

Ivana Putić^{1*}, Suzana Balaban², Dražen Jovanović²¹PhD student, Alfa BK University, Belgrade, Serbia, Teaching Assistant, Novi Sad School of Business, Novi Sad, Serbia²Alfa BK University, Belgrade, Serbia

Hedging Strategies with Gold in Reducing Index- Based and Sectoral-Based Equity Portfolio Risk

DOI: 10.7595/management.fon.2026.0003

Abstract:

Research Question: This study examines the effectiveness of gold as a hedge in portfolios with NASDAQ-100 and sectoral ETFs during market stress to determine its ability to reduce risk. **Motivation:** Gold is widely recognized as a safe-haven asset during periods of market volatility, yet its effectiveness in portfolios containing NASDAQ-100 and sectoral ETFs under financial stress remains underexplored. Considering recent market disruptions, such as the COVID-19 pandemic, the war in Ukraine, and energy market fluctuations, understanding how portfolios can be stabilized is essential. This study provides investors with practical, evidence-based insights on strengthening portfolio resilience and enhancing risk-adjusted performance. Specifically, it addresses the research question of whether gold can effectively reduce portfolio risk and improve hedging efficiency during market crises. **Idea:** The study proposes examining how adding gold influences portfolio behaviour in NASDAQ-100 and sectoral ETFs during periods of heightened market stress. It focuses on identifying whether such inclusion reduces portfolio volatility and provides stability across different sources of financial disruption. **Data:** The analysis uses daily closing prices for gold, NASDAQ-100, XLE, and XLF from January 2020 to April 2025, covering approximately 1,350 observations, obtained from the Stooq platform. **Tools:** Econometric modelling and volatility analysis were conducted in EViews. The methodological framework includes descriptive statistics, correlation analysis, GARCH volatility modelling, rolling correlations, and portfolio metrics such as the Hedge Effectiveness Index, Sharpe ratio, and minimum variance portfolios. **Findings:** The results indicate that gold consistently exhibits low volatility and tends to negatively correlate with NASDAQ-100 and XLF during stress periods, confirming its safe-haven properties. XLE shows more mixed correlations due to its sensitivity to energy markets. These patterns highlight gold's potential as a stabilizing component in diversified equity portfolios and suggest practical implications for investors seeking to mitigate risk during periods of heightened market uncertainty. Including gold, which shows low volatility and negative correlations with key indices, reduces portfolio risk and enhances investors' resilience. **Contribution:** Overall, the findings show that including gold in portfolios can reduce overall risk, enhance risk-adjusted performance, and provide investors with a practical tool for managing uncertainty.

Keywords: hedge, gold, NASDAQ-100, XLE, XLF

JEL classification: G11, G12, G15, E44

1. Introduction

During periods of global economic uncertainty, investors face an increasing difficulty in predicting financial market movements and actively seek assets that can function as safe havens. Gold is widely recognized as a safe-haven asset, with its tendency to perform well during market stress due to its negative correlation with broader financial cycles. This study examines the hedging effectiveness of gold from January 1, 2020, to April 30, 2025, focusing on portfolios combining sectoral indices XLE and XLF, as well as the NASDAQ-100, with gold as a hedging instrument. Quantitative measures and models, including the Sharpe ratio, HEI, GARCH(1,1), and rolling correlations, are employed to analyze risk-return dynamics and interrelationships among assets over time. This research examines whether gold can reduce portfolio risk across various indices and sectors, particularly during times of high market volatility.

* Corresponding author: Ivana Putić, e-mail: putic.ivana@gmail.com

In line with these objectives, the following hypotheses have been formulated:

H1: The inclusion of gold in index-based equity portfolios (NASDAQ 100) leads to a statistically significant reduction in portfolio risk.

H2: The inclusion of gold in sectoral-based equity portfolios (XLE, and XLF) leads to a statistically significant reduction in portfolio risk.

This study examines hedging strategies for NASDAQ-100, XLE, and XLF using gold as a tool to reduce risk and enhance returns. The motivation of this research is to address a gap in the literature on the effectiveness of gold under volatile and uncertain market conditions, while exploring portfolio dynamics and its diversification potential. This study offers practical guidance for investors and companies in managing risk and optimizing portfolios, highlighting the role of gold as a safe-haven during global economic and geopolitical uncertainties. The introduction presents the research objectives, motivation, and hypotheses, followed by a literature review that provides a theoretical and empirical framework on the role of gold in portfolios. The methodology section explains the choice of models and metrics, including the Sharpe ratio, HEI, GARCH, and rolling correlations, while the data chapter details sources, observation periods, and descriptive statistics. The results and discussion section analyzes hedging effectiveness, compares findings with previous studies, and identifies limitations and implications. Finally, the conclusion summarizes key findings, evaluates the hypotheses, and suggests directions for future research.

