Gold as a Systemic Safe Haven Amid Global Economic Uncertainty in G20 Countries

Ahmad Saifi Athoillah[1], Dwi Rahma Fitriani[2], Mutia Tsalitsa Alawia[3], Dion Yanuarmawan[4], Yohan Bakhtiar[5], Wiwik Mukholafatul Farida[6]

[1,2,3]Diploma 4 Finance Study, Malang State Polytechnic, Malang, Indonesia
[4,5,6]Diploma 3 Accounting Study Program, Malang State Polytechnic, Malang, Indonesia

The escalation of global economic uncertainty driven by financial crises, geopolitical tensions, and monetary policy tightening has reignited debates regarding the role of gold as a value-preserving asset within the global financial system. Although prior studies have extensively examined gold as a hedging instrument and safe haven asset, empirical evidence concerning its ability to function as a systemic safe haven particularly under conditions of extreme risk, crisis regime dynamics, and cross-market interconnectedness remains limited and inconclusive, especially within G20 countries characterized by high levels of financial integration. This study aims to investigate whether gold serves as a systemic safe haven during periods of global economic uncertainty by emphasizing the dimensions of tail risk, crisis regimes, and risk transmission across financial markets. The study employs monthly panel data from G20 countries over the period 2000–2024 obtained from open-access databases, including global gold prices, the Global Economic Policy Uncertainty (GEPU) Index, the Volatility Index (VIX), global financial stress indicators, exchange rates, stock market indices, and government bond yields. To capture nonlinear relationships and extreme dependence structures, this research adopts advanced econometric approaches combining Markov-Switching Quantile Vector Autoregression and connectedness analysis. The empirical findings reveal that gold significantly functions as a systemic safe haven at the lower quantiles of financial market return distributions, particularly during periods of crisis and heightened uncertainty. Furthermore, gold tends to act as a shock absorber within cross-market connectedness networks, thereby contributing to the stability of financial systems across G20 countries. These findings enrich the existing literature by offering a systemic safe haven perspective and provide important policy implications for monetary authorities and foreign reserve managers in designing global financial resilience strategies.
Keywords: Gold, Systemic safe haven; Global economic uncertainty; Tail risk; G20 countries

Corresponding Author:
Ahmad Saifi Athoillah
Malang State Polytechnic
saifiathoillah@polinema.ac.id

1. Introduction

Over the past two decades, the global economy has undergone significant structural transformation, marked by rising economic uncertainty, financial market volatility, and increasingly complex cross-border interconnectedness. The period since the early 2000s has seen a series of recurring global crises, ranging from the bursting of the dot.com bubble (2000–2002), the global financial crisis (2008–2009), the European debt crisis (2010–2012), the COVID-19 pandemic (2020–2021), to the escalation of geopolitical tensions and the fragmentation of the global economy post-2022. These conditions have prompted investors, policymakers, and academics to re-examine the effectiveness of traditional financial assets in addressing extreme risks and systemic uncertainty [1].

One asset that consistently emerges in this discourse is gold. Historically, gold has been used as a store of value and a monetary instrument before evolving into a global financial asset traded on international bullion markets. In the modern financial context, gold is often associated with two primary functions: hedging and

safe haven. Hedging refers to gold's ability to protect portfolio value under normal market conditions, while safe haven refers to gold's ability to maintain or increase its value, particularly when financial markets are under extreme stress or systemic crises [2], [3].This conceptual distinction is important because numerous studies have shown that an asset can function as a hedge without necessarily acting as a safe haven, and vice versa.

Empirically, the movement of global gold prices over the period 2000–2024 provides a strong picture of investor response to global economic uncertainty. In 2000, the global gold price hovered around USD 279 per troy ounce, reflecting low demand for safe haven assets amidst global stock market optimism. However, over the next 24 years, gold prices have risen by more than 650%, reaching a range of USD 2,100–2,400 per troy ounce in 2024, amid increasing macroeconomic uncertainty and global geopolitical risks. The most significant spikes occurred during periods of crisis, such as the 2008 global financial crisis, when gold prices rose by more than 25% in one year, and during the COVID-19 pandemic, when gold prices rose by approximately 27% between 2019 and 2020 [4].

This pattern reinforces the argument that gold not only serves as a long-term hedge but also exhibits safe haven characteristics in the face of tail risk the risk of extreme events located at the tail of the market return distribution. Recent financial literature emphasizes that tail risk and economic policy uncertainty have asymmetric impacts on asset prices, so average-based analytical approaches often fail to capture their true dynamics [5]. In this context, gold often exhibits a negative or very low correlation with the stock market precisely at times of peak volatility, a characteristic highly relevant to systemic risk management.

The relevance of this issue increases when linked to the G20, which includes both developed and developing economies, contributing more than 85% of global Gross Domestic Product (GDP) and approximately 75% of world trade. G20 countries, including Indonesia, are part of a highly integrated global financial network, allowing economic shocks in one country to quickly spread to others through financial and trade channels. Under these conditions, global safe-haven assets become crucial, not only for individual investors but also for the stability of the international financial system and the management of national foreign exchange reserves [6].

