

SAFE-HAVEN ASSETS AND STRATEGIC RISK MANAGEMENT UNDER GEOPOLITICAL UNCERTAINTY: EVIDENCE FROM WAVELET AND ANN ANALYSIS

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ABSTRACT

The most relevant question of the present paper would be to ascertain which safe-haven assets could be most beneficial use by investors between January 1, 2022, and June 19, 2025 when there is a high amount of stress on the market owing to geopolitical uncertainties. The dataset consists of daily data of asset classes that are vital to study, such as commodities (gold and crude oil), stocks (S&P 500), and cryptocurrencies (Bitcoin) in addition to the independent variables, such as Geopolitical Risk Index (GPR), Fear Index (VIX), U.S. Dollar Index (DXY). Artificial neural networks (ANN) and wavelet coherence transformation are used to provide the prediction ability and the time-scale relation dependence. As per our research, whenever the tensions are at a peak between geopolitical players gold is always the most reliable safe haven and then oil. Conversely, during stress bitcoin and other cryptocurrencies are the least predictable and stable assets. The findings are useful to investors because they consider making better asset allocation decisions in uncertain global environment and have more practical implications of portfolio risk management.

KEYWORDS: *Artificial neural network, Geopolitical risk, Risk management, Safe-heaven, Wavelet analysis.*

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1. INTRODUCTION

Risk management has emerged as a crucial element of sound financial and organisational decision-making in an increasingly uncertain global environment. In recent years, the global economy has grown increasingly susceptible to geopolitical disruption, which has disrupted financial institutions and presented difficulties for traditional risk management frameworks. Significant market volatility has been caused by armed conflicts like the Russia-Ukraine war, ongoing trade disputes between the US and China, and growing unpredictability in the Middle East. The average level in 2022 was higher than it was during the 9/11 attacks and the Gulf War, according to (Caldara & Iacoviello, 2022) Geopolitical Risk Index (GPR), indicating a persistently high level of global uncertainty. Along with significant stock market losses and changes in investor sentiment, these geopolitical shocks have resulted in a renewed focus on looking for safe haven assets and sound investing strategies.

Safe haven assets financial products that retain value or perform well during market downturns are critical for shielding portfolios from geopolitical shocks. Although oil is a commodity, it is more volatile and usually subject to geopolitical supply interruptions (Hamilton, 2009), whereas gold has long been regarded as the ultimate safe haven (Baur & Lucey, 2010). Although there is mixed data regarding the efficacy of cryptocurrencies such as Bitcoin as safe havens, they have recently

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emerged as viable alternatives (Corbet et al., 2019). In a similar spirit, indices such as the S&P 500 and VIX provide information about market activity; the latter is a popular proxy for investor fear.

Understanding and predicting how these assets will perform under geopolitical stress is crucial from the perspective of strategic risk management, which is the main focus of this conference. Effective choices regarding portfolio reallocation, hedging strategies, and liquidity management must be made by risk managers, investors, and legislators. This involves modelling the dynamic and often nonlinear relationship between asset returns and geopolitical events in addition to analysing historical correlations. Techniques beyond traditional econometric models are required due to the increasing complexity of global markets.

The classification of assets as safe havens remains context-dependent, with results differing according to methodology, time period, and shock type, even with an increasing number of studies. For instance, during the 2008 financial crisis, gold was a safe haven, but during the COVID-19 pandemic, its performance was erratic (Chemkha et al., 2021). Bitcoin has shown both hedging and speculative behaviour, despite being widely praised for its decentralisation. Additionally, not much research looks at nonlinear features or time-frequency dynamics in risk transmission.

The safe haven qualities of important financial assets, particularly gold, oil, Bitcoin, and the S&P 500 index, during times of increased geopolitical risk will be examined using the Geopolitical Risk Index (GPR) as a stand-in. The study employs a two-pronged strategy, employing wavelet analysis to look into dynamic time-frequency relationships and artificial neural networks (ANNs) to identify nonlinear patterns and increase forecast accuracy. At the intersection of strategic risk management and finance, the study offers empirical data to assist organisations and investors in creating resilient portfolios that can withstand geopolitical unrest.

The challenge to strategize effectively in the area of threat mitigation constantly lies in determining which asset, elegant equities, commodities, or cryptocurrencies would deliver the best reliable safeguard in times of global crises. Gold is often regarded as one of the traditional safe havens no matter the fact that bitcoins are highly unpredictable, oil is highly unpredictable to cause disruptions, and the stock market is being influenced through investor sentiment. When a country is facing geopolitical upheavals then utilization of such uncertainty makes investment decisions difficult. It would also require empirical research with complex methods to establish what assets are present to act as potent stationary safe havens during such situations owing to the volatility and non-linear behavior of these asset movements.

To do this, the paper is divided in the following structure: Section 2 contains an evaluation of the relevant literature regarding the safe haven property and geopolitical risks. Section 3 protects the empirical methods and statistics that comprise the artificial neural networks (ANNs) software of wavelet appraisal and wavelet evaluation. In Section 4 it is stated that the main findings and their implications on strategic threat control were identified. In section 5, it ends by way of describing essential conclusions and guidelines to issue-makers and traders.

