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Dynamic Correlations Between Gold, Oil, Bitcoin, and Global Equity Markets in the 2024–2026 Crisis Period: A Cross-Country Empirical Study

Mukhtar[1*]
Faculty of Economics and Business
University of Sultan Ageng Tirtayasa

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ABSTRACT

This study investigates the correlation dynamics among gold prices, crude oil prices, Bitcoin, and stock market indices of ten selected countries (USA, China, India, Germany, Japan, Saudi Arabia, Indonesia, Brazil, Vietnam, and Russia) over a 27-month period from January 1, 2024, to March 31, 2026—a condensed era marked by trade wars, oil shocks, geopolitical conflicts, and digital asset evolution. Using daily closing prices and Pearson correlation analysis, we examine six hypotheses grounded in modern portfolio theory, safe-haven theory, and macroeconomic spillover frameworks.
Descriptive statistics reveal that Bitcoin exhibits the highest volatility, while gold shows moderate positive skewness, and stock indices display mixed distributional characteristics. Correlation results indicate that Bitcoin is most strongly correlated with the US stock market, followed by Brazil and Germany, supporting the integration hypothesis. Gold shows weak positive correlations with most stock indices, consistent with its role as a weak hedge. Oil exhibits near-zero or negative correlations with equities, particularly in oil-importing nations. The gold-oil correlation is positive but weak, while Bitcoin-gold and Bitcoin-oil are negligible, suggesting decoupling during crises. These findings provide crucial implications for portfolio diversification, risk management, and policy formulation in an era of compounded global shocks.

Corresponding Author:
Mukhtar

INTRODUCTION

The global financial situation from January 2024 to March 2026 was characterized by conflict across various sectors, potentially leading to overlapping financial crises. Although relatively short, this period can be considered a transformative era in global finance. The resulting situation could fundamentally reshape asset price dynamics, investor behavior, and inter-market correlations. Unlike previous market cycles driven primarily by monetary policy shifts or isolated geopolitical events, the 2024–2026 period has witnessed the simultaneous convergence of a full-scale trade war, an unprecedented oil price shock exceeding 50% within three weeks, the emergence of artificial intelligence as a dominant technological and economic force, and the deepest escalation of Middle East geopolitical tensions in decades (De Wit, 2026; World Economic Forum, 2026).

According to the World Economic Forum (2026), the global risk landscape has entered an "Age of Competition," where intensifying geopolitical rivalries, supply chain fragmentation, and resource nationalism collectively amplify financial market volatility. This assessment is reinforced by the escalating trade war between the United States and China. Judd et al. (2025) reported that former

President Trump announced new 100% tariffs on China ‘over and above’ current rates, massively escalating the trade war and creating additional uncertainty for global financial markets. Furthermore, Lee and Bu (2025) provided a detailed timeline of Trump's trade war with China in 2025, documenting how sequential tariff announcements and retaliatory measures systematically disrupted supply chains and investor sentiment across multiple asset classes.

The macroeconomic backdrop of this period has been shaped by persistent geopolitical conflicts and their spillover effects. **Alvi and Haider (2025)** analyzed the Iran-Israel War of 2025 as a catalyst for human rights crises and global order reconfiguration, demonstrating how military confrontations in the Middle East directly impacted energy security, commodity price volatility, and cross-border capital flows. Their findings indicate that geopolitical shocks of this magnitude produce lasting effects on risk perceptions and asset allocations worldwide. The commodity markets themselves have reflected these tensions: CGTN (2025) noted that global commodity markets experienced extreme fluctuations throughout 2025, with energy and metal prices responding sharply to supply disruptions and policy shifts. These overlapping stressors—trade wars and military conflicts—make the 2024–2026 window uniquely suited for studying asset interconnections under extreme conditions.

For investors, policymakers, and risk managers, analyzing the relationships among traditional assets (gold and oil), digital assets (Bitcoin), and stock indices across countries is crucial. This understanding is crucial for navigating global financial uncertainty triggered by brief but intense market volatility.

Various empirical studies on correlations between asset classes have produced broad, but often contradictory, findings. This suggests that these patterns of correlation are strongly influenced by specific circumstances and tend to fluctuate over time. Traditional finance theory posits that gold serves as a hedge against inflation and geopolitical uncertainty, while oil prices transmit shocks through production costs and inflation expectations into equity valuations (Arouri et al., 2011; Wang et al., 2013). Baur and Lucey (2010) established the foundational distinction between gold as a hedge versus a safe haven—a distinction that has profoundly influenced subsequent research on both precious metals and cryptocurrencies. Extending this framework to Bitcoin, Dyhrberg (2016) demonstrated that Bitcoin exhibits hedging capabilities against the US dollar and possesses similar volatility characteristics to gold, though with distinct differences in response to news and market sentiment.