Indonesia, as a developing member of the G20, faces unique dynamics. On the one hand, Indonesia's financial markets are increasingly integrated with global markets, reflected in increasing foreign capital flows and exchange rate volatility. On the other hand, domestic consumers and investors are showing a strong preference for gold as a store of value, particularly during periods of economic uncertainty and rupiah depreciation. This phenomenon demonstrates that gold's role as a safe haven is not only relevant globally but also has direct implications for the financial stability of developing countries like Indonesia.

From a theoretical perspective, the modern portfolio approach emphasizes the importance of diversifying low-correlation assets to minimize portfolio risk [1]. Subsequent literature has developed this concept by incorporating uncertainty dynamics and market regimes, demonstrating that correlations between assets are unstable and tend to increase during periods of crisis [7]. Under these conditions, only assets with safe haven characteristics can truly provide effective protection against systemic risk. Several empirical studies indexed by Scopus indicate that gold tends to maintain its safe haven function during periods of global crisis, but the results vary across countries and time periods [2], [3], [8].

While the literature on gold as a safe haven has grown rapidly, significant research gaps remain. First, many studies focus on specific countries or markets, thus failing to capture the global systemic dimensions relevant to the G20 countries. Second, most studies use a linear, average-based approach, which is less sensitive to tail risk and shifts in crisis regimes. Third, there is limited research integrating the perspectives of developed and developing countries, including Indonesia, within a consistent global analytical framework.

Therefore, this study offers a novel approach by positioning gold as a systemic safe haven in the context of global economic uncertainty, focusing on the G20 countries. This study not only tests whether gold functions as a safe haven in general but also evaluates its effectiveness in mitigating extreme risks and maintaining portfolio stability across markets across various global crisis regimes. Using long-term global gold price data (2000–2024), this study aims to provide more comprehensive and relevant empirical evidence for both academic literature and public policy. The list of global gold prices is shown in Table 1.

Table 1. Annual Average Global Gold Price (USD per Troy Ounce) in 2000–2025

Year	Price (USD/oz)	References
2000	279	[9]
2005	445	[9]
2010	1,227	[9]
2015	1,159	[9]
2020	1,774	[9]
2021	1,799	[9]
2022	1,802	[9]
2023	1,943	[9]
2024	2.107	[9]
2025	2,385	[9]

The data in Table 1 shows a significant long-term upward trend in gold prices, with accelerated growth during periods of global crisis. This pattern indicates that gold is increasingly perceived as a safe haven in a global financial system vulnerable to shocks. Based on this overall theoretical and empirical context, the critical question underlying this research is whether gold truly acts as an effective systemic safe haven in the face of global economic uncertainty and extreme risks in G20 countries, including Indonesia, or is this role temporary and dependent on the specific crisis regime.

2. Literature Review and Problem Statement

Gold as a Hedge and Safe Haven Asset

In international financial literature, gold has historically been viewed as an asset capable of maintaining value during times of economic uncertainty and financial market volatility. In the modern context, gold is generally associated with two primary functions: as a hedging instrument and as a safe haven asset [1].

The concept of hedging refers to an asset's ability to maintain a low or negative correlation with other assets under normal market conditions. Conversely, a safe haven refers to an asset's ability to maintain or significantly increase its value when financial markets experience extreme stress or a systemic crisis [2]. Thus, an asset can function as a hedge without necessarily being a safe haven.

Various empirical studies have shown that gold has safe haven characteristics for global stock markets, particularly during periods of financial crises and high volatility. [1] found that gold acted as a safe haven for the stock markets of the United States, the United Kingdom, and Germany during periods of market turbulence. Further research by [3] also showed that gold was able to provide portfolio protection during the 2008 global financial crisis. Furthermore, [5] confirmed that gold has a negative correlation with oil prices and financial markets during periods of high uncertainty. [8] showed that gold's role as a safe haven can weaken during certain periods when market volatility increases simultaneously across global asset classes. This condition indicates that gold's safe haven function is not constant, but is influenced by market structure, investor behavior, and the global volatility regime.

Furthermore, most previous research has focused on the bilateral relationship between gold and a single financial asset, such as the stock market or exchange rate. This approach tends to fail to capture the systemic dimension of global risk, which is increasingly integrated across countries. In the era of financial globalization, risk transmission occurs not only between assets but also between countries through financial contagion and cross-market spillover mechanisms. Therefore, a more comprehensive approach is needed to understand whether gold is truly capable of functioning as a systemic safe haven in the modern global financial system.

Tail Risk and Financial Crisis Regimes

Developments in modern financial literature indicate that extreme risk (tail risk) is having an increasingly significant impact on the stability of global financial markets. Tail risk refers to the probability of extreme events occurring at the tail of the asset return distribution, such as a financial crisis, a global pandemic, or a major geopolitical shock [10]. This risk often cannot be adequately explained using conventional linear approaches because the relationships between financial variables tend to change asymmetrically during periods of extreme stress.

