Gold as a portfolio diversifier and hedge for other assets: Evidence from Russia-Ukraine war, Israel-Hamas war and Israel-Iran war

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Introduction (1/3)

Hedge, diversifier, and safe haven asset can be described 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." (Baur & Lucey, 2010)
- "Diversifier: An asset that is positively (but not perfectly correlated) with another asset or portfolio on average."(Baur & Lucey, 2010)
- "Safe haven: An asset that is uncorrelated or negatively correlated with another asset or portfolio in times of market stress or turmoil." (Baur & Lucey, 2010)

Geopolitical crises:

Russia invaded Ukraine on February 24, 2022

Israel-Hamas war started on October 7, 2023

Israel-Iran war on April 13, 2024

Introduction (2/3)

Significance of the study

- The increase in gold prices has prompted considerable academic and policy discussion.
- The impact of prior financial crises on financial markets highlights the importance of analysing gold price dynamics.
- The evaluation of an asset's financial capabilities is based on its liquidity, response to fluctuations in other assets, and its hedging potential.
- Therefore, identifying connectedness of gold with other assets under adverse market conditions will enhance portfolio allocation during periods of volatility.
- Our objective is to identify the role of gold as a diversification and hedging tool under different market conditions.
- We compare the pre-war period with ongoing war period.
- Existing studies examining the influence of gold prices on various assets during crises remains in its infancy.

Introduction (3/3)

Motivation of the study:

- This study is purported to be the first examining the diversification and hedging characteristics of gold across numerous asset classes throughout three significant geopolitical crises.
- Our study focuses on a wide array of asset class, longer time frames and hence is more comprehensive and broader.
- In light of the ongoing development of war, the study seeks to provide portfolio managers and investors with precise insights by forecasting optimal portfolio weights, hedging effectiveness, hedge ratios, and Sharpe ratio of portfolios.
- We employ a novel TVP-VAR based extended joint connectedness method.

Literature review (1/2)

Base metals such as gold are essential assets for a country's economic growth, stability, boost GDP and stock market reliability (Kang et al., 2017).

Gold impacts the framework of international relations, rendering it susceptible to global occurrences such as geopolitical, economic, financial, or health crises (Gunay et al., 2024).

Historically, gold has functioned as a store of value and a portfolio stabilizer during crises (Hussain Shahzad et al., 2020).

Role of gold as a diversifier, safe haven and hedge:

Gold acts as a hedging instrument against various stock markets (Do et al., (2009), Baur & McDermott, (2010)). Tarchella et al., (2024) and Khan et al., (2024) suggests that gold may provide diversification benefits.

Chkili, (2016), Peng, (2020), Ji et al., (2020) and Kumar & Padakandla, (2022) demonstrates that gold possesses safe haven characteristics.

On the contrary, Umar et al., (2021) suggested silver as an exception rather than gold and Enilov et al., (2023) assert that aluminium emerged as the most effective safe-haven asset during the COVID-19 pandemic.

Literature review (2/2)

Gold and other assets during crisis:

Geopolitical crises have wider and more immediate economic repercussions than other types of crises. They influence worldwide trade, disrupt global supply chains, and generate volatility in financial markets (Naeem et al., (2024).

Multiple studies have identified an increase in volatility spillover among the commodity, equity, currency, and energy markets during war, where gold acts as a receiver of volatility spillovers/shock from other markets (U et al., (2024), Lin et al., (2024), Triki & Ben Maatoug, (2021), Alam et al., (2022), Lo et al., (2022)).

On the contrary, some studies have concluded that gold functions as net transmitter of spillover shocks to other markets (Ha, (2022), Kyriazis et al., (2024), Gunay et al., (2024)) during geopolitical crisis.

The existing literature reveals mixed results for gold's hedging and diversification properties against various assets and its connectedness with other assets. The emphasis is to study the reason behind gold's volatile behavior during war like situation.