The safe-haven properties of Bitcoin have been vigorously debated, particularly following the COVID-19 pandemic. Ozkan (2021) provided evidence on the impact of COVID-19 on stock market efficiency in developed countries, showing that the pandemic significantly altered market dynamics and the behavior of various assets, including cryptocurrencies. Conlon and McGee (2020) found that Bitcoin acted not as a safe haven but rather as a "risky hazard" during the COVID-19 bear market, declining more than the S&P 500 and offering no protection during extreme market turmoil.

More recently, Mensi et al. (2023) provided compelling evidence that tail spillover effects between cryptocurrencies and uncertainty in gold, oil, and stock markets vary significantly across quantiles, suggesting that diversification benefits differ substantially between normal and extreme market conditions—a finding particularly relevant for the crisis-prone 2024–2026 window. Yaya et al. (2025) confirmed strong volatility interdependencies among cryptocurrencies, gold, oil, and US stocks using intraday quantile connectedness analysis, underscoring the increasingly integrated nature of these markets.

Despite the extensive literature, significant research gaps remain, particularly for the compressed and intense 2024–2026 period. First, few studies have examined these four assets simultaneously across multiple national stock markets using data spanning the unique post-trade-war, post-oil-shock, and post-Iran-Israel War conditions of 2024–2026. Second, the dynamic nature of correlations—particularly the potential for sign changes during crisis periods—remains inadequately understood. Third, the Indonesian perspective, while valuable, has been underrepresented in global studies despite Indonesia's significance as a major commodity exporter and one of the world's fastest-growing digital asset markets. This study addresses these gaps by investigating the correlation relationships among gold prices, oil prices, Bitcoin prices, and stock market indices of ten selected countries over the 27-month period from January 1, 2024, to March 31, 2026.

LITERATURE REVIEW

Based on the theoretical framework and empirical literature, the following six hypotheses are proposed. Each hypothesis states the existence of a correlation between specified variables.

Correlation Between Gold and Oil

Modern portfolio theory, as developed by Markowitz (1952), emphasizes the importance of diversification through assets with low correlation. Within this framework, gold and oil as major commodities often exhibit interconnected movements because both are sensitive to inflationary pressures and geopolitical uncertainty (Baur & Lucey, 2010). The relationship between gold and oil can be theoretically explained through two main channels: (1) the inflation channel, where rising oil prices increase production costs and general price levels, which in turn drives demand for gold as an inflation hedge (Wang et al., 2013); and (2) the geopolitical channel, where conflicts in oil-producing regions increase global uncertainty, prompting investors to shift toward gold as a safe haven asset (World Economic Forum, 2026).

Alvi and Haider (2025) demonstrated that the Iran-Israel War of 2025 acted as a major geopolitical catalyst, reconfiguring global order and intensifying uncertainty in energy and commodity markets, thereby strengthening the gold-oil nexus. The initial hypothesis from this relationship is that gold and oil tend to move in the same direction (positive) in the long term, although short-term

correlations may weaken or even reverse during periods of extreme shocks (Mensi et al., 2023; De Wit, 2026).

H1: There is a correlation between global gold prices and global oil prices.

Diebold and Yilmaz (2012) demonstrated that commodity markets exhibit directional volatility spillovers, particularly during financial crises. Mensi et al. (2023) found that extreme movements in oil prices affect gold markets, and vice versa, during periods of global uncertainty. Inayah et al. (2024) confirmed return and volatility spillovers between oil and gold during the COVID-19 pandemic.

The Global Risks Report 2026 (World Economic Forum, 2026) highlights intensifying geopolitical competition likely to amplify the co-movement between oil and gold. Agustin and Chan (2024) noted that gold and oil provide varying diversification benefits depending on market conditions in emerging economies. De Wit (2026) observed an "oil shock" that indirectly confirmed gold and oil remain fundamentally linked through inflationary and geopolitical channels. Judd et al. (2025) reported that escalating US-China tariff wars contribute to global uncertainty, indirectly reinforcing the gold-oil connection through trade policy channels.

Correlation Between Bitcoin and Gold

The comparison between Bitcoin and gold in financial literature often refers to the safe haven and hedging theory formalized by Baur and Lucey (2010), who defined a safe haven as an asset that is uncorrelated or negatively correlated with stock markets during periods of extreme market stress. Within this context, gold has long been recognized as a traditional safe haven (Ji et al., 2020). Bitcoin, as a relatively new digital asset, was initially considered to have similar characteristics due to its supply cap and decentralization (Dyhrberg, 2016).

However, there are fundamental theoretical differences: gold has intrinsic physical value and a long history as a store of value, while Bitcoin exhibits much higher volatility and greater sensitivity to market sentiment and monetary policy (Conlon & McGee, 2020). Ozkan (2021) showed that during the COVID-19 crisis, market efficiency in developed countries declined significantly, creating conditions where traditional safe havens like gold behaved differently from digital assets like Bitcoin.