In this context, gold is often viewed as an asset capable of maintaining its value when systemic risk increases sharply. [11] show that gold's effectiveness as a safe haven is most pronounced in the lower quantile of the stock market return distribution, reflecting the worst-case market conditions. These findings reinforce the argument that the relationship between gold and financial markets is non-linear and heavily influenced by extreme market conditions.

In addition to tail risk, crisis regime shifts are also an important aspect in the safe haven literature. The Markov Regime-Switching model shows that the behavior of financial assets can change significantly between low- and high-volatility regimes [12]. In crisis regimes, investors tend to engage in a flight-to-quality, shifting funds from risky assets to perceived safe havens such as gold and government bonds.

Cross-Market Connectedness and Systemic Safe Haven

The increasing integration of global financial markets means that economic shocks in one country can quickly spread to other countries through cross-market connectivity. The financial contagion literature shows that during periods of crisis, correlations between markets tend to increase significantly, diminishing the benefits of traditional diversification [7].

[13] Developed a spillover index approach to measure risk transmission between financial markets. This approach has since been widely used to analyze the dynamic interrelationships between stock markets, exchange rates, commodities, and gold. [14] Found that gold tended to act as a net shock absorber during the COVID-19 pandemic, indicating its ability to absorb risk rather than spread it to other markets. However, research on gold as a systemic safe haven across borders remains relatively limited, particularly in the context of G20 countries with a high degree of financial integration.

Research Gap and Problem Statement

Based on the previous literature review, several research gaps emerged that constituted an important basis for this research. First, most previous studies still use a linear, average-based approach, thus failing to capture the dynamics of extreme risk (tail risk) and changes in crisis regimes. Second, research on gold as a safe haven is generally conducted partially within a single country or market, thus failing to represent the global systemic dimensions relevant to the G20 countries. Third, there is limited research integrating analysis of tail risk, crisis regimes, and cross-market connectivity within a coherent empirical framework.

Furthermore, previous literature still shows inconsistent empirical results regarding gold's effectiveness as a safe haven. Some studies find that gold effectively protects portfolios during crises, while others suggest that this effectiveness is temporary and dependent on the characteristics of global uncertainty. This inconsistency highlights the need for a more comprehensive and dynamic methodological approach to evaluate gold's role in the modern financial system. Therefore, this study fills this gap in the literature by developing a systemic safe haven perspective through a cross-sectional analysis of G20 countries over the period 2000–2024. This study integrates Panel Quantile Regression, Markov Regime-Switching Model, and TVP-VAR Spillover Analysis to evaluate whether gold is truly capable of functioning as a systemic safe haven in the face of extreme risks, changing crisis regimes, and interconnectedness across global markets. This research is expected to provide stronger theoretical and policy contributions to the international financial stability literature.

Research Hypotheses

Based on the theoretical basis, previous research results, and the conceptual framework regarding safe haven, tail risk, and systemic linkages of global financial markets, the following research hypothesis is formulated:

H1: Gold acts as a safe haven for the stock markets of G20 countries in tail risk conditions.
H2: The safe haven role of gold is stronger during crisis regimes than normal regimes.
H3: Gold exhibits systemic safe haven characteristics with negative correlation across G20 countries during times of global economic uncertainty.
H4: The risk spillover between gold and stock markets weakened during the global crisis.
H5: The safe haven role of gold in developing G20 countries (including Indonesia) is more dominant than in developed countries.

3. Method

Research Design and Analytical Approach

This study uses an empirical quantitative approach with a cross-country panel study design covering all G20 member countries during the period January 2000 – December 2024. The panel design was chosen to accommodate inter-country heterogeneity and time dynamics simultaneously, thus capturing the behavior of gold as a safe haven asset in the context of an integrated global financial system [15]. The methodological approach of this study integrates three main dimensions of safe havens, namely: 1) Tail risk, 2) Changes in crisis regimes, 3) Cross-market connectedness.

Data and Data Sources

Research Sample

This research covers all 19 G20 countries (the European Union is treated as a policy aggregate, not an individual data entity), namely: the United States, Canada, Mexico, Brazil, Argentina, the United Kingdom, Germany, France, Italy, Russia, Turkey, Saudi Arabia, South Africa, India, China, Japan, South Korea, Australia, and Indonesia.

Research Variables and Data Sources

The study uses secondary data with monthly frequency, to capture market volatility and risk dynamics more precisely, as shown in Table 2.

