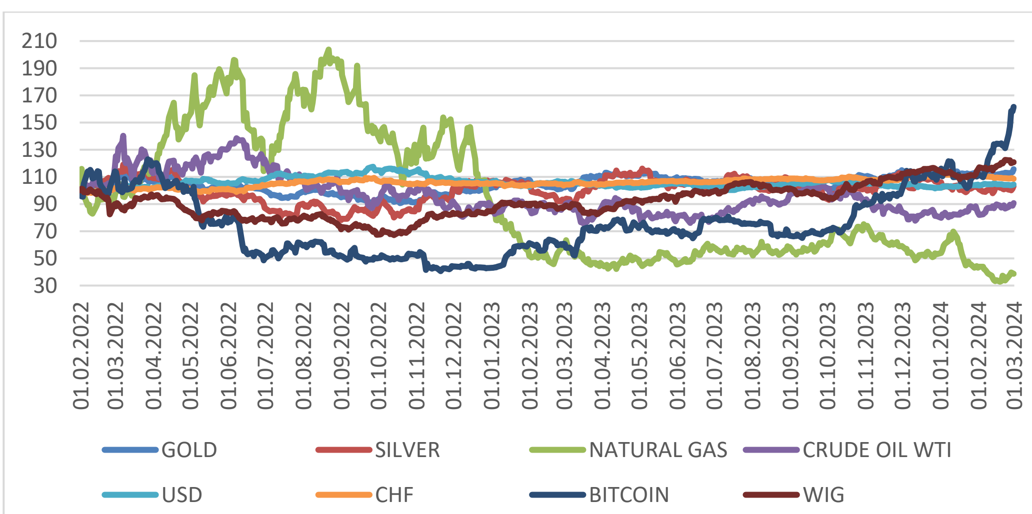

Figure 2 presents normalised quotations of the gold, natural gas, Crude Oil WTI, Euro, Swiss Franc, Bitcoin, and S&P500 from 1st February 2022 to 1st March 2024. We can observe that the possible highest value for investment was in Bitcoin. Moreover, we can observe huge fluctuations in the value of natural gas. Several reductions in the Russian pipeline gas supply, resulted in a series of rapid price increases in European natural gas futures, culminating in a record price being reached in August 2022. This compounded existing stress in the natural gas market.

Figure 3 presents normalised quotations of the gold, natural gas, Crude Oil WTI, US Dollar, Swiss Franc, Bitcoin, and S&P500 from 1st February 2022 to 1st March 2024. It differs from a quotation from Figure 2, because here we considered the US Dollar – not the Euro, and the relation Swiss franc to Euro, not to US Dollar. Also, it shows that it was possible to obtain the highest value for investment in Bitcoin at the end of the studied period. Moreover, we can observe small fluctuations in the prices of such instruments as USD, CHF, and silver.

TABLE 1. DESCRIPTIVE STATISTICS FOR THE RATES OF RETURN SERIES OF THE ANALYSED INSTRUMENTS.

	MIN	MAX	MEAN	ST. DEV.	SKEWNESS	KURTOSIS
GOLD	-2.847	3.130	0.028	0.878	0.140	1.084
SILVER	-5.260	7.827	0.006	1.762	0.501	1.952
NATURAL GAS	-18.066	14.852	-0.180	4.790	-0.219	0.844
CRUDE OIL WTI	-12.927	8.024	-0.019	2.554	-0.441	1.542
USD	-2.102	1.581	0.008	0.545	-0.168	0.761
CHF	-1.355	1.739	0.016	0.391	0.247	1.366
BITCOIN	-23.602	18.637	0.091	3.520	-0.474	6.533
CAC40	-5.093	6.883	0.021	1.132	0.122	3.990
DAX	-4.508	7.623	0.024	1.150	0.213	4.733
FTSE250	-3.507	4.336	-0.026	1.107	0.266	1.471
NIKKEI225	-3.054	3.860	0.073	1.109	0.018	0.338
WIG	-11.347	7.433	0.036	1.407	-0.652	8.961
S&P500	-4.420	5.395	0.023	1.189	-0.170	1.562

Table 1 presents descriptive statistics for the rates of returns series on the gold, natural gas, Crude Oil WTI, US Dollar, Swiss Franc, and Bitcoin, and stock exchanges indices the CAC40, DAX, FTSE250, NIKKEI225, PX, SAX, WIG, and S&P500 for the considered period. We can observe that the mean value was close to zero: in three cases it was negative, and for the other ten instruments it was positive. The highest volatility as measured by the standard deviation was reported for natural gas. The highest skewness was observed for silver, and it was positive for seven instruments. In the other six cases, it was negative, which indicates a long-left tail of the empirical distribution of returns. The highest kurtosis was observed for WIG.