Using quantile connectedness analysis, Yaya et al. (2025) observed that volatility interdependencies between Bitcoin and gold vary across market conditions. The developing hypothesis is that the correlation between Bitcoin and gold is dynamic and state-dependent—positive under normal conditions but potentially negative (decoupling) during extreme shock periods when investors choose one over the other as a hedging instrument (De Wit, 2026; Mensi et al., 2023).

H2: There is a correlation between Bitcoin prices and gold prices.

Dyhrberg (2016) concluded that Bitcoin shares similar hedging capabilities against stocks as gold. However, Conlon and McGee (2020) found that Bitcoin was a "risky hazard" during the COVID-19 bear market, whereas gold retained its safe-haven properties. Using quantile connectedness analysis, Yaya et al. (2025) observed that volatility interdependencies between Bitcoin and gold vary

across market conditions. Mensi et al. (2023) confirmed that tail risks in cryptocurrency markets transmit to gold markets. Agustin and Chan (2024) found that Bitcoin and gold offer distinct roles in portfolio allocation in Indonesia, with gold acting as a more consistent diversifier. De Wit (2026) documented a decoupling event during the February 2025 oil shock, where gold fell while Bitcoin rose. Lee and Bu (2025) documented that trade war escalations created alternating risk-on and risk-off episodes, which likely influenced the relative attractiveness of gold versus Bitcoin.

Correlation Between Bitcoin and Oil

The relationship between Bitcoin and oil can be explained through two main theoretical frameworks. First, the production cost theory (Sapra et al. 2024) states that Bitcoin is directly influenced by the energy costs required for the mining process. The higher the energy prices—especially oil and electricity—the higher the marginal cost of Bitcoin mining, which in turn puts upward pressure on Bitcoin prices in the long term (Wang et al., 2024). Second, the macroeconomic spillover theory (Hung, 2022) states that oil price shocks transmit their effects to financial markets through inflation expectations and monetary policy.

Rising oil prices increase inflation expectations, which may drive investors to seek alternative assets, including Bitcoin (Inayah et al., 2024). However, theoretically, this relationship is asymmetric: negative oil price shocks (sharp declines) have a stronger impact than positive shocks because falling oil prices reflect weakening aggregate demand and increased risk aversion (Hung, 2022). Alvi and Haider (2025) emphasized that the Iran-Israel War of 2025 directly disrupted oil supplies in the Middle East, creating energy price shocks that reverberated through global digital asset markets. The World Economic Forum (2026) predicts that energy price volatility will remain a central global risk through 2026, reinforcing the plausibility of a persistent Bitcoin-oil relationship.

H3: There is a correlation between Bitcoin prices and global oil prices.

Hung (2022) discovered that Bitcoin and crude oil exhibit asymmetric volatility spillovers, with negative oil price shocks having a stronger impact on Bitcoin than positive shocks. Wang et al. (2024) concluded that oil price fluctuations influence Bitcoin prices through mining cost channels and inflationary expectations. During the COVID-19 pandemic, Inayah et al. (2024) found intensified return transmission between oil and Bitcoin. Sapra et al. (2024) state that the price of Bitcoin acts as a net contributor, while Bitcoin-based electricity consumption and crypto market volatility act as net receivers of spillover from the Bitcoin price. The World Economic Forum (2026) predicts that energy price volatility will remain a central global risk through 2026. Mutmainna and Retnasih (2024) also included both oil and Bitcoin in their study of leading stock markets, noting that oil's influence on digital assets operates through liquidity and risk-on/risk-off cycles. Judd et al. (2025) noted that trade war-induced disruptions to global supply chains can amplify oil price volatility, indirectly affecting Bitcoin mining costs and market sentiment.

Correlation Between Gold and Stock Market Indices (Ten Countries)

The relationship between gold and stock market indices is theoretically grounded in the concepts of hedging and safe haven as articulated by Baur and Lucey (2010). Under normal market conditions, gold often exhibits a positive or near-zero correlation with stocks because these two assets are driven by different factors: stocks are influenced by corporate earnings and economic performance, while gold is influenced by inflation and the US dollar exchange rate (Wang et al., 2013). However, during periods of crisis or high uncertainty, this correlation tends to become negative as investors sell risky assets (stocks) and shift to safe assets (gold) (Ji et al., 2020).

The effectiveness of gold as a safe haven varies across countries depending on each country's capital market characteristics and degree of economic openness (Agustin & Chan, 2024). Ozkan (2021) studied stock market efficiency during COVID-19 and noted that gold's hedging effectiveness increased as market efficiency declined, particularly in developed countries. Mensi et al. (2023) confirmed that gold's spillover effects to stock markets are asymmetric and more pronounced during extreme market conditions. The proposed hypothesis is that the negative correlation between gold and stocks will be more visible during crisis periods than during stable periods and stronger in developed countries than in emerging countries (Mutmainna & Retnasih, 2024).

H4: There is a correlation between gold prices and the stock market index of each of the ten selected countries (USA, China, India, Germany, Japan, Saudi Arabia, Indonesia, Brazil, Vietnam, Russia).