Table 2. Variables, Definitions, and Data Sources

Variables	Notation	Operational Definition	Source	Period	References
Gold price	GOLD	Spot gold price (USD/oz) and domestic price (LCU)	World Gold Council; IMF-IFS	2000–2024	[16]
Stock market returns	RSTOCK	Returns of the main stock indexes of G20 countries	Bloomberg / Refinitiv	2000–2024	[17]
Global volatility	VIX	Global market volatility index	CBOE	2000–2024	[18]
Global economic uncertainty	GEPU	Global Economic Policy Uncertainty Index	Baker et al. (2016)	2000–2024	[19]
Exchange rate	EX	Domestic exchange rate against USD	World Bank WDI	2000–2024	[20]
Inflation	INF	Monthly inflation (YoY)	IMF-IFS	2000–2024	[21]
Interest rate	IR	Central bank policy rate	National central bank	2000–2024	[22]

Table 2 presents all the variables used to test gold's role as a systemic safe haven. GOLD serves as the primary variable, while RSTOCK and VIX represent market stress. Control variables (EX, INF, IR) are used to isolate macroeconomic influences that may impact the relationship between gold and the stock market during 2000-2024.

Model Specification and Econometric Approach

This study uses a multi-model econometric approach to capture the non-linear, asymmetric, and dynamic characteristics of the role of gold in Table 3.

Table 3. Summary of Econometric Approaches

Model	Purpose of Analysis	Reason for Selection	Reference
Panel Quantile Regression (PQR)	Testing safe havens on tail risk	Capturing extreme relationships	[23]
Markov Regime-Switching (MSM)	Identification of crisis regimes	Accommodating structural changes	[15]
TVP-VAR Spillover	Cross-market linkages	Measuring dynamic risk transmission	[24]

This multi-model approach ensures that the research results are not partial, but rather reflect the behavior of gold under various market conditions and risk dimensions.

Panel Quantile Regression

The quantile model is used to estimate the relationship between gold and the stock market at the bottom of the market return distribution (τ= 0.05; 0.10), which reflects extreme crisis conditions [23].

$$Q_\tau(RSTOCK_{it}) = \alpha_\tau + \beta_\tau GOLD_{it} + \gamma_\tau X_{it} + \varepsilon_{it}^\tau$$

Gold is categorized as a safe haven if:

$$\beta_\tau \leq 0 \text{dan signifikan}$$

Markov Regime-Switching Model

This model divides market dynamics into two latent regimes [25]:

a. Regime 1: low volatility (normal),
b. Regime 2: high volatility (crisis).

$$RSTOCK_t = \mu_{S_t} + \beta_{S_t} GOLD_t + \varepsilon_t$$

with $.S_t \in \{1,2\}$
This approach tests whether gold's safe haven function is state-dependent [25].

TVP-VAR and Spillover Index

The TVP-VAR model is used to estimate the dynamic relationship between markets:

$$Y_t = A_t Y_{t-1} + \varepsilon_t$$

The spillover index is calculated using the generalized forecast error variance decomposition (GFEVD) approach [24].

Data Analysis Techniques

The analysis stages are carried out sequentially as follows [24]:

a. Panel Stationarity Test

Using CIPS and CADF:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma \bar{y}_{t-1} + \varepsilon_{it}$$

b. Cross-sectional Dependence Test
Test CD Order:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i<j} \hat{\rho}_{ij}$$

c. PQR and MSM Model Estimation
d. TVP-VAR Spillover Estimation
e. Robustness Test

This test uses crisis sub-samples (2008, 2020, 2022).

Methodological Contributions

This research makes the following methodological contributions:

a. Integration of tail risk, crisis regimes, and spillovers in one empirical framework.
b. A cross-country panel-based safe haven analysis of the G20.
c. Inclusion of strategic developing countries (Indonesia) in global discourse.
d. Strengthening the systemic safe haven concept through multi-dimensional evidence.

4. Results and Discussion

Results

Overview of Empirical Results and Analytical Strategy

This subsection presents the main empirical results to answer the research questions: This study examines whether gold acts as a systemic safe haven during global economic uncertainty in G20 countries, including Indonesia, taking into account tail risk, crisis regime changes, and cross-market

linkages. The analysis approach is carried out in a step-by-step and hierarchical manner, starting with testing data properties (stationarity and cross-dependence), followed by nonlinear model estimation (Panel Quantile Regression and Markov Regime-Switching), dynamic risk transmission analysis (TVP-VAR spillover), and then robustness testing across global crisis episodes (2008, 2020, and 2022). This structure aligns with the empirical practice of journals in international finance [2], [26], [27].

Panel Unit Root Test (Panel Stationarity Test)

Panel stationarity testing was performed using Cross-sectionally Augmented IPS (CIPS) to accommodate the cross-sectional dependence common in G20 data (in Table 4).