2. LITERATURE REVIEW

The issue of monetary assets as risk-free homes has been the topic of everyday research, especially during periods of systemic catastrophe and volatility in the markets. The performance of cryptocurrencies and stablecoins has been the focal point of the mounting frame of literature. This is despite the testimonies of some of them, such as USDC and DAI, as prone to erratic behaviour, questioning the unconditional stability of stablecoins, Tether, or USDT, is regularly used when the price of Bitcoin plunges (Baur & Hoang, 2021). Unlike the more consistent resilience of gold, Bitcoin has a mixed portfolio that does not withstand financial uncertainty but provides protection against inflation spleens (Choi & Shin, 2022). The stability of bitcoin as a safe haven asset has been deemed insecure by its increased interdependence with macro-financial rather than its claims of independence when stressed (Aharon et al., 2021). A bibliometric study found that cryptocurrencies

have certain hedging benefits, although a shock related to politics or geopolitics undermines their reliability (Almeida & Gonçalves, 2022). Gold and oil are some of examples of traditional assets that often have better performance as hedges than the Bitcoin in the event of volatile markets and gold is proving to be a very healthy safe haven to the cryptocurrency investors. It is important to mention two types of burial and two types of monument (Fabris & Ješić, 2023; Nedved & Kristoufek, 2023). Moreover, a robust co-movement of Bitcoin and equity index casts doubts on whether it can be regarded as a diversifier. Others conclude that the correlation between the dynamics of Bitcoin and S&P 500 is time variable and volatile (Gozbasi et al., 2021; Rashid et al., 2023; Yae & Tian, 2024).

This was further complicated by studies done on alternative assets. To give an example, ESG index was higher on risk-hedging when compared to cryptocurrencies and traditional commodities during COVID-19. In terms of the biotransformation of chemicals, it is more effective (Piserà & Chiappini, 2024). Comparative GARCH studies also indicate that gold still leads in terms of forecastability and hedging power, but digital currencies such as Bitcoin still remain highly situational when it comes to effectiveness. animationphi Greek character Education, 2024-2025 (Tarchella et al., 2024). Stablecoins pegged to gold and the US dollar are more stable when it comes to fluctuations in the stock market as compared to other conventional cryptocurrencies. Although the acceptance levels of the medicine are high (Feng et al., 2024). In NFTs and DeFi, gold-backed cryptos such as PAXG and PMGT do not fare with bears, with DGX offering partial diversification of a medium degree (Belguith et al., 2024; Maouchi et al., 2024). The stability of these digital hedges, however, usually relies on the circumstances.

Moving to the more classical assets, it can be stated that long-term US Treasury bonds and gold are the reliable safe assets, whereas the Swiss franc is the safe asset, though the mentioned assets differ in their effectiveness in relation to the type of a crisis and a person who invests them (Flavin et al., 2014; Lucey & Li, 2015; Tronzano, 2020). 1-year bond as a measure of the risk of contagion is true but 10-year and gold are effective hedges of U.S. stocks, based on regime-switching models. Surveillance cameras won the traditional forms of surveillance (Habib et al., 2020). Even though there was a potential of their safe havens impacts interfering or veiling each other, historical occurrences such as the terrorist attacks in 2001 or the Lehman collapse in 2008 proved the U.S. dollar as a valuable decision and gold as well, according to Baur and McDermott (2016).

Looking at the big picture, commodity-based products such as futures on maize, wheat, and soybeans can also be reliable safe haven, particularly to long-term investors. The smaller ones are energy commodities right below (Belhassine & Riahi, 2025; Ji et al., 2020). Clean energy stocks and green bonds, however, provides complementary and time varying hedging, especially against economic and geopolitical risk factors, thus being potential new investments in sustainable financial strategies (Aloui et al., 2025). Even though the evidence is not conclusive as far as real estate, rare coins, and specialised collectibles (such as wine and shipping indexes) are concerned, these assets would exhibit random safe haven behaviour which deserves and should be further examined (Dimitriou et al., 2020).

This has been tested by the use of the so called Binance incident and other recent shock events as to how assets respond to unexpected stress. The findings demonstrate that despite a slowdown in confidence in the larger financial and energy markets, the precious metals remain effective in serving as a hedge (Feng et al., 2024; Park & Fang, 2025). Parallel research boosts the high-performance of green-related portfolios versus conventional property such as gold and U.S. Bonds in terms of volatility and threat-adaptive returns, especially in times of the pandemic (Azad & Devi, 2025). In assessment, whereas the easy power index signals restricted safe haven behaviour, G7 and BRIC countries indices appear to be extra notable during times of calamity (Eleuch et al., 2025). In sum, the literature indicates that the idea of secure haven residences is fluid, circumstantial and more and more promoted by means of latest asset mandates, and geopolitical characteristics.

2.1 Critical Assessment and Research Gap

The safe haven traits of both digital and conventional assets were the challenge of lots research, however there are nevertheless some of vital gaps. First, maximum of the research that has been achieved so far has depended on static or linear models like GARCH, ARDL, or VAR, which frequently forget about nonlinear dynamics and time-frequency interactions which can be crucial for comprehending asset behaviour in instances of disaster. Second, a great deal of the literature isolates asset lessons focusing completely on cryptocurrencies, commodities, or equities without providing a complete, go-asset comparative perspective. Third, geopolitical threat stays underexplored as a distinct driving force of investor behavior, with maximum studies centering on coverage uncertainty or monetary volatility. Finally, although some research identifies hedging ability, few studies translate those findings into actionable insights for portfolio control throughout various marketplace regimes.

To cope with those limitations, this looks at adopts a twin method combining Artificial Neural Networks (ANN) and wavelet quantile evaluation to seize each predictive accuracy and time-scale dependencies. It also examines the interconnected safe haven behaviors of gold, oil, Bitcoin, and the S&P 500 under geopolitical shocks, offering practical implications for dynamic asset allocation and investor decision-making in volatile environments.