Dynamic conditional correlation and Constant conditional correlation models

Let $Y_t = (y_{1,t}, \dots, y_{k,t})$ be the k −sized vector of observation at time t. The total number of observations is $n \in \mathbb{N}$. We assume that $E_{t-1}[\varepsilon_{i,t}] = 0$ and $E_{t-1}[\varepsilon_{i,t}, \varepsilon'_{i,t}] = H_t$. The dynamic conditional correlation (DCC) model of Engle (2002) reads:

$$Y_t = \mu_t + \varepsilon_t, \text{ with } \varepsilon_t = \boldsymbol{H}_t^{1/2}\mathbf{z}_t, \quad (1)$$

$$\boldsymbol{H}_t = \boldsymbol{D}_t\boldsymbol{R}_t\boldsymbol{D}_t, \quad (2)$$

$$\boldsymbol{D}_t = \mathrm{diag}\left(\sqrt{h_{11,t}}, \dots, \sqrt{h_{kk,t}}\right), \quad (3)$$

Where:

μ_t - is the k −dimensional conditional mean structure, $\boldsymbol{H}_t$ denotes the $(k \times k)$ −sized conditional variance matrix,

$\mathbf{z}_t$ - is a k −dimensional vector of independent and identically distributed random variables with zero mean and unit variance,

$\boldsymbol{R}_t$ - is the dynamic correlation matrix of size $(k \times k)$ from which we obtain the time-varying correlation coefficient estimates,

$\boldsymbol{D}_t$ - is a diagonal matrix of conditional standard deviations of ε_t. We assume $\mathbf{z}_t \sim St - t_v(0, I_k)$.

Let $z_{i,t}$ denote the standardized residual with respect to the idiosyncratic volatility given as $z_{i,t} = \varepsilon_{i,t}/\sqrt{h_{ii,t}}$. The dynamic correlation matrix then decomposes to:

$$\boldsymbol{R}_t = (\mathrm{diag}\,\boldsymbol{Q}_t)^{-1/2}\boldsymbol{Q}_t(\mathrm{diag}\,\boldsymbol{Q}_t)^{-1/2}, \quad (4)$$

Where:

$\boldsymbol{Q}_t$ - denotes the covariance matrix of the standardized residuals $z_t = (z_{1,t}, \dots, z_{k,t})$.

Engle (2002) introduced a GARCH (1,1)-like structure on the elements of $\boldsymbol{Q}_t = [q_{ij,t}]_{i,j=1}^{k,k}$ with:

$$q_{ij,t} := \bar{\rho}_{ij} + \alpha\left(z_{i,t-1}z_{j,t-1} - \bar{\rho}_{ij}\right) + \beta\left(q_{ij,t-1} - \bar{\rho}_{ij}\right) = \\ = \bar{\rho}_{ij}(1 - \alpha - \beta) + \alpha z_{i,t-1}z_{j,t-1} + \beta q_{ij,t-1}, \quad (5)$$

which is mean reverting as long as $\alpha + \beta < 1$ and where $\bar{\rho}_{ij}$ is the unconditional expectation of $q_{ij,t}$ with $\bar{\rho}_{ii} = 1$ for all $i = 1, \dots, k$. An estimator for the dynamic correlation is then obtained by calculating:

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}} = \frac{\bar{\rho}_{ij}(1-\alpha-\beta) + \alpha z_{i,t-1}z_{j,t-1} + \beta q_{ij,t-1}}{\sqrt{1-\alpha-\beta+\alpha z_{i,t-1}^2+\beta q_{ii,t-1}}\sqrt{1-\alpha-\beta+\alpha z_{j,t-1}^2+\beta q_{jj,t-1}}} \quad (6)$$

The difference between DCC and constant conditional correlation (CCC) model is in equation (2), where $\boldsymbol{H}_t$ is defined (Bollerslev, 1990):

$$\boldsymbol{H}_t = \boldsymbol{D}_t\boldsymbol{R}\boldsymbol{D}_t, \quad (7)$$

Where:

$\boldsymbol{H}_t$ - is conditional variance matrix and $\boldsymbol{R}$ is the constant conditional correlation matrix of the process ε_t.