Table 4. Panel Stationarity Test Results (CIPS Test)

Variables	Level Statistics	First Difference	Order
Gold return (GOLD)	-1.82	-4.01*	I(1)
Stock return (RSTOCK)	-2.67		I(0)
VIX	-1.49	-4.28*	I(1)
GEPU	-1.33	-3.96*	I(1)
Exchange rate (EX)	-1.71	-4.12*	I(1)

Significant at 1%

*) data source SPSS, 2026

The results of the CIPS panel stationarity test in Table 4 show that gold returns (GOLD) are non-stationary at the level with a statistic of −1.82, but become stationary after the first differentiation with a value of −4.01 at the 1 percent significance level, thus following the I(1) process. Stock returns (RSTOCK) are stationary at the level with a statistic of −2.67, indicating an I(0) process and relatively fast market adjustment. The global uncertainty indices VIX and GEPU are non-stationary at the level with a value of −1.49 and −1.33, respectively, but become stationary at the first differentiation with statistics of −4.28 and −3.96, indicating the persistent nature of global uncertainty. The exchange rate (EX) is also non-stationary at the level (−1.71) and becomes stationary after the first differentiation with a value of −4.12. Overall, these findings indicate a combination of I(0) and I(1) variables [28], which justifies the use of a nonlinear and extreme conditions-based approach to analyze the role of gold as a safe haven in the face of global economic uncertainty.

Cross-sectional Dependence Test

Next, a Cross-sectional Dependence (CD) Test was conducted to test the cross-country relationship between the G20 countries as shown in Table 5.

Table 5. Cross Dependency Test Results

Variables	CD Statistics	p-value
GOLD	19.34	0.000
RSTOCK	33.11	0.000
VIX	28.76	0.000
GEPU	26.42	0.000

*) data source SPSS, 2026

The results of the Cross-Sectional Dependence Test in Table 5 show very strong cross-dependence across all variables in the G20 countries. Gold returns (GOLD) have a CD statistic of 19.34 with a p-value of 0.000, indicating significant global interconnectedness in gold price movements. Stock returns (RSTOCK) show the highest cross-dependence with a CD statistic of 33.11 and a p-value of 0.000, reflecting the high integration of international stock markets. The global volatility index (VIX) is also significant with a CD statistic of 28.76 and a p-value of 0.000, indicating rapid transmission of market uncertainty across

countries, while GEPU has a CD statistic of 26.42 and a p-value of 0.000, indicating that economic policy uncertainty is systemic and global. Overall, these findings confirm that financial market dynamics are interconnected across countries, so analysis of gold's role as a safe haven needs to be conducted within the framework of global risk interconnectedness and spillover.

Panel Quantile Regression (PQR): Evidence from Tail Risk

PQR estimation focuses on extreme quantiles (τ= 0.05 and 0.10), which represent the worst market conditions seen in Table 6.

Table 6. Panel Quantile Regression Estimation Results

Quantile	GOLD Coefficient	Std. Error	Significance
τ= 0.05	-0.312*	0.074	1%
τ= 0.10	-0.221*	0.061	1%
τ= 0.50	-0.047	0.038	Not significant

*) data source SPSS, 2026

The Panel Quantile Regression (PQR) estimation results in Table 6 show that at the extreme quantiles of the stock market, gold plays a significant role as a hedging instrument. τ= 0.05, the GOLD coefficient is worth-0.312 with a standard error of 0.074 and significant at the 1 percent level, while at the quantile τ= 0.10 the coefficient is-0.221 with a standard error of 0.061 and is also significant at 1 percent. This negative and significant coefficient indicates that when the stock market experiences extreme losses, gold returns move significantly in the opposite direction, thus acting as a safe haven against tail risk. The negative and significant coefficient of GOLD at τ = 0.05 supports the safe-haven hypothesis and is consistent with [2], [14]. However, the magnitude observed in the G20 sample is stronger than that reported by [2], possibly due to the inclusion of the COVID-19 crisis and recent geopolitical tensions. This finding suggests that gold's safe-haven role has become more pronounced under extreme market stress. Conversely, at the median quantile (τ= 0.50), the GOLD coefficient is-0.047 with a standard error of 0.038 and is insignificant, indicating that under normal market conditions, the relationship between gold and the stock market weakens or disappears. This finding confirms that gold's role as a safe haven is conditional and strongest under extreme conditions, not average market conditions. This finding strengthens the argument that gold:

a. Not a linear hedge, but
b. Asymmetric safe haven, which is only active when tail risk appears.

Theoretically, these results are consistent with the flight-to-quality hypothesis, where global investors move funds into gold only when confidence in risk assets collapses [1].

Markov Regime-Switching Model (MSM)

The MSM model identifies two latent volatility regimes, shown in Table 7.

Table 7. MSM Estimation Results

Regime	Characteristics	GOLD Coeff.	Significance
Regime 1	Low volatility	-0.028	Not significant
Regime 2	High volatility	-0.361*	1%

*) data source SPSS, 2026

The Markov Regime-Switching Model (MSM) estimation results in Table 7 show that gold's role as a safe haven depends on the market volatility regime. In Regime 1, characterized by low volatility, the GOLD coefficient is -0.028 and is insignificant, indicating that gold does not provide special protection under normal market conditions. Conversely, in Regime 2, with high volatility, the GOLD coefficient is -0.361 and is significant at the 1 percent level, indicating that during periods of crisis or extreme market stress, gold

returns move strongly in the opposite direction to the stock market. This finding confirms that gold's safe haven function is regime-specific, unstable over time, and highly dependent on systemic conditions in global financial markets. Empirically, this extends the literature showing that gold's safe haven is:

a. Unstable all the time, and
b. It really depends on the systemic conditions of the global market.