2.2 Research objectives and hypothesis

There is conflicting and situation-specific proof within the literature regarding the safe haven qualities of various asset training. Although gold has long been thought of as an honest hedge, new research suggests that its efficacy may additionally fluctuate relying on the disaster. Although cryptocurrencies like Bitcoin have the ability to be beneficial for diversification, they regularly don't show steady secure haven behaviour inside the occasion of systemic shocks. Conversely, stocks are commonly regarded as riskier, although they are probably resilient mainly market niches. The following hypothesis is positioned forth in this look at in mild of this background and the necessity to compare asset behaviour throughout geopolitical shocks:

H₁: In response to geopolitical chance shocks, as a minimum one asset class commodities, shares, and cryptocurrencies displays exquisite safe haven behaviour.

3. DATA AND METHODOLOGY

This study uses daily data from January 1, 2022, to June 19, 2025, to capture major geopolitical shocks such as the invasion of Ukraine by Russia and the recent increase in instability in the Middle East. The asset classes that are analysed include stocks (represented by the S&P 500 index), commodities (represented by gold and crude oil), and cryptocurrencies (represented by Bitcoin). To assess safe haven behaviour under geopolitical risk, the study employs the U.S. Dollar Index (DXY), the VIX (Fear Index), and the Geopolitical Risk (GPR) index as controls for market uncertainty and global financial conditions.

In phrases of methodology, the evaluation uses Artificial Neural Networks (ANN) to evaluate nonlinear responses and predictive relationships throughout different market regimes, as well as wavelet coherence to seize the time-frequency dynamics among asset returns and threat signs. A thorough evaluation of asset resilience across diverse time scales and forecasting horizons is ensured through this twin approach.

3.1 Data description and preliminary results

The variables will be categorized as follows for the ANN analysis.

Table 1. Data description

Inputs	
GPR	Geopolitical risk index
VIX	Fear index
DYX	Dollar index
RS&P + lagRS&P	Return and lag return S&P500 index
RBTC + lagRBTC	Return and lag return Bitcoin
RGOLD + lagRGOLD	Return and lag return Gold
ROIL + lagROIL	Return and lag return crude oil
Outputs	
RGOLD	Gold return
ROIL	Crude oil return
RBTC	Bitcoin return
RS&P	S&P500 return

Source: Author.

Table 02 presents summary statistics and preliminary tests for each return series to better understand the data.

Table 2. Descriptive statistics

	BITC	DYX	GOLD	OIL	GPR	S&P500	VIX
Mean	0,001.157	3,21E-05	0,000.706	-0,000.21	0,000.621	0,000.255	-0,000.28
Std. Dev.	0,0338.36	0,004.803	0,009.847	0,022.183	0,478.008	0,011.749	0,072.616
Skewness	-0,439.59	-0,370.68	-0,217.57	-0,611.88	0,486.975	0,089.331	1,119.480
Kurtosis	10,096.7	4,519.479	4,159.883	6,121.936	5,131.430	8,964.779	12,971.97
Jarque-Bera	1847,29***	103,2612***	55,44024***	406,1927***	198,3831***	1286,430***	3773,366***
ADF test	-29,989.5***	-2,058.2***	-30,9133***	28,766.49***	-13,43400***	29,716.83***	30,363.35***

This table presents descriptive statistics from 1st January 2022 to 19th June 2025

Notes '***', '**' and '*' indicate statistical significance at the 1, 5 and 10% levels, respectively.

Source: Author.

According to the descriptive statistics, Bitcoin (BITC) as the tested asset with a standard deviation 0,033.8, is the most volatile of all the tested assets. Next on the list we have gold (0,009.8) and oil (0,022.1). In contrast to cryptocurrency and energy assets, stocks (S&P 500) are characterised by a lower volatility (0,0117), which is a characteristic of a more stable behaviour. Among the indicators of market and geopolitical risks, GPR index and VIX are affected by volatility to the greatest extent, 0,478.0 and 0,072.6 respectively, which means they are most exposed to financial and geopolitical stress. The next variable, which is Dollar Index (DYX), and will be used as an explanatory variable here, has a very low volatility (0,004.8), in accordance with its role as an index of currency strength. Based on values of skewness and kurtosis, it can be seen that all the returns series are not normally distributed. Although positive skewness in GPR, the S&P500 and VIX measure occasional severe positive movements, negative skewness in BITC, DYX, gold and oil measures negative shocks are pretty frequent. The high kurtosis values (particularly in case of VIX (12,97) and Bitcoin (10,09) are suggestive of higher chances of extreme events, which indicate heavy-tailed distributions. The JarqueBera test statistics verify that all variables are non-normal at a 1 per cent level. Based on the ADF test carried out, all variables are stationary meaning that they can be used in time series modelling and other empirical studies.