2. Literature Overview

While the role of gold as a hedge and safe-haven asset has been widely explored, its effectiveness depends on market conditions, investment horizon, and portfolio composition. Evidence shows that gold can provide long-term hedging benefits for stock market risks (Dee et al., 2013), while in other contexts, such as the S&P 500, it cannot simultaneously hedge equity and inflation risks (Chen, 2020). Sectoral analyses also highlight the potential of gold to reduce portfolio risk, though results are mixed across markets (Shakil et al., 2018; Dar & Maitra, 2017; Manuj, 2021). It can be argued that gold can reduce the portfolio risk, but its impact depends on a specific market situation. This motivates our investigation into the role of gold in portfolios based on both the NASDAQ-100 index and sector ETFs (XLE, and XLF). Table 1 summarizes the results of the previous studies.

Table 1: Summary of the Previous Research

Author(s)	Primary instrument	Period	Methodology	Results
Zhang et al. (2025)	Stock markets of G7 and E7 countries	January 2000 to December 2024	QQ regression	The safe-haven function of gold is time-varying.
Zivkov et al. (2025)	Carbon emission allowances	January 2015 to August 2024	VaR models	The gold portfolio outperforms the industrial metals portfolio.
Dias et al. (2024)	Stock indexes	January 2018 to November 2023	SVAR	Assets with gold are crucial for portfolio diversification, especially during economic uncertainty.
Gomes et al. (2023)	G7 countries plus China and India stock market	2000 to 2020	Baur and Lucey (2010) methodology	Gold is relevant for strategic asset allocation.
Hassan et al. (2021)	UCRY Price	December 2013 to February 2021	GARCH model	Gold provides a stable and reliable safe-haven against cryptocurrency risk.
Akhtaruzzaman et al. (2021)	Stock indexes	January 2018 to April 2020	DCC-GARCH	Gold acts as safe haven asset during Phase I (31 Dec 2019–16 Mar 2020). Gold loses the safe haven status during Phase II (17 Mar –24 April 2020).

Author(s)	Primary instrument	Period	Methodology	Results
Manuj (2021)	U.S. and the Indian stock markets	1980–2020	GARCH	Gold has not served as a hedge or a safe haven for long-term investors.
Baur and Smales (2020)	Geopolitical risk	January 1985 to October 2018	Regression	Gold lowers the impact of geopolitical risk.
Chen (2020)	S&P 500	January 1985 to May 2019	Multi-variate regression	Gold fails to hedge both stock market and inflation simultaneously.
Ming et al. (2020)	SHFE and CSI 300 index	2008 to 2017	QQ regression	Gold acts as a safe haven when market returns are below their 1%, 5%, and 10% quantiles and during the two crash periods.
Bouri et al. (2020)	World, developed, emerging, USA, and Chinese stock	July 2010 to February 2018	Wavelet VAR	Diversification benefits vary over time, with Bitcoin outperforming gold and commodities.
Ghazali et al. (2020)	S&P 500, FTSE 100, SSEC, BSESN, KLCI	July 2001 to December 2017	TGARCH	Gold displays substantial evidence of strong hedge characteristics.
Shrydeh et al. (2019)	US stocks	2007 to 2017	VAR-ADCC-BVGARCH	Gold's hedging effectiveness against US stocks declines with larger market capitalization.
Shakil et al. (2018)	Shariah-compliant stock market index	2011 to 2015	ARDL	Gold seems to be a useful portfolio hedge
He et al. (2018)	UK and US equity indices	1968 to 2017 1969 to 2017 1985 to 2017	Markov-Switching CAPM	Gold consistently acts as a hedge, but shows no clear safe-haven effect for UK or US stocks.
Dar and Maitra (2017)	USA, China and India stock markets	November 1999 to October 2013	DCC GARCH CWT Wavelet coherence	The results indicate a weak hedge and safe haven-property of gold for stocks.
Chkili (2016)	BRIKS stock markets' indices	2000-2014	Asymmetric DCC GARCH	Gold can act as a safe haven against extreme market movements
Smirnova (2016)	S&P 500	2004 to 2012	Correlation	Gold ETFs and gold mining stocks act as a safe haven in market downturn
Beckmann et al. (2015)	18 individual markets and 5 regional indices	January 1970 to March 2012	Novel regime-dependent framework	Gold serves as both a hedge and a safe haven
Dee et al. (2013)	China's stock market prices	October 2002 to April 2012	Different panel models	Gold is not a safe haven when investors face with stock risk.