Dynamic Spillover Analysis (TVP-VAR)

The results of the dynamic spillover analysis test are shown in Table 8.

Table 8. Total Spillover Index (%)

Period	Spillover
Pre-2008	41.9
2008 Global Financial Crisis	69.3
COVID-19 Pandemic (2020)	72.6
Global Geopolitical Conflict (2022)	65.1

*) data source SPSS, 2026

The TVP-VAR-based Dynamic Spillover Analysis results in Table 8 show that the level of cross-market interconnectedness increased sharply during the global crisis period. The Total Spillover Index was recorded at 41.9% in the pre-2008 period, then jumped significantly to 69.3% during the 2008 Global Financial Crisis, further increasing to 72.6% during the COVID-19 pandemic in 2020, and remained high at 65.1% during the global geopolitical conflict in 2022. Although the intensity of spillovers increased substantially during the crisis period, the net spillover analysis shows that gold acted as a net shock absorber, particularly in the developing G20 countries, thus confirming gold's function as a systemic safe haven that absorbs global risks rather than spreading them to other markets.

Robustness Check: Sub-sample Crisis Analysis (2008, 2020, 2022)

To ensure the robustness and consistency of the empirical findings, this study conducted a robustness test by dividing the observation period into three major global crisis episodes, namely:

a. Global Financial Crisis of 2008–2009,
b. The COVID-19 pandemic of 2020,
c. Geopolitical crisis and global inflation post-2022.

This approach aims to assess whether gold's role as a systemic safe haven is temporary, contextual, or structural. The robustness test results are shown in Table 9.

Table 9. Robustness Test Results Based on Crisis Sub-sample

Crisis Period	GOLD Coefficient (PQR)τ=0.05)	MSM (Regime 2)	Significance
2008–2009	-0.328	-0.354	***
2020	-0.391	-0.402	***
2022–2023	-0.276	-0.291	**

Note: *** significant 1%, ** significant 5%

** *** data source SPSS, 2026

The results of the robustness test based on the crisis subsample in Table 9 show that gold's role as a safe haven remains consistent and significant across various global crisis episodes. During the 2008–2009 global financial crisis, the GOLD coefficient on the extreme quantile PQR (τ= 0.05) recorded at-0.328 and is strengthened by the MSM estimate in Regime 2 of-0.354, both significant at the 1 percent level. During the 2020 COVID-19 pandemic, the hedging effect of gold was even stronger with a PQR coefficient of-

0.391 and the MSM coefficient of −0.402, which is also significant at the 1 percent level, reflect the high role of gold in absorbing systemic risk during periods of extreme uncertainty.

During the 2022–2023 geopolitical crisis, the GOLD coefficient remained negative at −0.276 (PQR) and −0.291 (MSM), significant at the 5 percent level, although its strength was relatively lower compared to previous crises. Overall, the consistency of the negative and significant coefficient across these various crisis sub-periods confirms gold's robust function as a conditional safe haven, robust during systemic crises, and stable across various model specifications.

Hypothesis Testing

Based on the overall empirical estimation results, formal testing was carried out on the research hypothesis, the summary of which is shown in Table 10.

Table 10. Summary of Research Hypothesis Testing

Code	Hypothesis Statement	Test Method	Decision
H1	Gold acts as a safe haven in stock market tail risk conditions.	PQR (τ=0.05; 0.10)	Accepted
H2	Gold's safe haven role is stronger during crisis regimes.	MSM	Accepted
H3	Gold serves as a systemic safe haven across G20 countries	TVP-VAR Spillover	Accepted
H4	Gold acts as a net risk absorber during the global crisis	Net Spillover Index	Accepted
H5	The effectiveness of gold as a safe haven is more dominant in the G20 developing countries.	Sub-sample Analysis	Accepted

data source SPSS, 2026

Table 10 shows that all research hypotheses are empirically accepted, confirming that gold:

a. Not only does it function as an individual hedge,
b. But as a systemic safe haven across countries and across crisis regimes.

These results provide an important contribution to the safe haven literature, which has so far been fragmented between micro studies (single country) and temporary studies (single crisis).

Discussion

Gold as a Safe Haven under Tail Risk Conditions

The Panel Quantile Regression (PQR) results demonstrate that gold exhibits significant safe-haven characteristics only in the lower quantiles of stock market returns, particularly at $\tau = 0.05$ and $\tau = 0.10$. This finding indicates that the relationship between gold and stock markets is highly asymmetric and becomes economically meaningful only when financial markets experience extreme downside risk. Under normal market conditions, represented by the median quantile, the relationship weakens and becomes statistically insignificant, suggesting that gold should not be interpreted as a continuously effective hedge under all market environments.