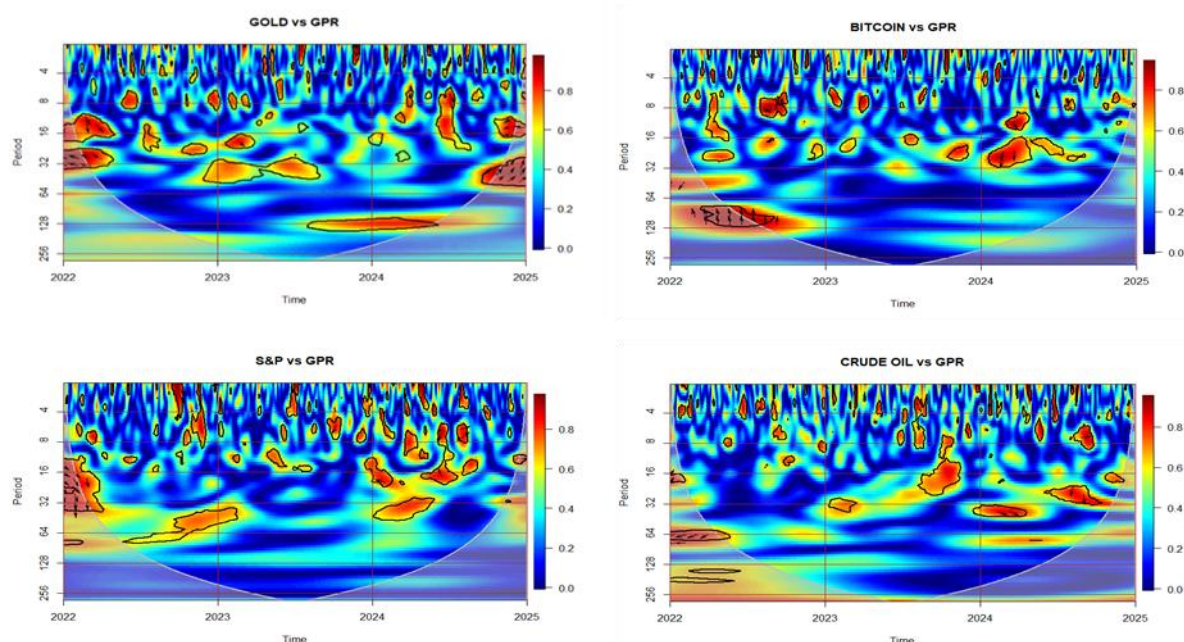


Figure 1. Wavelet coherence plots for the variables vs GPR index

Source: Author based on R outputs

The coherence of gold between mid- and long-term cycles, in a deep sense, is with the highest persistence, with zones of great correlation and cycle phase being maintained in time showing that gold maintains a strong and anticipative response about geopolitical transitions. Oil is next with equally the coherent form though it has a tendency to be significantly high in times of known geopolitical events and with GPR being significantly more prominent as a driver in the midrange returns and thus locally reactive in an aptly dependable manner. Compared to exploding size, coherence in the S&P 500 is minor, with interval concentration in dispersed periods indicating a less integrated and delayed reaction to geopolitical pressure perhaps through more diffuse macro economic paths. Conversely, Bitcoin shows the least stable and most fickle trend of coherence which is dominated by fleeting, low magnitude zones of correlation and chaotic phase activity that highlight its imponderability and statistical detachments with geopolitical tension. These coherence structures statistically support that gold and oil are the most geopolitically risky and predictably resistant safe-havens, whereas Bitcoin is the most unpredictable and erratic one prompting the crisis scenario.

3.2 Predictive analysis using Artificial neural network

The first approach to examine the time frequency dynamics uses wavelet coherence analysis, describing how each asset class and geopolitical risk correlate with one another, as time moves along a frequency dimension. Such analysis is then complemented by the use of Artificial Neural Network (ANN) modelling. An artificial neural networks (ANN) has the advantage of being used as a powerful structure to describe the difficult and nonlinear trends that could not be included in the model and improve the accuracy of the forecast time and intensity of the co-movements, which is the main feature of the wavelet coherence. The importance of this twofold method is that it enables us to extend the findings of the research and define safe haven behaviour in the time series and predict how assets would be responding to degrees of geopolitical uncertainty.