Baur and Lucey (2010) formally defined gold as both a hedge and a safe haven against stocks. Ji et al. (2020) found that gold served as a safe haven for major stock markets during the COVID-19 pandemic, though effectiveness varied across countries. For emerging markets, Agustin and Chan (2024) concluded that gold offers diversification benefits, especially during periods of stock market stress. Mensi et al. (2023) confirmed that gold's spillover effects to stock markets are asymmetric and more pronounced during extreme market conditions. Ozkan (2021**)** studied stock market efficiency during COVID-19 and noted that gold's hedging effectiveness increased as market efficiency declined. Mutmainna and Retnasih (2024) found that gold's relationship with stock indices is negative during crises but positive during stable growth periods. Wang et al. (2013) demonstrated that commodity-stock relationships are country-specific. **Lee and Bu (2025)** documented that trade war escalations caused alternating sell-offs in stock markets, periods during which gold typically exhibited its safe-haven function.

Correlation Between Oil and Stock Market Indices (Ten Countries)

The relationship between oil prices and stock market indices is theoretically explained through three main channels (Arouri et al., 2011). The first channel is the production cost channel: rising oil prices increase input costs for companies, squeezing profit margins, and ultimately lowering stock prices, especially in energy-intensive sectors (Wang et al., 2013). The second channel is the aggregate demand channel: high oil prices reduce consumers' real disposable income and suppress consumption,

which negatively impacts corporate performance and stock prices (Diebold & Yilmaz, 2012). The third channel is the oil dependency channel: the impact of oil price shocks is asymmetric between oil-importing and oil-exporting countries (Wang et al., 2013). Oil-exporting countries (such as Saudi Arabia and Russia) tend to benefit from rising oil prices, while oil-importing countries (such as Japan, India, Vietnam, and Germany) are disadvantaged (Mutmainna & Retnasih, 2024).

Alvi and Haider (2025) provided direct evidence that the Iran-Israel War of 2025 caused oil price spikes that differentially affected stock markets based on each country's net-importer or net-exporter status. Yaya et al. (2025) found that oil-stock market interdependencies are strongest during extreme market conditions. The World Economic Forum (2026) highlights that energy price volatility remains a top global risk. Thus, the proposed hypothesis is the existence of a correlation between oil and stock indices, with the direction of correlation differing across countries depending on their net-exporter or net-importer status.

H5: There is a correlation between global oil prices and the stock market index of each of the ten selected countries (USA, China, India, Germany, Japan, Saudi Arabia, Indonesia, Brazil, Vietnam, Russia).

Arouri et al. (2011) demonstrated that oil price volatility transmits to stock returns, especially in energy-intensive sectors. Diebold and Yilmaz (2012) found that oil markets are net transmitters of volatility to global stock markets. Wang et al. (2013) offered a crucial distinction between oil-importing and oil-exporting countries: positive oil price shocks benefit oil-exporting nations but harm oil-importing nations. Inayah et al. (2024) confirmed intensified spillovers between oil and stock markets during the COVID-19 pandemic, with emerging markets experiencing greater transmission effects. Mutmainna and Retnasih (2024) noted that oil's impact on stock indices is time-varying and depends on global liquidity conditions. Yaya et al. (2025) found that oil-stock market interdependencies are strongest during extreme market conditions. The World Economic Forum (2026) highlights that energy price volatility remains a top global risk. **Judd et al. (2025),** and **Lee and Bu (2025)** jointly indicate that trade wars and oil price shocks often coincide, creating compounded pressures on stock markets worldwide.

Correlation Between Bitcoin and Stock Market Indices (Ten Countries)

The relationship between Bitcoin and stock market indices has undergone significant evolution in the financial literature. In its early emergence, Bitcoin was considered an asset isolated from traditional financial markets—referred to as the "Decentralized Finance Paradox" (Dyhrberg, 2016). However, with increasing institutional adoption and market integration, Bitcoin now exhibits behavior increasingly integrated with risk-on assets such as stocks (Conlon & McGee, 2020). This relationship can be theoretically explained through perspective (integration hypothesis), which states that Bitcoin has become part of the same risk-on/risk-off cycle as stocks, especially following the entry of institutional investors and correlation with global liquidity.

Financialization theory explains that the current strong correlation between Bitcoin and stock prices is not due to shared economic fundamentals. Rather, it is due to institutional integration that began with the launch of Bitcoin futures contracts by the CME in December 2017. Here are the key points of this phenomenon:

Institutional Bridge: CME contracts provide the first gateway for traditional financial institutions to speculate without physically owning Bitcoin.

Market Correlation: This step increases market efficiency and aligns Bitcoin's movements with stock indices like the NASDAQ and S&P 500.

Pandemic Impact & ETFs: This trend has intensified post-COVID-19 and peaked in 2024 with the launch of Spot Bitcoin ETFs in the US.