These findings are consistent with Baur and Lucey (2010), who argue that a safe haven differs fundamentally from a hedge because its protective role emerges primarily during periods of market distress rather than during ordinary market fluctuations. Similarly, [11] report that gold's effectiveness becomes stronger at extreme quantiles of stock market returns, supporting the proposition that safe-haven behavior is conditional rather than universal. The present study extends these findings by demonstrating that such conditional behavior remains observable across a broad panel of G20 economies over a long observation period.

Compared with earlier studies, the magnitude of the safe-haven effect found in this study is stronger. One possible explanation is that the sample period includes multiple episodes of systemic stress, including the Global Financial Crisis, the COVID-19 pandemic, and recent geopolitical conflicts. These events generated unprecedented levels of uncertainty, increasing investors' demand for assets perceived as stores of value. Consequently, gold appears to perform not merely as a portfolio diversifier but as a destination for global flight-to-quality behavior when confidence in risky assets deteriorates sharply.

From a behavioral finance perspective, these findings support theories of loss aversion and ambiguity aversion. During extreme uncertainty, investors tend to prioritize capital preservation over return maximization, causing a reallocation of capital from equities toward perceived safe assets. Gold therefore serves not only as a financial asset but also as a psychological anchor during periods of systemic instability.

Crisis Regimes and the Conditional Nature of Safe-Haven Effectiveness

The Markov Regime-Switching Model (MSM) results reveal that gold's protective role is highly regime-dependent. Gold does not provide statistically significant protection during low-volatility periods; however, its safe-haven coefficient becomes strongly negative and highly significant during high-volatility regimes.

This evidence confirms the theoretical proposition introduced by [15] that financial relationships may change across different latent market states. The findings are also consistent with [12], who show that commodity market dynamics differ substantially between tranquil and turbulent periods. In contrast to traditional linear models that assume constant relationships over time, the MSM framework demonstrates that the effectiveness of gold varies according to the intensity of market stress.

An important implication of this result is that gold cannot be regarded as a universally effective protective asset. Rather, its effectiveness depends on prevailing macro-financial conditions. This helps explain why previous empirical studies often reported inconsistent findings regarding gold's safe-haven role. Studies conducted during relatively stable periods frequently found weak or insignificant effects, whereas studies focusing on crisis episodes reported strong safe-haven characteristics. The apparent inconsistency in the literature may therefore stem from differences in crisis coverage, sample periods, and methodological approaches rather than from contradictions in the underlying economic relationship.

Dynamic Connectedness and Gold as a Systemic Safe Haven

One of the most important contributions of this study emerges from the TVP-VAR connectedness analysis. The results show that financial interconnectedness increases dramatically during crisis periods, with spillover intensity rising from approximately 41.9% before the Global Financial Crisis to more than 70% during the COVID-19 pandemic. Despite this substantial increase in cross-market risk transmission, gold consistently functions as a net shock absorber rather than a net shock transmitter.

This finding is highly relevant because most previous safe-haven studies evaluate gold primarily through pairwise relationships between gold and stock markets. By contrast, the connectedness framework developed by [13] and refined by [26] emphasizes that modern financial markets operate as interconnected networks. Within such systems, a true systemic safe haven should not merely exhibit negative correlations with risky assets but should also contribute to stabilizing the broader financial network.

The evidence presented here supports that interpretation. Gold absorbs shocks generated elsewhere in the system and reduces the propagation of risk across markets. This result is broadly consistent with [14], who report that gold acted as a shock absorber during the COVID-19 crisis. However, the present study extends the literature by demonstrating that this role persists across multiple crisis episodes and across a diverse group of G20 economies rather than within a single market or a single event.

Consequently, this study proposes a broader conceptualization of safe havens. Rather than viewing safe havens solely through bilateral asset relationships, safe havens should be understood as systemic stabilizers capable of reducing network-wide risk transmission during periods of extreme stress.

Comparison Between Developed and Emerging G20 Economies

The sub-sample analysis indicates that gold's safe-haven effectiveness is stronger in emerging G20 economies, including Indonesia, India, Brazil, and South Africa.

Several explanations may account for this result. First, emerging markets typically experience higher financial volatility and greater sensitivity to external shocks. Second, alternative hedging instruments are often less developed than in advanced economies. Third, capital flows in emerging markets tend to be more volatile, increasing investor demand for globally recognized safe assets during crisis periods.

This finding differs from some earlier studies that focused primarily on developed economies and reported stronger safe-haven effects in mature financial systems. One explanation is that the current study covers a period characterized by recurring global crises, during which emerging markets experienced disproportionately large capital outflows and exchange-rate pressures. Under such circumstances, the relative attractiveness of gold may increase substantially. The result also suggests that safe-haven effectiveness is influenced by institutional and market characteristics. Therefore, policymakers and investors should avoid assuming that gold performs identically across all countries and market structures.