Data & Methodology

Panel A assets	Panel B assets	Panel C assets	Panel D assets
Gold	Gold	Gold	Gold
Silver	Bitcoin	NYSE (USA)	US bond (govt. 10 yr.)
Aluminium	Ethereum	FTSE 100 (UK)	Euro bond (govt. 10 yr.)
Crude oil	Binance coin	Shanghai SE (China)	Euro (currency)
Rice	Solana	BSE Sensex (India)	USD (currency)

Source: Refinitiv Eikon, Bloomberg, investing.com
Frequency: Daily, Duration: 01/01/2021 to 07/10/2024. This period is subdivided into four sample periods: pre - war period from 01/01/2021 to 23/02/2022, Russia – Ukraine war from 24/02/2022 to 07/10/2024, Israel– Hamas war from 08/10/2023 to 07/10/2024 and Israel-Iran war from 15/04/2024 to 07/10/2024.
Methodology: TVP – VAR extended joint connectedness approach (Balcilar et al., 2021).

Empirical analysis: Descriptive statistics

Panel A: Gold and Commodity								
Asset	Mean	SD	Skewness	Ex. Kurtosis	JB	ERS	Q (10)	Q2(10)
Gold	0.0001 (0.001) [0.002] {0.0013}	0.0092 (0.0098) [0.010] {0.011}	-0.395** (0.507***) [0.397**] {0.172*}	1.738*** (1.642***) [1.487***] {0.483*}	37.061*** (85.666***) [24.273***] {1.464*}	-1.369** (-7.926***) [-5.683***] {-3.522***}	4.618* (8.765*) [8.742*] {7.146*}	6.764* (5.242*) [2.148*] {3.980*}
Aluminium	0.0020 (-0.0002) [0.001] {0.001}	0.0166 (0.0173) [0.013] {0.015}	-0.363** (-0.046*) [0.405**] {0.135*}	1.323*** (4.399***) [0.306*] {0.290*}	23.147*** (446.181***) [6.393**] {0.652*}	-1.74* (-2.412**) [-2.635***] {-2.315**}	6.153* (6.880*) [7.884*] {2.910*}	8.013* (19.841***) [8.888*] {3.424*}
Crude Oil	0.0024 (0.000) [0.000] {-0.001}	0.0245 (0.0270) [0.020] {0.020}	-1.08*** (-0.094*) [-0.022*] {0.154*}	6.468*** (3.591***) [0.136*] {0.841*}	473.273*** (298.011***) [0.174*] {3.341*}	-1.265* (-8.478***) [-2.274**] {-5.095***}	3.887 (9.713*) [8.094] {12.062**}	8.077 (117.124***) [3.399] {2.390}
Rice	0.0000 (0.0017) [0.002] {0.002}	0.0347 (0.0565) [0.067] {0.073}	-1.50*** (-0.042*) [0.002*] {-0.139*}	16.846*** (4.936***) [3.807***] {3.613***}	3140.948*** (561.487***) [123.793***] {54.718***}	-6.76*** (-14.52***) [-5.742***] {-0.605}	23.393*** (50.306***) [17.726***] {6.718}	1.683 (43.8***) [21.468***] {7.782}
Silver	-0.0005 (0.0006) [0.002] {0.002}	0.0183 (0.0200) [0.020] {0.024}	-0.232* (0.452***) [0.252*] {0.232*}	4.731*** (2.051***) [0.876**] {0.399*}	229.752*** (115.808***) [8.721**] {1.559*}	-1.508 (-5.822***) [-6.197***] {-3.39***}	5.90 (1.848) [2.481*] {3.400*}	39.97*** (4.163) [8.602] {7.238}

Notes: ***, **, * denote significance at 1%, 5% and 10% significance level. The Descriptive statistics results are reported for the Pre-war period, (Russia-Ukraine war period), [Israel-Hamas war period] & {Israel-Iran war period}.

Correlation

Panel A: Gold and Commodity					
	Gold	Aluminium	Crude Oil	Rice	Silver
Gold	1 (1) [1] {1}				
Aluminium	0.245 (0.310) [0.271] {0.240}	1 (1) [1] {1}			
Crude Oil	0.085 (0.088) [0.076] {0.051}	-0.086 (0.170) [0.026] {0.053}	1 (1) [1] {1}		
Rice	-0.050 (0.072) [-0.013] {0.007}	0.036 (0.038) [-0.040] {0.014}	0.114 (-0.028) [-0.015] {-0.189}	1 (1) [1] {1}	
Silver	0.744 (0.796) [0.799] {0.819}	0.299 (0.356) [0.368] {0.401}	0.075 (0.108) [0.134] {0.150}	-0.082 (0.069) [0.000] {-0.013}	1 (1) [1] {1}

Note: The correlation results are reported for the Pre-war period, (Russia-Ukraine war period), [Israel-Hamas war period] and {Israel-Iran war period}.