Source: Authors' summary

Beckmann et al. (2015) find that gold can act both as a hedge and a safe haven, though its effectiveness depends on market conditions. This shows that the benefits of hedging in index-based portfolios depend on the situation, especially when comparing normal and extreme volatility, which is important for understanding risk reduction in NASDAQ-100 portfolios. According to Chkili (2016), gold and equities show negative correlations during the market crises in BRICS countries, suggesting that it may serve as a risk-

reducing asset in the sector-based portfolios such as XLE and XLF. Smirnova (2016) shows that gold assets can improve portfolio stability during the market downturns, while Shrydeh et al. (2019) suggest that the effectiveness of gold as a hedging asset is influenced by both market size and market dynamics. Zhang et al. (2025) further confirm that the effectiveness of gold as a hedging asset depends on portfolio context and market structure. Overall, the results indicate a need to examine how gold can reduce portfolio risk across different indices and sectors.

A number of studies suggest that including gold in a portfolio can reduce the risk and improve diversification. Bouri et al. (2020) show that gold provides meaningful diversification benefits compared to Bitcoin and other commodities, supporting its role as a hedge for both index-based and sectoral portfolios. Baur and Smales (2020) highlight gold's safe-haven function during geopolitical crises, which is especially relevant for sectoral portfolios like XLE and XLF. Akhtaruzzaman et al. (2021) demonstrate that gold initially served as a safe haven during the COVID-19 pandemic, showing that investors moved their money into safer assets, while Hassan et al. (2021) find that gold stays stable even with cryptocurrency risks, proving it is a reliable hedge. According to Dias et al. (2024), gold reduces risk in MENA stock markets during global crises, including the Russia-Ukraine conflict, while also pointing to close connections between regional equities and precious metals. Finally, Zivkov et al. (2025) show that portfolios dominated by precious metals, particularly gold, reduce extreme risk by over 60% and deliver higher risk-adjusted returns. Overall, findings suggest that the hedging effectiveness of gold depends on market conditions, crisis periods, and portfolio composition. These findings provide a basis for exploring whether gold can reduce risk in NASDAQ-100, XLE, and XLF portfolios, offering empirical support for the study's hypotheses on the role of gold as a risk-reducing asset.

3. Methodology

In order to evaluate the effectiveness of the hedging strategy, this study employs the Sharpe ratio, Hedge Effectiveness Index (HEI), the GARCH(1,1) model, and rolling correlations. The Sharpe ratio, commonly applied in portfolio optimization (Cascon & Shadwick, 2006), is calculated as:

$$\text{Sharpe ratio} = \frac{r_p - r_f}{\sigma_p} \tag{1}$$

Where

r_p is the portfolio return,

r_f is the risk-free rate, and

σ_p the portfolio's standard deviation.

This metric shows whether adding a hedging instrument like gold improves portfolio efficiency (Brandt, 2010), with a higher increase indicating a higher hedging effectiveness (Kavussanos & Visvikis, 2008). The HEI complements this by directly measuring the reduction in portfolio risk. It compares the variance of hedged versus unhedged portfolios (Chkili, 2016) and is expressed as:

$$\text{HEI} = \frac{\sigma^2_{\text{unhedged}} - \sigma^2_{\text{hedged}}}{\sigma^2_{\text{unhedged}}} \tag{2}$$

Higher HEI values indicate that the hedging strategy is more effective in reducing risk. In practice, the secondary asset in a portfolio is chosen based on its contribution to overall risk reduction. HEI and the Sharpe ratio are often used together to provide a more complete picture: HEI captures volatility reduction, while the Sharpe ratio reflects the risk-return quality of portfolio management (Brandt, 2010; Akhtaruzzaman et al., 2021; Kroner & Ng, 1998). To analyze volatility dynamics, the GARCH model is applied (Palic, 2025; Balaban et al., 2025). Its conditional variance is calculated as:

$$\sigma_t^2 = \omega + \alpha \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{3}$$

Where

σ_t^2 represents conditional variance at time t, and

ϵ_{t-1}^2 is the squared residual from the previous period.

This model allows us to observe periods of heightened risk and understand how shocks affect portfolio stability. It is particularly useful for hedging analysis because it tracks time-varying relationships between the main asset and the hedging instrument. Finally, rolling correlations are used to monitor how relationships between assets change over time (Zivot & Wang, 2003), especially during financial crises, when market volatility is high and prices shift quickly.

4. Results and Discussion

4.1 Descriptive statistics

The data were obtained from the Stooq platform, covering daily closing prices from January 1, 2020, to April 30, 2025, and processed in EViews. The key descriptive statistics of the analyzed series are presented in Table 2.