Risk Asset: This integration structurally ties Bitcoin into the same capital flows and risk management as stocks, so that Bitcoin now moves in the same direction as a risk asset, rather than a standalone hedge (Paul, February 17, 2026; Wu, 2025).

Fluctuations and growth in equity markets tend to be followed by Bitcoin price movements through a lagged effect. However, Bitcoin's significant impact on stock indices is relatively low. This indicates that Bitcoin does not demonstrate complete independence from traditional capital markets; instead, this digital asset acts as a responsive instrument to external shocks from major stock indices, particularly in the context of volatility transmission (Wang et al., 2020).

Mensi et al. (2023) show that the spillover between cryptocurrencies and volatility indices for the major traditional markets varies substantially across quantiles, implying that diversification benefits for these assets may differ widely across normal and extreme market conditions. Under normal market conditions, the total connectedness index is moderate and falls below the elevated values observed under bearish and bullish market conditions.

Ozkan (2021) demonstrated that during periods of reduced market efficiency, such as the COVID-19 crisis, correlations between previously segmented assets tend to increase, supporting the integration hypothesis. Empirical evidence tends to support the second perspective, particularly during periods of extreme market stress where Bitcoin moves in tandem with stocks rather than acting as a safe haven (Yaya et al., 2025). Agustin and Chan (2024) found that Bitcoin is exogenous and functions as a diversifier to mitigate Sharia stock losses, particularly during periods of high uncertainty. The proposed hypothesis is the existence of a positive correlation between Bitcoin and stock indices, with correlation strength varying across countries—stronger in developed countries with high crypto penetration and weaker in developing countries (Mutmainna & Retnasih, 2024; Wang et al., 2024).

H6: There is a correlation between Bitcoin prices and the stock market index of each of the ten selected countries (USA, China, India, Germany, Japan, Saudi Arabia, Indonesia, Brazil, Vietnam, Russia).

Ozkan (2021) found that during the COVID-19 pandemic, stock market efficiency declined in developed countries, a condition that typically increases correlations between cryptocurrencies and

traditional equities. Mutmainna and Retnasih (2024) concluded that Bitcoin exhibits return spillovers with major indices such as the S&P 500. Mensi et al. (2023) discovered that Bitcoin's tail risks transmit to stock markets, especially during extreme downward movements. Agustin and Chan (2024) suggest that, owing to the high volatility and speculative nature of Bitcoin, short-term rather than long-term investments are recommended. Yaya et al. (2025) confirmed that volatility interdependencies between Bitcoin and US stocks are quantile-dependent. Conlon and McGee (2020) warned that Bitcoin moved in tandem with stocks during the COVID-19 bear market. Wang et al. (2024) concluded that positive stock market sentiment tends to increase Bitcoin prices, indicating pro-cyclical behavior. **Lee and Bu (2025)** provided a timeline showing that trade war announcements often triggered simultaneous movements in both stock markets and Bitcoin, suggesting increasing integration.

RESEARCH METHODOLOGY

Research Design and Data Sources

This study employs a quantitative approach with a descriptive-correlational method to analyze the linkages between macroeconomic variables, digital assets, and global equity markets. Secondary data consisting of daily **closing prices was** retrieved via the Yahoo *Finance API*. The observation period spans 27 months, from January **1, 2024, to March 31, 2026**. This timeframe was selected to capture contemporary market dynamics and the evolving interactions between traditional and digital assets in the post-pandemic economic landscape.

Operational Definition of Variables

The study incorporates four primary global variables and stock market indices from 10 strategic countries:

1. **Global Variables:**
   - **Gold Price (X1):** Represented by Gold *Futures* (GC=F) as a proxy for safe-haven assets.
   - **Oil Price (X2):** Represented by Crude *Oil WTI* (CL=F) as a proxy for global energy commodities.
   - **Bitcoin (X3):** Represented by the BTC-USD pair as a proxy for crypto-assets and digital risk sentiment.
2. **Stock Market Variables (Y):** Composite indices from 10 nations:
   - **Developed Economies:**USA (S&P 500), Germany (DAX), Japan (Nikkei 225).
   - **Emerging & Strategic Economies:**China (SSE), India (SENSEX), Saudi Arabia (TASI), Indonesia (JKSE), Brazil (IBOVESPA), Vietnam (VN-Index), and Russia (MOEX).

Data Pre-processing

To account for asynchronous trading calendars (e.g., Saudi Arabia’s Sunday-Thursday schedule vs. Western Monday-Friday), the following data cleaning protocols were implemented:

1. **Data Integration:**Merging alltime series into a single synchronized matrix based on UTC timestamps.
2. **Handling Missing Values:**
   - **Linear interpolation** was used to fill gaps within the series.
   - **Last Observation Carried Forward (LOCF) was** applied to maintain continuity during national public holidays.
3. **Data Transformation: Calculating Logarithmic Daily Returns to** ensure data stationarity and normalize the distribution before correlation testing.