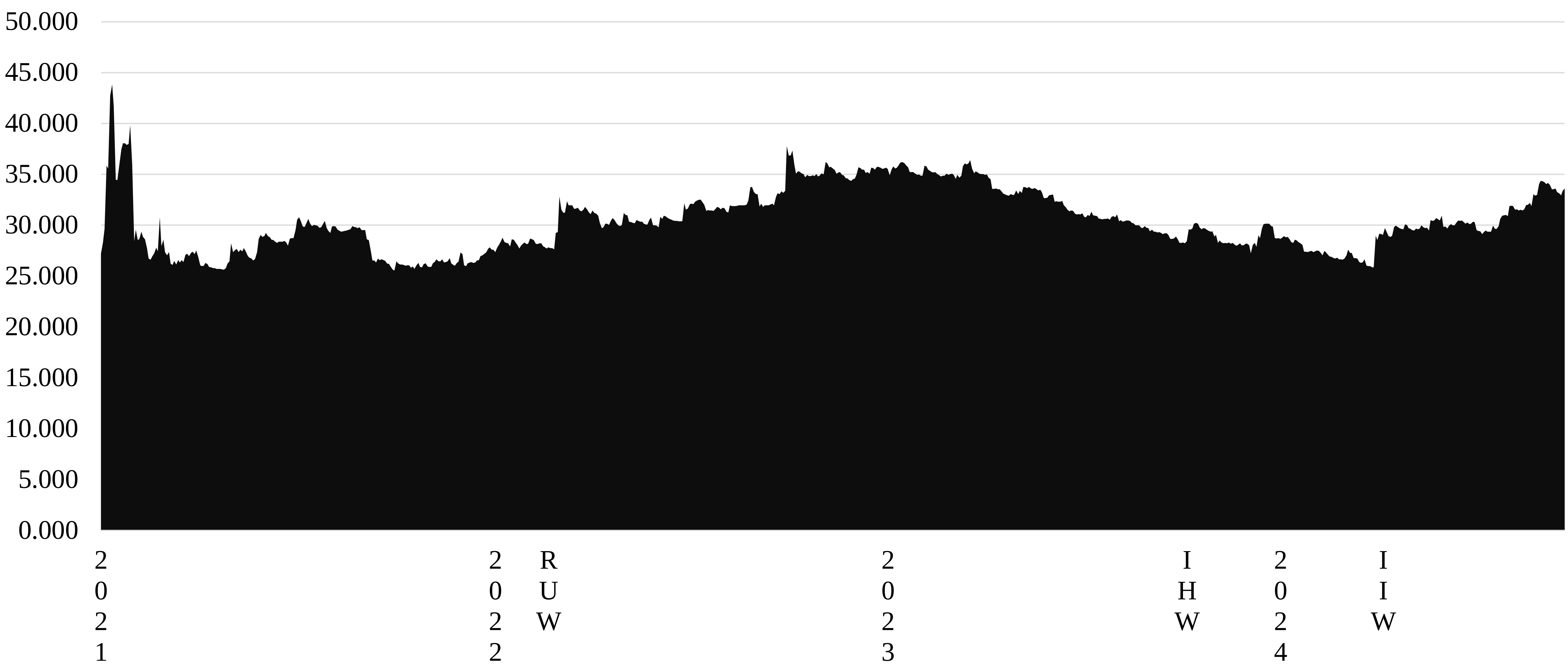
Figure 1: Gold price

Averaged dynamic connectedness - Panel A: Gold and Commodity

Pre-war period							Russia-Ukraine war period						
	Gold	Aluminium	Crude Oil	Rice	Silver	FROM		Gold	Aluminium	Crude Oil	Rice	Silver	FROM
Gold	44.07	11.22	1.85	1.49	41.37	**55.93**	Gold	50.64	6.17	3.70	2.04	37.45	49.36
Aluminium	7.51	75.46	8.46	1.55	7.02	24.54	Aluminium	10.19	72.01	5.98	1.76	10.05	**27.99**
Crude Oil	2.12	2.51	91.18	1.86	2.33	8.82	Crude Oil	6.35	3.69	84.52	1.75	3.69	15.48
Rice	2.2	3.23	2.86	88.62	3.08	**11.38**	Rice	3.06	2.11	2.26	91.11	1.46	**8.89**
Silver	41.11	8.87	2.8	1.36	45.86	**54.14**	Silver	36.75	9.43	6.08	1.46	46.29	**53.71**
TO	52.94	**25.84**	**15.98**	6.26	53.8	154.81	TO	**56.34**	21.39	**18.02**	7.01	52.66	155.43
Inc. Own	97.01	101.3	107.16	94.88	99.66	TCI	Inc. Own	106.98	93.41	102.54	98.12	98.95	TCI
NET	-2.99	1.3	7.16	-5.12	-0.34	**30.96**	NET	6.98	-6.59	2.54	-1.88	-1.05	**31.09**

Israel-Hamas war period							Israel-Iran war period						
	Gold	Aluminium	Crude Oil	Rice	Silver	FROM		Gold	Aluminium	Crude Oil	Rice	Silver	FROM
Gold	34.29	7.60	5.27	4.78	48.05	**65.71**	Gold	31.52	6.54	4.40	2.60	54.94	**68.48**
Aluminium	6.70	77.58	2.99	2.57	10.16	**22.42**	Aluminium	8.23	63.68	6.74	2.74	18.60	**36.32**
Crude Oil	1.98	1.26	89.72	4.67	2.36	10.28	Crude Oil	3.84	4.53	82.25	4.57	4.82	17.75