Table 2: Descriptive Statistics of Primary and Hedging Instruments

	Mean	Variance	Standard deviation	Skewness	Kurtosis
NASDAQ-100	0.021154	0.516853	0.719194	-0.397174	10.41267
XLE	0.013828	1.002393	1.001570	-0.939922	16.02867
XLF	0.016477	0.525376	0.725099	-0.548242	16.83902
Gold	0.024853	0.185346	0.430679	-0.377400	5.731017

Source: Author's calculation based on data from the Stooq platform

The results show that gold and NASDAQ-100 recorded the highest average values, reflecting their strong performance during the observed period, while the energy and financial sectors displayed more modest returns. The energy sector (XLE) exhibited the highest variance (1.0023) and standard deviation (1.0016), consistent with its exposure to global shocks such as oil and gas price volatility, geopolitical tensions, and disruptions during the COVID-19 pandemic and the war in Ukraine. By contrast, XLF (variance 0.5253, SD 0.7251) and NASDAQ-100 (variance 0.5168, SD 0.7192) indicate moderate risk levels, shaped by monetary policy shifts, interest rate changes, and post-pandemic valuation adjustments. Gold stands out with the lowest variance and standard deviation, confirming its role as a safe haven asset and a stabilizing element in portfolio hedging strategies. Negative skewness across all assets points to a higher likelihood of adverse returns, a common feature of financial time series under stress. However, since the subsequent analysis relies primarily on risk measures - variances and covariances - distributional aspects such as skewness and kurtosis are not decisive for portfolio construction.

The correlation analysis reveals distinct patterns between equities and gold, underscoring the latter's role as a safe-haven asset. The NASDAQ-100 and the financial sector ETF (XLF) generally display negative correlation with gold during turbulent periods, as investors reallocate capital to precious metals amid uncertainty. In contrast, the energy sector ETF (XLE) often exhibits positive correlation with gold, particularly in times of energy crises, when higher oil and gas prices boost sector revenues while inflationary pressures simultaneously support gold demand. These dynamics reflect a broader influence of macroeconomic conditions, monetary policy, and geopolitical events. As a result, combining gold with equity indices or sectoral ETFs can help mitigate portfolio volatility, with this stabilizing effect most evident during the COVID-19 pandemic and the war in Ukraine.

Descriptive statistics of the constructed portfolios (Table 3) provide insights into the effectiveness of the hedging strategy in reducing risk and preserving investment value over the observed period.

Table 3: Descriptive Statistics of the Constructed Portfolios

	Average return	SD	Variance without gold	Variance with gold
NASDAQ-100_gold	-0.016185	0.689517	0.516853	0.475433
XLE_gold	0.004394	0.969515	1.002393	0.939959
XLF_gold	0.011202	0.242027	0.525375	0.058577

Source: Author's calculation based on data from the Stooq platform

The constructed portfolios show relatively low average returns, with the NASDAQ-100_gold portfolio recording a negative mean return (-0.016), reflecting the sensitivity of the technology sector to unstable market conditions, interest rate shifts, and global economic shocks. In contrast, portfolios including XLE and XLF yield moderately positive returns, suggesting greater stability. Standard deviations and variances reveal notable differences in risk: XLE_gold displays the highest volatility (0.969), while XLF_gold shows the lowest (0.242), highlighting the strong hedging effect. Comparing variances with and without gold clearly

illustrates its risk-reducing role; XLF_gold drops from 0.525 to 0.058. Similar, though more moderate, effects appear for XLE_gold and NASDAQ-100_gold. Overall, the evidence indicates that gold significantly reduces portfolio risk in turbulent markets, providing a sound basis for further evaluation using Sharpe ratio, HEI, and GARCH models.

4.2 Minimum-variance portfolio structure

The results of the minimum-variance portfolio analysis (Table 4) show that portfolios including NASDAQ-100 allocate about 43% to the index and roughly 56% to gold, reflecting moderate risk exposure supported by hedging. In the case of XLE, the split is nearly even, with around 49% in the ETF and 51% in precious metals, suggesting a well-balanced structure that enhances diversification. The XLF portfolio shows a similar pattern to NASDAQ-100, with about 42% in the ETF and the remainder in gold. Prior research (Chemkha et al., 2021) indicates that an optimal risk-minimizing mix typically assigns close to 60% to gold, which aligns with these results.

Table 4: Structure of the Observed Portfolios

Structure	NASDAQ-100_gold	XLE_gold	XLF_gold
Primary instrument	42.50	48.95	42.16
Gold	57.50	51.05	57.84
Total	100	100	100

Source: Author’s calculation based on data from the Stooq platform

Emphasizing the role of gold in risk reduction, the results from the minimum variance portfolio analysis indicate that gold substantially lowers the overall portfolio risk. This aligns with the findings of Pruchnicka-Grabias (2020), who noted that gold can help reduce portfolio risk even during periods of price declines. The evidence supports the conclusion that including gold as a hedging instrument enhances portfolio stability and resilience under volatile market conditions.