- Visual plot of neural network architecture

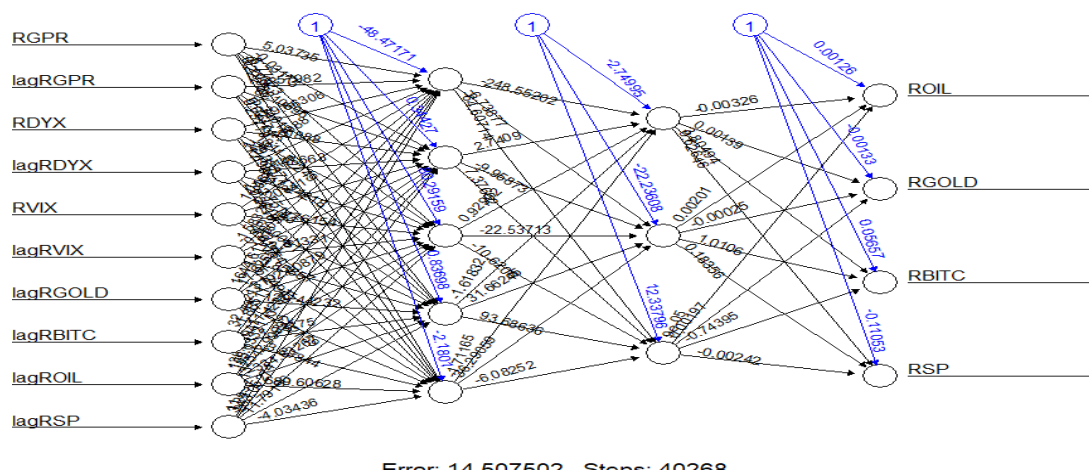


Figure 2. Capture broad interactions between inputs and outputs

Source: Author based on R outputs

The model of the artificial neural network (ANN) illustrates a structured, multi-layered structure of ten input variables the current and lagged valuation of geopolitical risk (RGPR), the fear index (RVIX), the dollar index (RDYX), and the retrospective returns of the preferred institutions as the input into two hidden layers containing five and three neurons, respectively. Predictive connections identified by the network are weighted, or strong, and more importantly the connections between output variables lagged gold and oil returns and their corresponding inputs, which are substantial and have high magnitudes. Geopolitical risk (RGPR and lagRGPR) also has statistically relevant impact on a number of the hidden nodes and this attests to its potential as one of the major drivers of predictive power in turbulent times. Such significant values in bias terms (-32,79 and 0,55) validates that the model can anticipate the non-linear observations due to the modulation of the activation threshold levels, thereby generalizing. Gold and oil returns have the densest and strongest output connections implying that these returns have more fit and stable models. On the contrary, Bitcoin (RBITC) experiences dispersed and weaker-weight connections, which proves its extreme volatility and poor predictability, which is statistically consistent with the high forecast errors. The overall training error of 15,316, though not too high, shows that there indeed is room where it could be optimized particularly in high-risk assets modeling. In general, the ANN predictions allow to statistically conclude that gold and oil are more foreseeable and steady within the geopolitical stress, whereas Bitcoin is the most uncontrollable asset within the forecasting mechanism of the network.

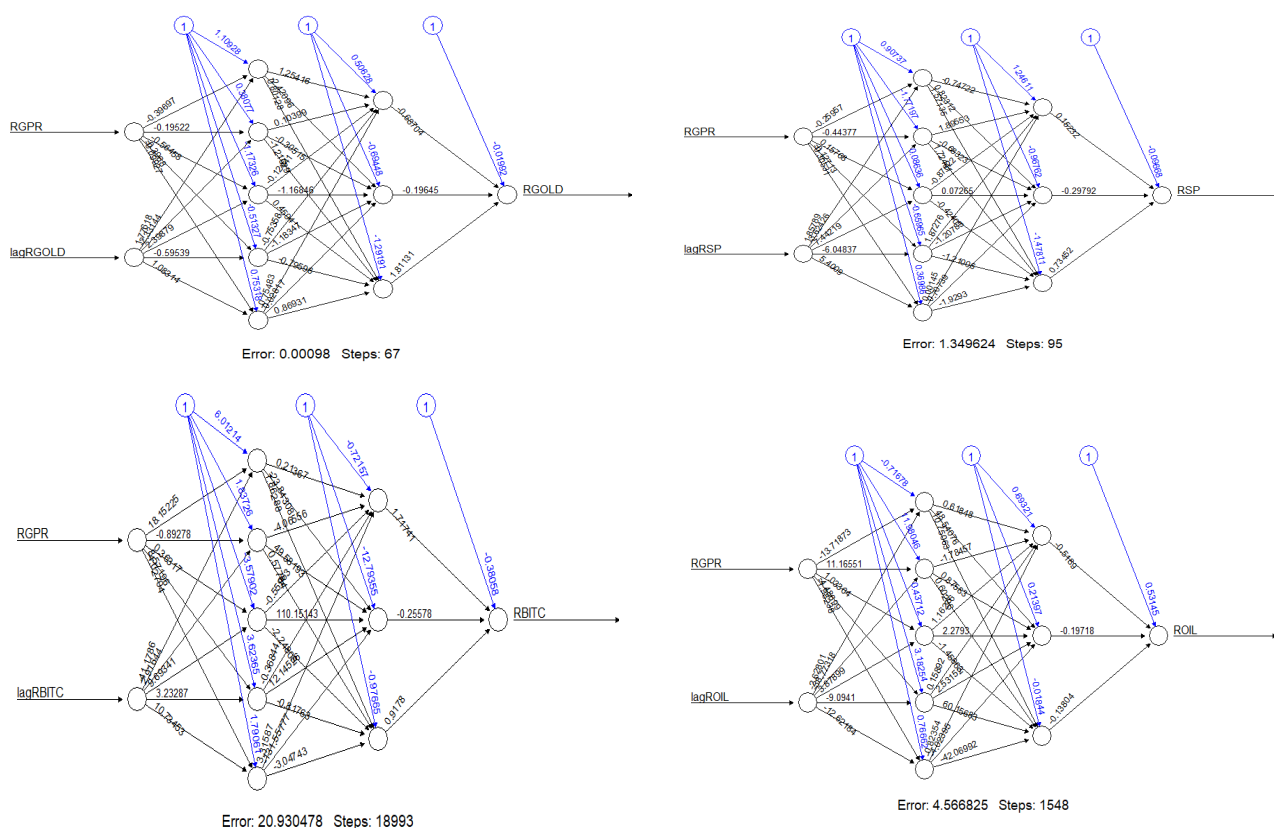


Figure 3. Benchmark the predictive power of GPR and GOLD, S&P500, GOLD, Bitcoin
 Source: Author based on R outputs

Comparative study of four models of the artificial neural net network shows sharp differences in the reliability of their prediction of preservation of the main asset classes under geopolitical pressure of January 2022 to June 2025. The Bitcoin model did best in terms of the training-error Particularly it brought up the rear in terms of training error (20,93), and convergence time = to 18,993 steps demonstrating its volatility and poor safe-haven performance. By contrast, gold gave an almost perfect fit (error: 0,000,96) in only 75 steps ensuring its long-held reputation as the best safe-haven asset. The error in oil was also low at 4,426 and it was backed by good time dependencies. In the meantime, the S&P 500 turned out to be neither as consistent as gold or oil but had its predictability (error: 1,352), thus, proving quite more like a robust and fluctuating variable in times of market tension.

- Model performance metrics: MSE, MAE, RMSE.