Rice	0.92	2.30	1.39	94.45	0.94	5.55	Rice	2.49	1.32	5.29	89.57	1.34	10.43
Silver	48.14	10.28	3.97	2.93	34.67	**65.33**	Silver	50.35	14.95	6.99	2.81	24.91	75.09
TO	57.74	21.45	**13.63**	**14.95**	61.50	169.28	TO	64.91	27.33	**23.42**	**12.72**	**79.69**	208.08
Inc. Own	92.04	99.03	103.35	109.40	96.18	TCI	Inc. Own	96.43	91.01	105.67	102.30	104.60	TCI
NET	-7.96	-0.97	3.35	9.40	-3.82	**33.86**	NET	-3.57	-8.99	5.67	2.30	4.60	**41.62**

Dynamic total connectedness – Panel A: Gold and Commodity



Impact of global factors on total connectedness

Pre-War period						
Factor	Constant	GEPU	GPR	OPU	TPU	WUI
Panel A	50.75 (0.0032)***	**0.0013** **(0.0774)***	0.0058 (0.8861)	-0.0084 (0.7384)	**0.2712** **(0.0792)***	**0.0003** **(0.0445)***
Russia-Ukraine War period						
Factor	Constant	GEPU	GPR	OPU	TPU	WUI
Panel A	34.9151 (0.0938)*	**0.0394** **(0.0387)****	**0.0768** **(0.0020)*****	0.0286 (0.2070)	**0.0849** **(0.0190)****	**0.0003** **(0.0189)****
Israel-Hamas war period						
Factor	Constant	GEPU	GPR	OPU	TPU	WUI
Panel A	21.751 (0.0971)*	0.1689 (0.3839)	**0.0242** **(0.0911)***	0.0783 (0.6320)	0.1395 (0.3566)	0.0008 (0.6302)
Israel-Iran war period						
Factor	Constant	GEPU	GPR	OPU	TPU	WUI
Panel A	22.250 (0.0741)*	4.1431 (0.7209)	**0.1340** **(0.0726)***	0.0730 (0.8550)	0.1597 (0.7126)	0.0232 (0.6973)

Note: ***, **, * indicates significance at 1%, 5% and 10%, respectively.