4.3 Sharpe ratio and HEI analysis

Analysis of the Sharpe ratio (Table 5) reveals notable differences between individual assets and portfolios combining them with gold. The standalone NASDAQ-100 index records a modest positive Sharpe ratio of 0.0409, indicating returns slightly above the risk-free rate. However, when combined with gold, the portfolio shows a negative Sharpe ratio of -0.0340, suggesting that gold did not improve risk-adjusted performance in this case. This outcome may reflect the high volatility and strong average returns of the technology sector during the period, which limited the hedging effect of gold. For the XLE energy sector, the standalone Sharpe ratio is very low at 0.0138, and combining it with gold further reduces it to 0.0047, indicating minimal improvement in risk-return efficiency. This can be attributed to energy sector exposure to price swings, geopolitical tensions, and the global energy crisis, which increased correlations with gold. In contrast, the XLF financial sector shows a standalone Sharpe ratio of 0.0314, while its combination with gold rises dramatically to 0.1912. This indicates that gold significantly enhanced portfolio efficiency, acting as a stabilizer during crises marked by inflationary pressures, monetary tightening, and geopolitical shocks. Overall, these findings highlight that the effectiveness of gold as a hedge depends on the asset class and market conditions.

Table 5: Sharpe ratio

	Sharpe ratio – primary instrument	Sharpe ratio – portfolio
NASDAQ-100_gold	0.04093	-0.0340
XLE_gold	0.0138	0.0047
XLF_gold	0.0314	0.1912

Source: Author’s calculation based on data from the Stooq platform

The HEI index results indicate strong hedging efficiency for portfolios with gold. NASDAQ-100 combined with gold shows an HEI of 80.13%, XLE portfolios reach 62.28%, and XLF portfolios record the highest value at 88.85% (Table 6). These findings confirm that gold effectively reduces risk and stabilizes returns, especially in stable market conditions. This aligns with previous research, such as Akhtaruzzaman et al. (2021), which

found gold to be a more efficient hedge than Bitcoin before the COVID-19 pandemic. While gold maintains its role as a traditional safe haven, alternative instruments like cryptocurrencies can provide additional protection during extreme market shocks.

Table 6: HEI index

Portfolio	NASDAQ-100_gold	XLE_gold	XLF_gold
HEI Index	80,13%	62,28%	88,85%

Source: Author’s calculation based on data from the Stooq platform

4.4 GARCH 1,1 - Volatility analysis and rolling correlations

The GARCH (1,1) results indicate that volatility across all analyzed instruments and portfolios was highly persistent (Table 7). The α values (0.0628–0.2034) reflect a strong impact of new market shocks, while β values (0.7470–0.9031) confirm that past volatility strongly influences future returns. The sum $\alpha + \beta$ is very close to one for all series (0.9423–0.9935), showing that shocks have long-lasting effects, particularly in the XLE_gold portfolio. High z-statistics and very low p-values confirm the statistical reliability of the results. These findings align with previous GARCH studies on gold and government bonds (Joy, 2011), demonstrating that high $\alpha + \beta$ series retain shock memory and effectively capture risk dynamics. Differences in persistence across portfolios support Charfeddine et al. (2020), showing that combinations of precious metals and financial instruments respond differently to crises. Overall, the analysis confirms that sectoral ETFs combined with gold can reduce risk and mitigate volatility effects, providing valuable guidance for portfolio management and hedging strategies under turbulent market conditions.

Table 7: Estimated Parameters of the GARCH(1,1) Model

Instrument /portfolio	ω (C)	α (ARCH)	β (GARCH)	$\alpha + \beta$	z-stat α	p-value $\alpha < 0.5$	z-stat β	p-value $\beta < 0.05$
NASDAQ-100	0.0113	0.1180	0.8617	0.9797	7.7956	<0.003	49.03	<0.000
XLE	0.0129	0.0919	0.8981	0.9900	14.6716	<0.000	95.22	<0.001
XLF	0.0226	0.2034	0.7470	0.9504	7.7232	<0.000	23.76	<0.000
NASDAQ-100_gold	0.0096	0.1046	0.8759	0.9805	8.1995	<0.000	56.72	<0.000
XLE_gold	0.0099	0.0904	0.9031	0.9935	15.5820	<0.000	107.6	<0.000
XLF_gold	0.0021	0.0628	0.9016	0.9644	13.1051	<0.000	116.2	<0.000