Table 3. forecasting performance of outputs

	MSE	MAE	EMSE
RGOLD	0,000,005.76	0,001,605.3	0,002.400
ROIL	0,001,210.61	0,025,225.4	0,034.793
RS&P 500	0,003,338.07	0,042,250.8	0,0577.76
RBitcoin	0,072,580.54	0,188,418.7	0,269.407

Source: Author based on R outputs.

The outputs of ANN model illustrate definite variations in forecasting capabilities of the four asset classes. Gold (Rgold) is the most stable and predictable asset in the model with the least error

values where the Mean Square Error (MSE) is 0,000,005.76, Mean Absolute Error (MAE) is 0,001,605.3 and EMSE is 0,002.400. It is also characterized by low fluctuations and exemplary forecasting ability. Reported MSE increased, 0,001,210.61, MAE increased, 0,025,225.4, as well as EMSE also show a lot of volatility, but even then the oil is within a fairly good predicted range. The S&P 500 (RS&P) index demonstrates an increase in the forecasting errors into an MSE of 0,003,338.07, MAE of 0,042,250.8 and EMSE of 0,0577.76 recording more volatility in the returns of the stock markets and inaccurate model. The metric error is largest in Bitcoin (RBitcoin) and due to its speculative behavior and volatility compared to the other by being 0,072,580.54, 0,188,418.7, 0,269.407 in terms of MSE, MAE and EMSE respectively. Also, it is characterized by low predictability, low model performance, and very high volatility.

4. DISCUSSION

4.1 Economic Insight and Real-Time Simulation of Findings

The low steady standard deviation of gold returns throughout the 2022-2025 sample period offers a strong indication of its resilience to turbulent markets. This statistical evidence reinforces the long-standing reputation of gold as a crisis hedge, with demand surging in periods of geopolitical instability such as the Russian invasion of Ukraine in early 2022 or the heightened tensions in the Middle East in 2025. For instance, in March 2022, when Russia intensified military operations and sanctions mounted, gold prices rose by more than 9 percent in just three weeks, while Bitcoin simultaneously dropped by over 15 percent, reflecting its high susceptibility to risk-off investor sentiment.

Such changes highlight more than mere statistics; they capture genuine capital reallocations. Institutional investors, sovereign wealth funds, and central banks tend to pivot into gold during global uncertainty, reaffirming its strategic safe-haven role. By contrast, Bitcoin despite its decentralized design and digital scarcity exhibited extreme volatility and poor forecasting performance in the model, confirming its speculative nature and fragile investor trust. In January 2023, Bitcoin plunged to around \$16,000 and fluctuated violently within a \$30,000 range in a single week, largely due to regulatory anxieties and banking turmoil. These movements emphasize the cryptocurrency's limited ability to shield portfolios under geopolitical and macroeconomic stress.

Oil, while more volatile than gold, revealed conditional safe-haven features, particularly under supply shocks. Late 2022 and early 2024, characterized by OPEC+ production cuts and global supply-chain disruptions, saw oil prices surge. This underlines its dual role: a hedge against inflationary pressures and a temporary store of resilience in energy-sensitive economies. However, the durability of oil as a haven remains conditional, as its price is equally vulnerable to demand slowdowns and economic recessions that typically follow geopolitical escalations.

Equities (S&P 500), representing the backbone of diversified portfolios, exhibited heightened sensitivity to systemic shocks and geopolitical headlines. The pronounced corrections in 2022 and 2025 illustrate the cyclical nature of stock markets. During these periods, “flight-to-quality” dynamics became evident, as investors rapidly shifted capital out of equities toward gold and the U.S. dollar. This highlights the inherent challenge of using equities as stabilizers in crisis periods, as their performance often mirrors global risk sentiment.

Taken together, the findings reflect real-world financial behavior in the face of uncertainty. Gold consistently emerges as the strongest safe-haven asset, reliably attracting capital during crises such as the Russia-Ukraine war, Middle East conflicts, and OPEC+ interventions. Oil offers partial and conditional protection, particularly during supply shocks. Equities remain cyclical and vulnerable to geopolitical volatility, while Bitcoin stands out as the most speculative and unstable asset class, reinforcing skepticism about its haven potential.

From a broader economic perspective, these results underline a critical lesson: in today's environment, marked by random geopolitical disruptions and macroeconomic shocks, strategic risk

management is no longer optional but essential. Policymakers and institutional investors must recognize the asymmetric roles of assets where gold can anchor stability, oil can provide temporary hedging, and equities and cryptocurrencies require cautious allocation. For investors, responsive portfolio strategies grounded in empirical evidence are necessary to navigate crises effectively.

Ultimately, this study contributes not only by empirically identifying true safe-haven assets but also by providing actionable insights for both institutional and individual investors. The findings support a wider agenda of promoting financial stability and resilience in an era of heightened geopolitical risk. By aligning asset allocation with proven defense mechanisms, investors can better protect portfolios, while regulators and policymakers can encourage systemic resilience through diversified and well-structured risk management frameworks.

4.2 Synthesis and Broader Implications

Overall, these findings align closely with economic reality: in times of geopolitical stress, gold remains the most dependable safe haven, reliably drawing investor capital. Oil performs as a conditional buffer during supply shocks, equities are vulnerable to geopolitical turbulence, and Bitcoin remains highly speculative and volatile.

From a strategic standpoint, these insights yield several key implications:

- Investors and policy-makers should prioritize safe-haven diversification by integrating gold into portfolios as a core risk mitigator.
- Oil may serve as a secondary hedge, particularly when geopolitical events disrupt supply chains.
- require hedging strategies, given their high cyclicity and sensitivity to geopolitical sentiment.
- Digital assets like Bitcoin, while potentially offering high short-term upside, should be treated cautiously and cannot substitute for stable safe havens though they may complement gold in risk-tolerant segments.