Portfolio analysis

Panel A: Gold and Commodity						
Asset	MVP - Weights	MCP - Weights	MCoP - Weights	EWP-Weights	RPP-Weights	MSP-Weights
Gold	**0.73** **(0.82)** **[0.64]** **{0.56}**	**0.12** **(0.15)** **[0.19]** **{0.21}**	**0.13** **(0.16)** **[0.13]** **{0.22}**	**0.20** **(0.20)** **[0.20]** **{0.20}**	**0.33** **(0.35)** **[0.30]** **{0.30}**	**0.00** **(0.96)** **[0.89]** **{0.76}**
Aluminium	0.15 (0.12) [0.24] {0.30}	0.23 (0.17) [0.23] {0.22}	0.22 (0.21) [0.22] {0.23}	0.20 (0.20) [0.20] {0.20}	0.22 (0.22) [0.28] {0.25}	0.64 (0.00) [0.09] {0.21}
Crude Oil	0.07 (0.05) [0.10] {0.13}	0.23 (0.27) [0.26] {0.28}	0.24 (0.23) [0.26] {0.24}	0.20 (0.20) [0.20] {0.20}	0.16 (0.17) [0.21] {0.25}	0.36 (0.00) [0.00] {0.00}
Rice	0.05 (0.01) [0.01] {0.01}	0.27 (0.31) [0.29] {0.29}	0.26 (0.28) [0.27] {0.27}	0.20 (0.20) [0.20] {0.20}	0.12 (0.09) [0.07] {0.07}	0.00 (0.04) [0.02] {0.03}
Silver	0.00 (0.00) [0.00] {0.00}	0.15 (0.10) [0.03] {0.00}	0.16 (0.11) [0.12] {0.04}	0.20 (0.20) [0.20] {0.20}	0.16 (0.17) [0.14] {0.12}	0.00 (0.00) [0.00] {0.00}

Note: The weights are reported for the Pre-war period, (Russia-Ukraine war period), [Israel-Hamas war period] and {Israel-Iran war period}.

Sharpe Ratio

Panel A: Gold and Commodity			
Strategy	Mean	Std. Dev.	Sharpe Ratio
MVP	0.0005 (0.0008) [0.0016] {0.0009}	0.0082 (0.0092) [0.0083] {0.0090}	**0.061 (0.088) [0.188] {0.102}**
MCP	0.0009 (0.0007) [0.0013] {0.0008}	0.0128 (0.0201) [0.0205] {0.022}	**0.070 (0.035) [0.061] {0.037}**
MCoP	0.0010 (0.0007) [0.0013] {0.0009}	0.0127 (0.019) [0.020] {0.020}	**0.079 (0.036) [0.065] {0.044}**
EWP	0.0008 (0.0006) [0.0014] {0.0011}	0.0112 (0.015) [0.016] {0.017}	**0.071 (0.040) [0.089] {0.063}**
RPP	0.0008 (0.0006) [0.0013] {0.0008}	0.0097 (0.012) [0.010] {0.011}	**0.081 (0.047) [0.130] {0.073}**
MSP	0.0021 (0.0010) [0.0019] {0.0013}	0.0132 (0.010) [0.010] {0.010}	**0.162 (0.105) [0.204] {0.127}**

Note: The Sharpe ratios are reported for the Pre-war period, (Russia-Ukraine war period), [Israel-Hamas war period] and {Israel-Iran war period}.

Hedging analysis

Panel A: Gold and Commodity			
	Optimal weights	Hedge ratios	HE (%)
Aluminium/Gold	0.21 (0.16) [0.36] {0.44}	0.38 (0.55) [0.35] {0.21}	6 (12) [8] {6}
Crude Oil/Gold	0.11 (0.09) [0.19] {0.29}	0.26 (0.43) [0.08] {0.13}	1 (2) [1] {1}
Rice/Gold	0.09 (0.02) [0.03] {0.01}	-0.17 (0.30) [-0.29] {0.61}	1 (2) [1] {1}
Silver/Gold	1. (0.00) [0.00] {0.00}	1.65 (1.57) [1.55] {1.39}	53 (64) [64] {65}

Note: The Optimal weights, hedge ratios, and hedging effectiveness results are reported for the Pre-war period, (Russia-Ukraine war period), [Israel-Hamas war period] and {Israel-Iran war period}.

Conclusion

- There is a partial connectedness among the Gold-based portfolios…
- The connectedness increased during war periods, but of partial level and offers the diversification and hedging opportunity.
- Gold based portfolio gives diversification benefits to investors, hence one should increase the investment in gold during the war periods.
- Gold also serves as a hedge during war period.
- Hence, findings derived from this asset are crucial for policymakers, all players in financial markets, and society at large.

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Thank you