Statistical Analysis

The primary analysis involves calculating the **Pearson Correlation Coefficient** to determine the strength and direction of the linear relationship between variables:

Sample Criteria

The selection of the ten countries follows a purposive sampling method, ensuring a comprehensive representation of the global economic spectrum:

1. **Global Economic Weight (G20 & BRICS)**

   The sample includes the world's five largest economies: the USA**, China, India, Japan, and Germany**. These nations are the primary drivers of global GDP and monetary policy. The inclusion of **Brazil, Russia, India, and China (BRIC)**ensures the study captures the influence of major emerging powers on global commodity demand.
2. **Geo-Economic Diversification**
   - **Saudi Arabia:**Representing the Middle East and the world's leading oil exporter, its market (TASI) is highly sensitive to energy price fluctuations.
   - **Indonesia & Vietnam:**Representing the ASEAN region, which exhibits the highest economic growth rates. Indonesia is the largest economy in Southeast Asia and a G20 member, while Vietnam is a critical node in the global manufacturing supply chain.
3. **Asset Sensitivity**
   - **China & India:**As the world's largest physical gold consumers, their equity markets provide unique insights into the relationship between domestic capital markets and precious metal prices.
   - **Russia:**Despite geopolitical complexities, Russia remains a systemic player in energy and gold markets. Its inclusion allows for the observation of how geopolitical risk affects asset correlations.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1. Descriptive Statistic

Variable	Mean	SD	Median	Min	Max	skew	Kurtosis
Gold	3131.632	864.5353	2893.283	1990.3	5318.4	0.77906	-0.38249
Oil	70.5263	8.792606	69.73333	55.27	102.88	0.67411	0.430599
BTC	83124.02	21322.23	84676.29	39507.37	124752.5	0.012699	-1.12773
USA	5933.285	623.3544	5916.955	4688.68	6978.6	0.071776	-1.09838
PRC	3398.573	407.9213	3347.674	2702.185	4182.591	0.33531	-1.03807
IND	79123.93	4060.841	80,219.54	70370.55	85836.12	-0.35427	-1.04661
DEU	21219.57	2733.065	21419.88	16431.69	25420.66	-0.1026	-1.57411
JPN	41657.19	6022.719	39166.19	31136.58	58850.27	1.156378	0.190343
KSA	11638.34	625.7253	11736.45	10290.76	12835.65	-0.24085	-1.00181
IDN	7440.129	616.0253	7283.953	5967.988	9134.7	0.57756	0.085308
BRA	138129.7	17317.11	131624.2	118533	191490	1.571613	1.59686
RUS	3233.361	61.27498	3215.91	3136.07	3501.89	2.89702	7.733213
N= 818							

Table 1 presents the descriptive statistics for all variables over 818 daily observations. The mean gold price stood at USD 3,131.63 per ounce, with a median of USD 2,893.28, indicating a right-skewed distribution (skewness = 0.779). The maximum gold price reached USD 5,318.40, reflecting safe-haven demand during peak geopolitical tensions in 2025 (Alvi & Haider, 2025; World Economic Forum, 2026). Oil prices exhibited moderate volatility (SD = 8.793) with a mean of USD 70.53 and a maximum of USD 102.88, consistent with the oil shock documented by De Wit (2026).

Bitcoin demonstrated the highest dispersion (SD = 21,322.23) among all assets, with a near-zero skewness (0.013) and negative kurtosis (-1.128), suggesting a relatively flat distribution but with extreme price swings from USD 39,507 to USD 124,752. This aligns with Mensi et al. (2023) and Yaya et al. (2025), who highlight Bitcoin's tail-dependent behavior. Among national stock indices, Brazil (IBOVESPA) exhibited the highest mean (138,129.7) and positive skewness (1.572), driven by commodity export booms, while Russia (MOEX) showed extreme kurtosis (7.733), reflecting episodic

geopolitical shocks. Developed markets like the US (S&P 500) and Germany (DAX) displayed near-symmetric distributions, consistent with mature market efficiency (Ozkan, 2021).

Hypothesis Testing Results

Table 2. Matrix Correlation

Var	Gold	Oil	BTC	USA	PRC	IND	DEU	JPN	KSA	IDN	BRA	RUS
Gold	1	0.096	0.078	0.112	0.151	0.168	0.141	0.113	0.067	0.037	0.201	0.024
Oil	0.096	1	0.001	0.082	0.061	-0.051	-0.099	-0.010	0.012	-0.060	0.001	-0.013
BTC	0.078	0.010	1	0.350	0.066	0.004	0.128	0.006	0.031	0.026	0.153	0.056
USA	0.112	0.082	0.350	1	0.097	0.086	0.302	0.050	0.038	0.019	0.374	-0.027
PRC	0.151	0.063	0.066	0.097	1	0.104	0.167	0.218	0.116	0.060	0.129	-0.002
IND	0.168	-0.051	0.004	0.086	0.104	1	0.255	0.310	0.217	0.161	0.072	-0.013
DEU	0.141	-0.099	0.128	0.302	0.167	0.255	1	0.371	0.224	0.193	0.192	-0.041
JPN	0.113	-0.010	0.006	0.051	0.218	0.310	0.371	1	0.295	0.292	0.110	-0.014
KSA	0.067	0.012	0.031	0.037	0.116	0.217	0.224	0.295	1	0.136	0.103	-0.013
IDN	0.037	-0.060	0.027	0.019	0.060	0.161	0.193	0.292	0.136	1	0.039	-0.016
BRA	0.201	0.001	0.153	0.374	0.129	0.071	0.191	0.111	0.103	0.039	1	-0.038
RUS	0.024	-0.013	0.056	-0.027	-0.002	-0.013	-0.041	-0.014	-0.013	-0.016	-0.038	1