The vector $GARCH\ (p,q)$ process of ε_t is defined as follows (Nakatani and Terasvirta, 2009):

$$\boldsymbol{h}_t = \boldsymbol{a}_0 + \sum_{i=1}^{q}\boldsymbol{A}_i\,\varepsilon_{t-1}^{(2)} + \sum_{j=1}^{p}\boldsymbol{B}_j\,h_{t-j}, \quad (8)$$

Where:

$\varepsilon_{t-1}^{(2)} = (\varepsilon_{1,t}^2, \dots, \varepsilon_{N,t}^2)'$,

$\boldsymbol{a}_0$ - is a k-dimensional vector, and $\boldsymbol{A}_i$ and $\boldsymbol{B}_j$ are $(k \times k)$ matrices with elements such $h_{ii,t}$ in $\boldsymbol{h}_t$ are positive for all t.

Equations (1), (2), (8) jointly define the k-dimensional CCC-GARCH (p, q) model if $\boldsymbol{A}_i$ and $\boldsymbol{B}_j$ are diagonal for all i and j.

In 1986 Engle and Bollerslev proposed the integrated GARCH (IGARCH) model. Many studies have shown that the sum of the parameters in GARCH models almost always is close to unity. In the IGARCH model we consider the sum of the parameters to be equal to one which means that the return series is not covariance stationary and there is a unit root in the GARCH process (Jensen and Lange, 2007). Jensen and Lange pointed out that “the conditional variance of the GARCH model converges in probability to the true unobserved volatility process even when the model is misspecified and the IGARCH effect is a consequence of the mathematical structure of a GARCH model and not a property of the true data generating mechanism.”

The condition for IGARCH is $\sum_{i=1}^{q} \alpha_i + \sum_{i=1}^{p} \beta_i = 1$. For IGARCH model, the equation (5) is than given by:

$$q_{ij,t} := (1-\lambda)\left(z_{i,t-1} z_{j,t-1}\right) + \lambda q_{ij,t-1}, \qquad (9)$$

Where: $\lambda = 1 - \alpha = \beta$. Then DCC model is called Integrated DCC.

The GJR-GARCH was proposed by Glosten, Jagannathan and Runkle (1993) and this model assumes to reveal and take into account the asymmetry property of financial data in obtaining the conditional heteroscedasticity (see Glosten, Jagannathan and Runkle, 1993). The general form of the GJR-GARCH (q, p) is given by:

$$\sigma_t^2 = w + \sum_{i=1}^{q} (\alpha_i + \lambda_i I_{t-i}) \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-i}^2, \qquad (10)$$

Where:

I_{t-i} is an indicator function taking the value one if the residual is smaller than zero and the value zero if the residual is not smaller than zero.

$$I_{t-i} = \begin{cases} 1, \text{if } \varepsilon_{t-i} < 0 \\ 0, \text{otherwise} \end{cases}.$$

III. RESULTS AND DISCUSSION

This part presents the research results for the CAC40, DAX, FTSE250, NIKKEI225, WIG and S&P500 indices obtained using the methodology described earlier in the article.

TABLE 2. STATIC CORRELATION BETWEEN THE STUDIED INSTRUMENTS FOR THE PERIOD OF 1 FEB 2022–01 MARCH 2024.