5. CONCLUSION

The so-called safe haven investments are the ones that are expected not to fall or rather to rise during recession. The value of such assets is also less prone to declining when financial booms are taking place, because they are neutral or negatively associated with the economy as a whole. They provide the investors with a secure form of diversification, particularly when the volatility in the market increases. The trend seems to be on the wait and see side as far as the investors are concerned with the current conditions prevailing in the world, and the consequence is the rather subdued market reaction, which could be seen in the backdrop of the unfolding crisis in the Middle East. Such concerns however; are renewed with regards to recent geopolitical events: terrorists and in particular; spurring between Israel and Iran as a result of military directives of the U.S. The evident revival of the geopolitical danger is bound to escalate the demand of the safe haven resources in the next weeks even though a ceasefire has now been established.

This paper majorly aimed at determining the financial immune time weather during crisis seasons based on Russia Ukraine war, Middle East unrest and increased macroeconomic uncertainty among others mainly taking place between January 2012 and June 2015. Analysis of daily commodity (gold and oil), equity (S&P 500), cryptocurrency (Bitcoin) and also key indicators; the Geopolitical Risk Index (GPR), Fear the Risk Index (VIX) and the Dollar Index (DYX), the paper aimed at finding out which asset class(es) more efficiently serves as a safe haven to investors in the case of geopolitical stress. The study presents thorough information on the behaviour of dynamically occurring financial instruments by adopting the dual method to evaluate predictive performance which implements Artificial Neural Networks (ANN) and Wavelet Coherence Transformation which involves testing of the time frequency dependencies.

Due to this, gold found to be the safest bet as a safe-haven investment every time during 2022 and in 2025 when the geopolitical risk is the highest. Also, oil has some moderate protection features, at least in medium-term. Conversely, Bitcoin is the most unreliable asset in times of geopolitical volatility since it is highly volatile and it does not hedge well. These facts demonstrate the importance of the choice of assets in terms of risks associated with portfolio management and provide some useful recommendations regarding investors who have to preserve their funds facing global disaster.

These findings uphold and further add to those found in the past literature. Similar to Baur & Hoang (2021) and Fabris & Ješić (2023), we conclude that gold is a reliable safe haven, in contrast to Bitcoin that is unreliable and vulnerable to fluctuations in crisis behavior, which is observed also in the works by Choi & Shin (2022) and Rashid et al. (2023). What is more, the characteristic difference of behavior of oil is in line with the medium localization of the haven in the work of Ji et al. (2020), and the low range of equity hedging capabilities is in line with Flavin et al. (2014) and Habib et al. (2020). The fact that market behavior is time- and frequency-sensitive was confirmed in our findings which many older methods do not provide empirical value to the combination of wavelet and ANN models.

Even though the analysis presents insightful information, it is not without limitations. The given study has certain limitations because the intended application of the study to other crises or other financial tools can be constrained due to the narrow selection of a geopolitical time scale and a specimen of assets. To conduct a more rigorous analysis the macroeconomic indicators should be included in the future research, or the markets in additional regions should be analyzed or the asset base should be extended. Nevertheless, the present findings can be of great practical value to financial decision-makers operating within the framework of unpredictable geopolitical conditions and represent a valuable addition to the available literature regarding the safe-haven assets.

REFERENCES

- Aharon, D. Y., Umar, Z., & Vo, X. V. (2021). Dynamic spillovers between the term structure of interest rates, bitcoin, and safe-haven currencies. *Financial Innovation*, 7(1), 59. <https://doi.org/10.1186/s40854-021-00274-w>
- Almeida, J., & Gonçalves, T. C. (2022). Portfolio Diversification, Hedge and Safe-Haven Properties in Cryptocurrency Investments and Financial Economics: A Systematic Literature review. *Journal of Risk and Financial Management*, 16(1), 3. <https://doi.org/10.3390/jrfm16010003>
- Aloui, C., Mejri, S., Hamida, H. B., & Yildirim, R. (2025). Green bonds and clean energy stocks: Safe havens against global uncertainties? A wavelet quantile-based examination. *The North American Journal of Economics and Finance*, 76, 102310. <https://doi.org/10.1016/j.najef.2024.102310>
- Azad, S., & Devi, S. L. T. (2025). Sustainable development and investor confidence: The safe-haven appeal of green-bond issuing firms. *Sustainable Development*, 33(1), 1249–1268. <https://doi.org/10.1002/sd.3172>
- Baur, D. G., & Hoang, L. T. (2021). A crypto safe haven against Bitcoin. *Finance Research Letters*, 38, 101431. <https://doi.org/10.1016/j.frl.2020.101431>
- 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. <https://doi.org/10.1111/j.1540-6288.2010.00244.x>
- Baur, D. G., & McDermott, T. K. (2016). Why is gold a safe haven? *Journal of Behavioral and Experimental Finance*, 10, 63–71. <https://doi.org/10.1016/j.jbef.2016.03.002>