Gold–Oil Correlation

The correlation between gold and oil is positive but weak ($r = 0.096$, $p < 0.01$). This finding partially supports H1 but suggests that the traditional inflation and geopolitical channels were less dominant during the 2024–2026 period, possibly due to simultaneous monetary tightening and decoupling effects (Mensi et al., 2023; De Wit, 2026). The result is lower than pre-pandemic estimates (Wang et al., 2013), confirming that the gold-oil nexus weakened under concurrent multiple shocks.

The weak positive correlation between gold and oil provides partial empirical support for the inflation and geopolitical transmission channels posited by Wang et al. (2013) and Baur and Lucey (2010). However, the magnitude is considerably lower than theoretical expectations under normal conditions. This finding confirms the observation by Mensi et al. (2023) that extreme market conditions

can attenuate commodity co-movements. The Iran-Israel War of 2025 (Alvi & Haider, 2025) and the simultaneous US-China trade war escalation (Judd et al., 2025) created conflicting signals: oil prices surged on supply disruption fears, while gold attracted safe-haven bids, but the two movements were not synchronized due to divergent liquidity preferences. Thus, the theoretical gold-oil nexus remains valid in direction but weakened in strength during multi-shock periods.

Bitcoin–Gold Correlation

The correlation between Bitcoin and gold is very weak and positive (r = 0.078), rejecting the notion that Bitcoin serves as “digital gold” during crises. This aligns with Conlon and McGee (2020) and Yaya et al. (2025), showing that Bitcoin and gold behave as distinct asset classes—gold as a defensive safe haven, Bitcoin as a speculative risk-on asset. The decoupling event noted by De Wit (2026) is reflected in this low coefficient.

The near-zero correlation between Bitcoin and gold rejects the initial hypothesis that Bitcoin shares gold’s safe-haven properties (Dyhrberg, 2016). Instead, this result empirically confirms the theoretical critique by Conlon and McGee (2020) and Yaya et al. (2025) that Bitcoin behaves as a “risky hazard” rather than a digital safe haven. During the 2024–2026 crisis window, gold retained its defensive role, while Bitcoin moved with risk-on sentiment, particularly following the March 2025 oil shock (De Wit, 2026). This decoupling supports the theoretical distinction between intrinsic value assets (gold) and sentiment-driven digital assets (Bitcoin), as articulated by Agustin and Chan (2024). Therefore, the safe-haven theory (Baur & Lucey, 2010) applies to gold but not to Bitcoin under extreme conditions.

Bitcoin–Oil Correlation

The correlation between Bitcoin and oil is near-zero (r = 0.010), rejecting H3. Despite theoretical production cost channels (Sapra et al., 2024; Wang et al., 2024), the empirical result suggests that energy price shocks did not systematically transmit to Bitcoin prices during 2024–2026, possibly due to the dominance of liquidity and sentiment cycles over fundamental mining costs (Hung, 2022; Inayah et al., 2024).

The absence of a systematic correlation between Bitcoin and oil contradicts the production cost theory proposed by Sapra et al. (2024) and Wang et al. (2024), which posits that energy prices directly influence Bitcoin mining costs and thus Bitcoin prices. However, this finding aligns with the macroeconomic spillover theory articulated by Hung (2022), who demonstrated that asymmetric spillovers only manifest under specific market conditions (e.g., negative oil shocks). During 2024–2026, persistent quantitative tightening and crypto-specific events (e.g., exchange failures, regulatory shifts) dominated Bitcoin price formation, overwhelming the fundamental energy cost channel. Thus, the theoretical linkage between oil and Bitcoin is conditional rather than universal.

Gold–Stock Market Indices

Gold shows consistently weak positive correlations with all ten stock indices, ranging from r = 0.037 (Indonesia) to r = 0.201 (Brazil). The highest correlation with Brazil (r = 0.201) reflects Brazil's commodity-driven equity market. Notably, no negative correlations were observed, suggesting that gold did not act as a strong safe haven during the crisis period, contrary to Baur and Lucey (2010) and Ji et al. (2020). This may be due to the simultaneous sell-off of all liquid assets during the March 2025 liquidity crunch (De Wit, 2026).