'	GOLD	SILVER	NATURAL GAS	CRUDE OIL WTI	USD	CHF	BITCOIN
SILVER	0.666	1.000					
NATURAL GAS	0.017	0.028	1.000				
CRUDE OIL WTI	0.257	0.237	0.138	1.000			
USD	-0.377	-0.315	-0.004	-0.099	1.000		
CHF	0.128	0.094	0.095	0.061	0.386	1.000	
BITCOIN	0.110	0.165	0.083	0.047	-0.267	-0.118	1.000
CAC40	-0.003	0.105	0.092	0.020	-0.335	-0.178	0.265
DAX	-0.021	0.082	0.047	-0.057	-0.330	-0.177	0.244
FTSE250	-0.011	0.034	0.056	0.034	-0.274	-0.151	0.127
NIKKEI225	0.002	-0.030	0.041	0.062	-0.036	0.034	0.023
WIG	0.189	0.162	0.008	0.100	-0.127	0.124	0.062
S&P500	0.097	0.192	0.127	0.086	-0.423	-0.159	0.448

Table 2 presents the static correlation between the studied instruments for the period of 1 Feb 2022–01 March 2024. We can see that gold, USD, or Euro if we consider investors from the USA, and CHF was able to act like a safe haven instrument, and the correlation coefficient was negative (bold numbers).

TABLE 3. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE CAC40 STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD	DCC-GARCH	0.906	0.367	0.618	20.271
SILVER	DCC-GARCH	0.839	0.394	0.591	55.174
NATURAL GAS	DCC-GARCH	-0.905	0.309	0.670	51.157
CRUDE OIL WTI	DCC-GARCH	-0.601	0.518	0.443	48.689
USD	DCC-IGARCH	0.094	0.266	0.734	4.877
CHF	DCC-GARCH	0.090	0.262	0.737	4.844
BITCOIN	DCC-GARCH	0.711	0.377	0.616	15.782

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

Table 3 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from France in the considered period. The analysis shows that natural gas, and crude oil WTI (the bold number of $\bar{\rho}$) acted like safe haven instruments.

TABLE 4. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE DAX STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD	DCC-IGARCH	0.897	0.361	0.625	53.630
SILVER	DCC-GJR	0.696	0.393	0.596	23.234
NATURAL GAS	DCC-GJR	-0.847	0.352	0.628	32.902
CRUDE OIL WTI	DCC-GARCH (normal distribution)	-0.284	0.509	0.469	
USD	DCC-GARCH	-0.913	0.966	0.011	4.593
CHF	DCC-GARCH	-0.174	0.191	0.808	4.227

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
BITCOIN	DCC-GJR	0.600	0.423	0.570	22.477

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

Table 4 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from Germany in the considered period. We can observe that natural gas, crude oil WTI, USD, and CHF acted like safe haven instruments. For crude oil WTI, we could estimate the DCC-GARCH model only with normal distribution.

TABLE 5. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE FTSE250 STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD	DCC-IGARCH	-0.212	0.623	0.315	47.189
SILVER	DCC-GARCH	-0.134	0.636	0.297	31.042
NATURAL GAS					
CRUDE OIL WTI	DCC-GARCH (normal distribution)	0.307	0.596	0.345	
USD	CCC	-0.005			3.848
CHF	CCC	-0.011			3.841
BITCOIN	DCC-GJR	0.452	0.411	0.577	20.001

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

Table 5 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from Great Britain in the considered period. The analysis shows that gold, silver, USD, and the CHF acted like 'safe haven' instruments. If the number $\bar{\rho}$ is written in bold, it means that the instrument can be considered a safe haven for a given financial market. We could not, however, estimate any model for natural gas, which means that the parameters were non-significant. Moreover, for USD, and CHF, which were recognized as a safe haven instrument, we could only estimate the CCC model for them.

Table 6 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from Japan in the considered period. The table shows that only natural gas could be considered a safe haven instrument. We were not able to estimate any model for gold, which means that the parameters were non-significant. Moreover, for natural gas and crude oil WTI, we could estimate models DCC-GARCH with normal distribution.

TABLE 6. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE NIKKEI225 STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD					
SILVER	DCC-GARCH	0.126	0.772	0.139	52.213
NATURAL GAS	DCC-GARCH (normal distribution)	-0.129	0.680	0.270	
CRUDE OIL WTI	DCC-GARCH (normal distribution)	0.056	0.687	0.268	
USD	DCC-IGARCH	0.052	0.196	0.803	5.023
CHF	DCC-IGARCH	0.048	0.188	0.810	5.025
BITCOIN	DCC-GARCH	0.608	0.507	0.465	28.259

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

TABLE 7. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE WIG STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD	DCC-GJR	0.643	0.427	0.557	58.984
SILVER	DCC-GJR	0.444	0.594	0.360	32.176
NATURAL GAS					
CRUDE OIL WTI					
USD	DCC-GJR	-0.408	0.275	0.724	5.888
CHF					
BITCOIN	DCC-GJR	0.934	0.358	0.615	21.345

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

Table 7 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from Poland in the considered period. For that sample, only USD was identified as a safe haven instrument. We could not, however, estimate any models for natural gas, crude oil WTI, and CHF.