Source: Author’s calculation based on data from the Stooq platform

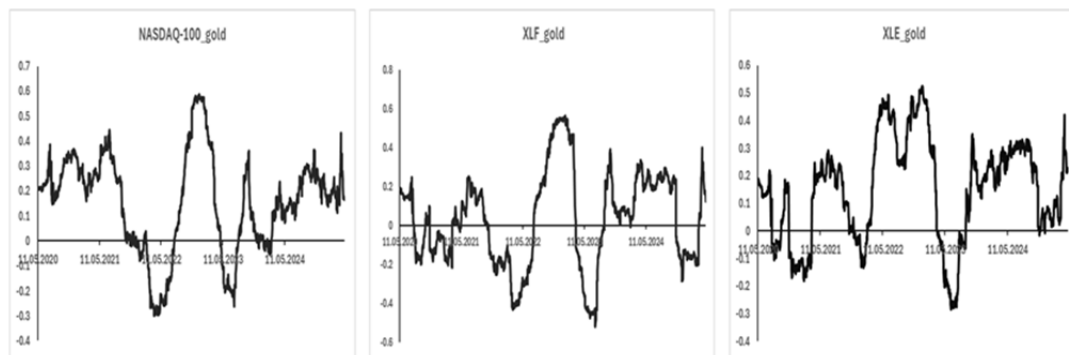


Figure 1: Rolling correlation for three portfolios.

Source: Author’s calculation based on data from the Stooq platform

Figure 1 presents the 90-day rolling correlation, offering a dynamic view of the relationships between primary instruments and hedging components over the observed period. While the GARCH model highlights volatility, the rolling correlation illustrates how the degree of co-movement between assets and gold changes across different market phases. Correlations ranged from -0.3 to +0.6, reflecting periods of stronger positive linkage as well as weaker connections. During market stress, correlations with gold tended to rise, indicating

shared exposure to shocks, whereas in more stable periods, correlations declined, underscoring the role of gold in risk reduction and portfolio diversification. GARCH and rolling correlations provide a comprehensive perspective on both volatility and interdependencies, supporting conclusions on the effectiveness of hedging strategies in turbulent markets.

Conclusion

The analysis confirms that gold plays a significant role as a hedging instrument, effectively reducing portfolio risk, particularly for XLF and, to a lesser extent, NASDAQ-100 and XLE, thereby supporting both hypotheses H1 and H2. The results indicate that gold consistently exhibits low volatility and negative correlations with equities during periods of market stress, enhancing portfolio stability and risk-adjusted performance, as reflected in HEI and Sharpe ratio metrics. This study contributes to the literature by providing empirical evidence on the hedging effectiveness of gold across sectoral and broad-market portfolios during turbulent periods, including the COVID-19 pandemic, the war in Ukraine, and energy market disruptions. However, limitations include the reliance on historical daily closing prices, potential structural breaks, and the focus on only three instruments, which may affect generalizability. Future research could expand the analysis to additional sectors, incorporate alternative hedging assets such as silver or cryptocurrencies, and explore multi-factor models or high-frequency data to capture a more granular risk dynamics and better inform portfolio management strategies.

Acknowledgement

The authors acknowledge the use of Grammarly Premium and ChatGPT 5.2 to improve English in this manuscript. The AI tools were used to assist with language enhancement but were not involved in developing the scientific content. The authors take full responsibility for the originality, validity, and integrity of the manuscript.