- Belguith, R., Manzli, Y. S., Bejaoui, A., & Jeribi, A. (2024). Can gold-backed cryptocurrencies have dynamic hedging and safe-haven abilities against DeFi and NFT assets? *Digital Business*, 4(2), 100077. <https://doi.org/10.1016/j.digbus.2024.100077>
- Belhassine, O., & Riahi, M. (2025). Searching for safe haven assets against American and European stocks during the Russo-Ukrainian War. *Studies in Economics and Finance*, 42(2), 352–372. <https://doi.org/10.1108/sef-01-2024-0056>
- Caldara, D., & Iacoviello, M. (2022). Measuring geopolitical risk. *American Economic Review*, 112(4), 1194–1225. <https://doi.org/10.1257/aer.20191823>
- Chemkha, R., BenSaïda, 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. <https://doi.org/10.1016/j.qref.2021.07.006>
- Choi, S., & Shin, J. (2022). Bitcoin: An inflation hedge but not a safe haven. *Finance Research Letters*, 46, 102379. <https://doi.org/10.1016/j.frl.2021.102379>
- Corbet, S., Lucey, B., Urquhart, A., & Yarovaya, L. (2019). Cryptocurrencies as a financial asset: A systematic analysis. *International Review of Financial Analysis*, 62, 182–199. <https://doi.org/10.1016/j.irfa.2018.09.003>
- Dimitriou, D., Kenourgios, D., & Simos, T. (2020). Are there any other safe haven assets? Evidence for “exotic” and alternative assets. *International Review of Economics & Finance*, 69, 614–628. <https://doi.org/10.1016/j.iref.2020.07.002>
- Eleuch, M., Souissi, N., & Mroua, M. (2025). Does the crisis period affect the properties of various financial assets: evidence from G7, BRIC, GCC countries. *Cogent Business & Management*, 12(1). <https://doi.org/10.1080/23311975.2025.2451132>
- Fabris, N., & Ješić, M. (2023). Are gold and bitcoin a safe haven for European indices? *Journal of Central Banking Theory and Practice*, 12(1), 27–44. <https://doi.org/10.2478/jcbtp-2023-0002>
- Feng, J., Yuan, Y., & Jiang, M. (2024). Are stablecoins better safe havens or hedges against global stock markets than other assets? Comparative analysis during the COVID-19 pandemic. *International Review of Economics & Finance*, 92, 275–301. <https://doi.org/10.1016/j.iref.2024.02.014>
- Flavin, T. J., Morley, C. E., & Panopoulou, E. (2014). Identifying safe haven assets for equity investors through an analysis of the stability of shock transmission. *Journal of International Financial Markets Institutions and Money*, 33, 137–154. <https://doi.org/10.1016/j.intfin.2014.08.001>
- Gozbasi, O., Altinoz, B., & Sahin, E., E. (2021). Is Bitcoin a safe haven? A study on the factors that affect Bitcoin prices. *International Journal of Economics and Financial Issues*, 11(4), 35.
- Habib, M. M., Stracca, L., & Venditti, F. (2020). The fundamentals of safe assets. *Journal of International Money and Finance*, 102, 102119. <https://doi.org/10.1016/j.jimonfin.2019.102119>
- Hamilton, J. D. (2009). Causes and consequences of the oil shock of 2007–08. *Brookings Papers on Economic Activity*, 2009(1), 215–261. <https://doi.org/10.1353/eca.0.0047>
- Ji, Q., Zhang, D., & Zhao, Y. (2020). Searching for safe-haven assets during the COVID-19 pandemic. *International Review of Financial Analysis*, 71, 101526. <https://doi.org/10.1016/j.irfa.2020.101526>

- Lucey, B. M., & Li, S. (2015). What precious metals act as safe havens, and when? Some US evidence. *Applied Economics Letters*, 22(1), 35–45. <https://doi.org/10.1080/13504851.2014.920471>
- Maouchi, Y., Fakhfekh, M., Charfeddine, L., & Jeribi, A. (2024). Is digital gold a hedge, safe haven, or diversifier? An analysis of cryptocurrencies, DeFi tokens, and NFTs. *Applied Economics*, 56(60), 9158–9173. <https://doi.org/10.1080/00036846.2023.2299217>
- Nedved, M., & Kristoufek, L. (2023). Safe havens for Bitcoin. *Finance Research Letters*, 51, 103436. <https://doi.org/10.1016/j.frl.2022.103436>
- Park, K., & Fang, Z. (2025). Time-varying intra-safe haven currency behaviour: The U.S. dollar, the Swiss franc, and the Japanese yen. *The Quarterly Review of Economics and Finance*, 100, 101976. <https://doi.org/10.1016/j.qref.2025.101976>
- Piserà, S., & Chiappini, H. (2024). Are ESG indexes a safe-haven or hedging asset? Evidence from the COVID-19 pandemic in China. *International Journal of Emerging Markets*, 19(1), 56–75. <https://doi.org/10.1108/ijjem-07-2021-1018>
- Rashid, A., Bakry, W., & Al-Mohamad, S. (2023). Are cryptocurrencies a future safe haven for investors? The case of Bitcoin. *Economic Research-Ekonomska Istraživanja*, 36(2). <https://doi.org/10.1080/1331677x.2022.2140443>
- Tarchella, S., Khalfaoui, R., & Hammoudeh, S. (2024). The safe haven, hedging, and diversification properties of oil, gold, and cryptocurrency for the G7 equity markets: Evidence from the pre- and post-COVID-19 periods. *Research in International Business and Finance*, 67, 102125. <https://doi.org/10.1016/j.ribaf.2023.102125>
- Tronzano, M. (2020). Safe-Haven Assets, Financial Crises, and Macroeconomic Variables: Evidence from the Last Two Decades (2000–2018). *Journal of Risk and Financial Management*, 13(3), 40. <https://doi.org/10.3390/jrfm13030040>
- Yae, J., & Tian, G. Z. (2024). Volatile safe-haven asset: Evidence from Bitcoin. *Journal of Financial Stability*, 73, 101285.