The consistently weak positive correlations between gold and all ten stock indices partially contradict the hedging and safe-haven theory of Baur and Lucey (2010), which predicts negative correlations during crisis periods. This finding instead supports the observation by Ji et al. (2020) that gold's safe-haven effectiveness is country- and crisis-specific. During the 2024–2026 period, simultaneous liquidity contractions across global markets (World Economic Forum, 2026) caused gold and equities to move in the same direction during extreme sell-offs, as investors liquidated all liquid assets, including gold, to meet margin calls. This "correlation breakdown" phenomenon confirms the theoretical insight by Mensi et al. (2023) that diversification benefits diminish under extreme tail events.

Oil–Stock Market Indices

Oil correlations with stock indices are mixed but generally weak. Positive but negligible correlations appear for the USA (r = 0.082) and China (r = 0.063), while negative correlations emerge for oil-importing nations such as Germany (r = -0.099), India (r = -0.051), and Indonesia (r = -0.060). This supports the theoretical distinction between oil-exporting and oil-importing countries (Mutmainna & Retnasih, 2024; Wang et al., 2013). Saudi Arabia, a major exporter, shows a near-zero correlation (r = 0.012), possibly due to sovereign wealth fund counter-cyclical interventions.

The finding that oil-importing countries (Germany, India, Indonesia) exhibit negative correlations with oil while major exporters (Saudi Arabia) show near-zero correlation strongly confirms the theoretical dependency channel proposed by Wang et al. (2013) and Arouri et al. (2011). This asymmetric relationship validates the production cost and aggregate demand channels under crisis conditions. However, the absence of a strong positive correlation for Saudi Arabia suggests that sovereign wealth fund interventions and strategic diversification may buffer direct oil-equity transmission (Mutmainna & Retnasih, 2024). Thus, the theoretical framework holds but requires modification for state-owned or heavily managed markets.

Bitcoin–Stock Market Indices

Bitcoin exhibits the strongest correlation with the US stock market (r = 0.351), followed by Brazil (r = 0.153), Germany (r = 0.128), and China (r = 0.066). This supports the integration hypothesis (Conlon & McGee, 2020; Mensi et al., 2023; Paul, February 17, 2026; Wang et al., 2020; Wu, 2025; Paul, February 17, 2026), indicating that Bitcoin has become increasingly integrated with global risk-on assets, particularly in developed markets with high institutional crypto participation. The weakest correlations are with Japan (r = 0.006) and Indonesia (r = 0.027), reflecting lower crypto penetration or distinct local market structures (Agustin & Chan, 2024).

The strongest finding is the moderate positive correlation between Bitcoin and the US stock market (r = 0.351), which strongly supports the integration hypothesis over the decentralization paradox. This confirms Conlon and McGee (2020) and Mensi et al. (2023), showing that Bitcoin has become a

pro-cyclical risk-on asset rather than an isolated digital commodity. The variation across countries (strongest in the USA and Brazil, weakest in Japan and Indonesia) theoretically aligns with institutional crypto adoption rates and market liquidity conditions. Therefore, the theoretical evolution from isolation to integration is empirically validated for the 2024–2026 crisis period.

In summary of gap research, this study was designed to address three major research gaps identified in the literature: Simultaneous examination of gold, oil, Bitcoin, and multiple national stock markets during the 2024–2026 crisis period, dynamic correlation changes and sign reversals during crisis periods Gap, and underrepresentation of the Indonesian and emerging market perspective. Responses to these gaps are as follows: Multi-asset, multi-country correlation matrices for the 2024–2026 crisis period are now available for calibration of global portfolio models. Theoretical boundaries of safe-haven, production cost, and integration hypotheses are empirically delineated: gold is not a universal crisis hedge, Bitcoin is not digital gold, and oil impacts are country-specific. Emerging markets exhibit distinct correlation structures that cannot be generalized from developed-market findings, validating purposive sampling strategies.

CONCLUSION

This study provides a comprehensive empirical analysis of correlations among gold, oil, Bitcoin, and ten national stock markets during the crisis-laden period of 2024–2026. The key findings are as follows:

- **Gold remains** a weak hedge rather than a strong safe haven, with low positive correlations across all equity markets.
- **Oil** exhibits asymmetric correlations, negatively impacting oil-importing stock markets while showing near-zero or positive links with oil-exporting nations.
- **Bitcoin is** not a safe haven but has become significantly integrated with global equities, especially the US market, confirming its role as a risk-on asset.
- The gold-oil and gold-Bitcoin correlations are weak, suggesting these assets serve distinct portfolio functions during compound crises.

- **Country-specific characteristics**—such as oil dependency, crypto adoption, and market development—determine the strength and direction of asset correlations.

This study could be extended by using time-varying parameter models, high-frequency intraday data, and quantile-based connectedness to capture the non-linear dynamics suggested by these gap responses.

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