REFERENCES

- [1] Akhtaruzzaman, M., Boubaker, S., Lucey, B. & Sensoy, A. (2021). Is gold a hedge or a safe-haven asset in the COVID-19 crisis?, *Economic Modelling*, 102, 105588, DOI: 10.1016/j.econmod.2021.105588
- [2] Balaban, S., Milic, M. & Milosevic, M. (2025). Short- and long-run exchange rate volatility and FDI: A dynamic panel study of transition economies, *Acta Oeconomica*, 75(1), 1-18. DOI: 10.1556/032.2025.00001
- [3] Baur, D. & Smales, A. (2020). Hedging geopolitical risk with precious metals, *Journal of Banking and Finance*, 105823. DOI: 10.1016/j.jbankfin.2020.105823
- [4] Baur, D. G., & Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, 45(2), 217-229.
- [5] Beckmann, J., Berger, T. & Czudaj, R. (2015). Does gold act as a hedge or a safe haven for stocks? A smooth transition approach, *Economic Modelling*, 48, 16-24. DOI: 10.1016/j.econmod.2014.10.044
- [6] Bouri, E., Shahzad, S. J. H., Roubaud, D., Kristoufek, L. & Lucey, B. (2020). Bitcoin, gold, and commodities as safe havens for stocks: new insight through wavelet analysis, *The Quarterly Review of Economics and Finance*, 77, 156-164. DOI: 10.1016/j.qref.2020.03.004
- [7] Brandt, M. W. (2010). Portfolio choice problems. In Y. Aït-Sahalia & L. P. Hansen (Eds.), *Handbook of financial econometrics: Tools and techniques* (Vol. 1, pp. 269–336). Elsevier. DOI: 10.1016/B978-0-444-50897-3.50008-0
- [8] Cascon, A., & Shadwick, W. F. (2006). The SC character and limitations of the Sharpe ratio. *The Journal of Investment Consulting*, 8(1), 36-52.
- [9] Charfeddine, L., Benlagha, N., & Maouchi, Y. (2020). Investigating the dynamic relationship between cryptocurrencies and conventional assets: Implications for financial investors. *Economic Modelling*, 85, 198–217. DOI: 10.1016/j.econmod.2019.05.016
- [10] Chen, J. (2020). Can gold hedge stock market and inflation simultaneously, *International Journal of Economic and Finance*, 12(4), 1-10. DOI: 10.5539/ijef.v12n4p1
- [11] Chemkha, R., BenSaida, A., Ghorbel, A., & Tayachi, T. (2021). Hedge and safe haven properties during COVID-19: Evidence from Bitcoin and gold. *The Quarterly Review of Economics and Finance*, 82, 71–85. DOI: 10.1016/j.qref.2021.07.006
- [12] Chkili, W. (2016). Dynamic correlations and hedging effectiveness between gold and stock markets: evidence for BRICS countries. *Research in International Business and Finance*, 38, 22–34. DOI: 10.1016/j.ribaf.2016.03.005
- [13] Dar, A. B., & Maitra, D. (2017). Is gold a weak or strong hedge and safe haven against stocks? Robust evidences from three major gold-consuming countries. *Applied Economics*, 49(53), 5491–5503. DOI: 10.1080/00036846.2017.1310998

- [14] Dee, J., Li, L. & Zheng, Z. (2013). Is gold a hedge or safe haven? Evidence from inflation and stock market, *International Journal of Development and Sustainability*, 2(1), 12-27.
- [15] Dias, R., Galvao, R. & Alexandre, P. (2024). Precious metals as hedging assets: Evidence from MENA countries, *Investment Management and Financial Innovations*, 21(1) [http://dx.doi.org/10.21511/imfi.21\(1\).2024.13](http://dx.doi.org/10.21511/imfi.21(1).2024.13)
- [16] Ghazali, M. F., Lean, H. H. & Bahari, Z. (2013). Is gold a hedge or a safe haven? An empirical evidence of gold and stocks in Malaysia. *International Journal of Business and Society*, 14(3), 428–443.
- [17] Gomes, M., Ngoc, T., Le, M. & Williams, B. (2023). Gold in a portfolio: Why, when, and where? *Journal of Investing*, 32 (2), 108-119. DOI: 10.3905/joi.2022.1.246
- [18] Hassan, K. M., Hasan, B. & Rashid, M. (2021). Using precious metals to hedge cryptocurrency policy and price uncertainty, *Economics Letters*, 206, 109977. DOI: 10.1016/j.econlet.2021.109977
- [19] He, Z., O'Connor, F. & Thijssen, J. (2018). Is gold a Sometime Safe Haven or an Always Hedge for Equity Investors? A Markov-Switching CAPM Approach for US and UK Stock Indices. *International Review of Financial Analysis*, 30-37. DOI: 10.1016/j.irfa.2018.08.010
- [20] Joy, M. (2011). Gold and the US dollar: Hedge or haven? *Financial Research Letters*, 8 (3), 120-131. DOI: 10.1016/j.frl.2011.01.001
- [21] Kavussanos, M. G., & Visvikis, I. (2008). Hedging effectiveness of the Athens stock index futures contracts. *The European Journal of Finance*, 14(3), 243–259. DOI: 10.1080/13518470801890701
- [22] Kroner, K. F., & Ng, V. K. (1998). Modeling asymmetric comovements of asset returns. *The Review of Financial Studies*, 11(4), 817-844.
- [23] Manuj, H. (2021). Is Gold a Hedge against Stock Price Risk in U.S. or Indian Markets? *Risks*, 9(10), 174. DOI: 10.3390/risks9100174
- [24] Ming, L., Zhang, X., Liu, Q., & Yang, S. (2020). A revisit to the hedge and safe haven properties of gold: New evidence from China. *Journal of Futures Markets*, 40(10), 1442–1456. DOI: 10.1002/fut.22124
- [25] Palic, P. (2025). Spillover of volatility on the financial markets; M-GARCH insight from pre- and post-crisis periods in EU countries, *Economy and Market Communication Review*, 25(1), 8-30. DOI: 10.7251/EMC2501008P
- [26] Pruchnicka-Grabias, I. (2020). Equity Portfolio Optimization With Gold. *Problemy Zarządzania*, 18(4), 62-77. DOI: 10.7172/1644-9584.90.4
- [27] Shakil, H. M., Mustapha, I. M., Tasnia, M. & Saiti, B. (2018). Is gold a hedge or a safe haven? An application of ARDL approach, *Journal of Economics, Finance and Administrative Science*, 23(44), 60-76. DOI: 10.1108/JEFAS-03-2017-0052
- [28] Shrydeh, N., Shahateet, M., Mohammad, S., & Sumadi, M. (2019). The hedging effectiveness of gold against US stocks in a post-financial crisis era. *Cogent Economics & Finance*, 7(1). DOI: 10.1080/23322039.2019.1698268
- [29] Smirnova, E. (2016). Use of gold in financial risk hedge, *Quarterly Journal of Finance and Accounting*, 54(1/2), 69-91.
- [30] Zhang, F., Ma, Y., Liu, X. & Zhou, X. (2025). Revisiting the hedging and safe haven roles of gold: Evidence from quantile-on-quantile approach, *The Noerth American Journal of Economics and Finance*, 102516. DOI: 10.1016/j.najef.2025.102516
- [31] Zivot, E., & Wang, J. (2003). Rolling Analysis of Time Series. In: *Modeling Financial Time Series with S-Plus®*. Springer, New York, NY. DOI: 10.1007/978-0-387-21763-5_9
- [32] Zivkov, D., Kuzman, B. & Japundzic, M. (2025). Using metals to hedge carbon emission allowances – Tail-risk and Omega ratio analysis, *Resource Policy*, 100, 105447. DOI: 10.1016/j.resourpol.2024.105447