Table 8 presents parameters of DCC or CCC models of pairwise synchronised return data of a chosen instrument and the stock exchange index from the USA in the considered period. We can see that gold, natural gas, crude oil WTI, and CHF were safe haven instruments. We were not able to estimate any model for EUR, which means that the parameters were non-significant. Moreover, for the natural gas, crude oil WTI, and CHF we were able to estimate model DCC-GARCH with normal distribution.

TABLE 8. PARAMETERS OF DCC OR CCC MODELS (THE COVARIANCE PART) OF PAIRWISE SYNCHRONISED RETURN DATA OF A CHOSEN INSTRUMENT AND THE S&P500 STOCK INDEX FOR THE STUDIED PERIOD. ROBUST STANDARD ERRORS ARE AVAILABLE UPON REQUEST.

INSTRUMENT	MODEL	$\bar{\rho}$	α	β	ν
GOLD	DCC-GJR	-0.957	0.314	0.683	54.564
SILVER	DCC-GJR	0.462	0.509	0.449	32.071
NATURAL GAS	DCC-GARCH (normal distribution)	-0.254	0.548	0.431	
CRUDE OIL WTI	DCC-GARCH (normal distribution)	-0.036	0.592	0.379	
USD					
CHF	DCC-GARCH (normal distribution)	-0.056	0.012	0.901	
BITCOIN	DCC-GARCH	0.891	0.538	0.400	18.726

Note. Numbers written in bold indicate that the instrument can be considered a safe haven for a given financial market.

TABLE 9. COUNTRIES (STOCK EXCHANGES) IN WHICH WE WERE ABLE TO IDENTIFY THE ANALYSED INSTRUMENTS AS A 'SAFE HAVEN' DURING 01.02.2022-01.03.2024.

INSTRUMENT	CAC40	DAX	FTSE250	NIKKEI225	WIG	S&P500
GOLD			+			+
SILVER			+			
NATURAL GAS	+	+		+		+
CRUDE OIL WTI	+	+				+
USD		+	+		+	
CHF		+	+			+
BITCOIN						

Table 9 presents countries (stock exchanges) in which we were able to identify the analyzed instruments as a safe haven during considered period. That table is a summary of results obtained from estimation models (the results in Tables 2 to 8). From Table 9 we can observe that mostly, natural gas can be considered as a safe haven instrument during that time sample. For investors from Germany, Great Britain, and USA we can observe that four out of seven instruments were able to act like safe haven assets. Surprisingly, only Bitcoin was not identified as a safe haven instrument for any country. This might be the result of the specific characteristics of Bitcoin: especially at the end of the considered period, its quotations were subject to sharp fluctuations, while it is known that only those financial instruments can be considered a safe haven that are not risky themselves.

IV. CONCLUSIONS

Gold is seen as a reliable and solid investment over the long term, offering a security during crises and protection against uncertainty. This has begun a growing movement approving that countries should reconnect their currencies to gold, promising greater financial stability. Ultimately, gold is a safe haven, and we are not wrong to think of it as such. There will always be a demand for gold, not least because its value is stable, and it can provide protection from inflation and diversification for investors' portfolios. But while it can be resilient to crises, in turbulent events and periods, and with a government willing to protect its currency at all costs, gold might not be as safe an investment as you think.

This article examined the performance of gold, silver, natural gas, crude oil, U.S. dollar (or Euro), the Swiss franc, and Bitcoin as safe haven instruments after Russian aggression in Ukraine. Our studies shows that mostly, natural gas can be considered as a safe haven instrument during that time sample. For investors from Germany, Great Britain, and the USA we can observe that four out of seven instruments were able to act like safe haven assets. Surprisingly, only Bitcoin was not identified as a safe haven instrument for any country.

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