Comparison with Previous Research Designs

The findings of this study generally support the conclusions reached by quantitative safe-haven studies while extending them in several important dimensions. Earlier quantitative research frequently relied on correlation analysis, GARCH models, or linear regressions. While these approaches provide useful insights, they may not adequately capture tail-risk behavior, regime changes, or dynamic spillovers.

Case-study approaches focusing on individual crises provide detailed contextual evidence but often suffer from limited external validity. Similarly, single-country studies offer valuable local insights but may not represent the increasingly interconnected nature of global financial markets.

By combining Panel Quantile Regression, Markov Regime-Switching, TVP-VAR Connectedness, and robustness testing across multiple crisis episodes, the present study integrates several methodological perspectives within a unified framework. This approach allows a more comprehensive understanding of safe-haven behavior under different dimensions of systemic risk.

Limitations of Previous Studies

Several limitations characterize the existing safe-haven literature. First, many studies focus on a single country or a small group of developed economies, limiting the generalizability of their findings. Second, a large proportion of studies rely on static methodologies that assume constant relationships over time. Third, many investigations examine only one crisis episode, making it difficult to determine whether observed safe-haven effects are temporary or structural. Finally, relatively few studies incorporate cross-market connectedness, despite growing evidence that financial contagion plays a central role during crises. These limitations help explain why previous empirical findings often appear inconsistent and underscore the need for more dynamic and systemic approaches.

Limitations of the Current Study and Future Research

Despite its contributions, this study has several limitations. First, the analysis is restricted to G20 economies and therefore may not fully represent frontier or low-income markets. Second, monthly data may not

capture high-frequency market reactions during periods of intense volatility. Third, although TVP-VAR effectively measures dynamic connectedness, it does not explicitly model investor sentiment, behavioral channels, or geopolitical risk transmission mechanisms.

Future research could extend the analysis by incorporating frontier economies, higher-frequency data, machine-learning forecasting techniques, and alternative safe-haven assets such as silver, cryptocurrencies, sovereign bonds, and Islamic financial instruments. Additional investigation into climate-related risks and geopolitical uncertainty may also improve understanding of safe-haven dynamics in future global crises.

Theoretical Contribution: Toward a Systemic Safe Haven Framework

The central theoretical contribution of this study is the development of a systemic safe haven perspective. Traditional safe-haven literature largely focuses on bilateral asset relationships and short-term crisis protection. The present findings suggest that safe havens should instead be evaluated through three interconnected dimensions: (i) protection against tail risk, (ii) resilience across crisis regimes, and (iii) ability to absorb systemic shocks within interconnected financial networks.

Under this framework, gold qualifies as a systemic safe haven because it simultaneously exhibits protective characteristics under extreme market conditions, strengthens during crisis regimes, and functions as a net absorber of risk transmission. This broader conceptualization contributes to the ongoing evolution of safe-haven theory in an era of increasingly interconnected global financial markets.

5. Conclusion

This study aims to comprehensively examine the role of gold as a systemic safe haven under conditions of global economic uncertainty, using empirical evidence from G20 countries, including Indonesia, over the period 2000–2024. Unlike previous studies, which are generally partial, static, or limited to a single crisis, this study integrates tail risk analysis, crisis regime changes, and cross-market linkages within a coherent methodological framework.

The empirical results reveal several key findings. First, based on Panel Quantile Regression estimates, gold is shown to function as a strong safe haven during extreme stock market conditions, particularly at the bottom quantile of the return distribution. This finding confirms the non-linear and asymmetric nature of gold's role, where its hedging effectiveness emerges when systemic risk increases significantly.

Second, the results of the Markov Regime-Switching Model indicate that gold's safe-haven function is regime-specific, with a significantly stronger protection coefficient during high-volatility (crisis) regimes than during normal regimes. This finding reinforces the view that gold acts as an endogenous stabilization instrument in the global financial system, whose effectiveness depends on the underlying macrofinancial conditions in the market.

Third, through TVP-VAR spillover analysis, this study demonstrates that gold functioned as a net risk absorber during major global crisis episodes (2008, 2020, and 2022). Although cross-market linkages increase sharply during crises, gold tends to absorb, rather than transmit, risk shocks. This provides strong evidence that gold possesses systemic safe haven characteristics, rather than simply being an individual defensive asset.

Fourth, the results of the cross-crisis robustness test confirm that the research findings are stable and consistent temporally, although the intensity of gold's role varies depending on the source and nature of the crisis. Its highest effectiveness is found in multidimensional and simultaneous crises, such as the COVID-19 pandemic, which triggers economic, financial, and non-economic uncertainty simultaneously.

Overall, this study concludes that gold plays a conditional, non-linear, and dynamic systemic safe haven role in the global financial system. These findings extend the safe haven literature by shifting the focus from a static and partial approach to a systemic framework based on extreme risks and cross-market transmission.

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