Received: 2025-10-05

Revision requested: /

Revised: /

Accepted: 2026-03-26

/// About the Authors

Ivana Putić

PhD student, Alfa BK University, Belgrade, Serbia
Teaching Assistant, Novi Sad School of Business, Novi Sad, Serbia
putic.ivana@gmail.com



Ivana Putić graduated from the Novi Sad School of Business with a bachelor's degree in Finance and Banking, where she also completed her master's studies in Finance, specializing in International Business and Finance. In addition, she earned a bachelor's degree from the Alfa BK University, Faculty of Finance, Banking and Auditing, in the Trade and Marketing module, where she also completed her master's academic studies in Trade. She is currently pursuing her doctoral studies at the Alfa BK University, within the Economics and Business study programme. She works as a Teaching Assistant at the Novi Sad School of Business. Her research and professional interests include financial management, capital markets, risk management, hedging strategies, and accounting. She also actively contributes to the improvement of higher education quality through her role as a student reviewer for the National Entity for Accreditation and Quality Assurance in Serbia.

Suzana Balaban

Alfa BK University, Belgrade, Serbia
suzana.balaban83@gmail.com



Suzana Balaban is an Associate Professor at the Alfa BK University in Belgrade, where she currently serves as the Acting Vice-Rector for Research. In 2024, she was elected Research Associate upon the nomination of the Institute of Economic Sciences in Belgrade. She completed her undergraduate, master's, and doctoral studies at the Faculty of Economics in Subotica, University of Novi Sad. Balaban has authored more than 30 scholarly papers and two textbooks. Beyond her publications, she actively contributes to the academic community as a reviewer for several international journals and serves as a permanent reviewer for *Međunarodna politika* (International Politics). She is a member of the editorial boards of *Management in Sport*, *Ecologica*, and *Glasnik za društvene nauke* (Journal of Social Sciences), and participates in the scientific committees of several international conferences. Her professional engagement extends to national and regional quality assurance in higher education, serving as a reviewer for the National Entity for Accreditation and Quality Assurance in Serbia and as an expert for the Agency for Control and Quality Assurance of Higher Education in Montenegro. With a strong focus on finance and accounting, Balaban combines her research, teaching, and service activities to advance both academic knowledge and practical applications in her fields of expertise.

Dražen Jovanović

Alfa BK University, Belgrade, Serbia
drazen.jovanovic@alfa.edu.rs



Dražen Jovanović is an Associate Professor at Alfa BK University in Belgrade. He completed his undergraduate, master's, and doctoral studies at the Technical Faculty "Mihajlo Pupin" in Zrenjanin, University of Novi Sad. His main areas of interest include management, strategic management, human resource management, business decision-making, product and service development, multi-criteria analysis, reengineering, quality management, organizational culture, entrepreneurship, change management, and engineering and innovation. In his work, Jovanović has focused on a quantitative approach to practical problems in management and industrial engineering, applying statistical methods to analyze conditions and challenges across various management and industrial management domains. He has published more than fifty papers in these fields.