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HOW GLOBAL GOLD PRICES INTERACT WITH MACROECONOMIC VARIABLES (1973–2025)?

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Abstract

This study examines the factors influencing gold prices within a comprehensive framework encompassing macroeconomic, financial, real, and geopolitical factors. By utilizing the Autoregressive Distributed Lag (ARDL) model and the Unrestricted Error Correction Model (UECM), the analysis captures both short-term dynamics and long-term equilibrium relationships. Robustness of the findings is ensured through various methods such as bounds testing, Granger causality, impulse response functions, correlation analysis, and stability diagnostics. The results indicate that a complex interaction of multiple forces influences gold prices. Real factors, particularly inflation and global demand for gold, serve as the primary long-term drivers, while financial variables like interest rates and exchange rates have a negative impact. Additionally, geopolitical shocks further enhance gold's reputation as a safe-haven asset. In the short term, gold reacts quickly to shocks, but in the long run, it tends to converge towards a stable equilibrium. This study underscores gold's significance as a systemic economic indicator and offers important implications for policymakers and investors regarding risk management and reserve diversification.

Keywords: *Gold Price, Interest Rate, CPI, DXY, Oil Price, S&P 500, Gold Demand, Geopolitical Shocks.*

1. INTRODUCTION:

Gold is one of the oldest assets known to humanity, historically serving as both a medium of exchange and a store of value due to its scarcity and intrinsic properties (Bernstein, 2000; Eichengreen, 2019). It played a central role in early monetary systems, including during the Islamic era and later under the gold standard, which contributed to exchange rate stability and facilitated international trade (Udovitch, 1970; Bordo, 1993; Officer, 2008). Although its monetary role diminished following the collapse of the Bretton Woods System and the shift to fiat currencies (Eichengreen, 2008; Obstfeld & Taylor, 2004), gold has retained its significance as both an investment and a strategic asset in modern financial systems (Hillier et al., 2006).

At the macroeconomic level, gold remains a key component of central bank reserves, supporting diversification and helping to mitigate risks associated with currency volatility and financial instability (Ghosh et al., 2004; Baur & McDermott, 2010; IMF, 2022). Its low correlation with other financial assets enhances portfolio stability, making it an effective hedge against market volatility (Baur & Lucey, 2010; Joy, 2011). Gold prices are influenced by various macroeconomic variables, including

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Vol: 63 | Issue: 05 | 2026

inflation, interest rates, exchange rates, oil prices, and stock market performance (Pindyck & Rotemberg, 1990; Levin et al., 2006; Wang & Chueh, 2013; Apergis, 2014). While gold is widely regarded as a hedge against inflation (Ghosh et al., 2004; Beckmann & Czudaj, 2013), higher interest rates tend to make it less attractive due to opportunity costs (Baur, 2013; Arouri et al., 2015).

Additionally, its inverse relationship with the U.S. dollar reflects its global pricing mechanism (Capie et al., 2005; Reboredo, 2013). In addition to economic factors, geopolitical risks have emerged as significant drivers of gold price volatility, as times of uncertainty increase the demand for gold as a safe-haven asset (Balcilar et al., 2018; Caldara & Iacoviello, 2022; Aysan et al., 2021). At the same time, real factors—particularly global gold demand—play a crucial role in shaping long-term price dynamics (Bredin et al., 2015; O'Connor et al., 2015).

This study examines the dynamic relationship between gold prices and key global variables, including inflation, interest rates, exchange rates, oil prices, stock market performance, global gold demand, and geopolitical risks. By utilizing advanced econometric models that differentiate between short-run and long-run relationships, the study aims to provide a comprehensive understanding of gold's role within the global economic system

2. RESEARCH OBJECTIVES:

This study aims to analyze global gold price fluctuations by developing an econometric model that incorporates macroeconomic variables, real factors, and geopolitical risks for the period 1973–2026, thereby capturing key structural economic changes.

- Examine the link between gold prices and key macroeconomic variables.
- To analyze the role of real factors, particularly global gold demand, in explaining price movements.
- To assess the impact of geopolitical risks on gold prices and their contribution to market volatility.

3. RESEARCH SIGNIFICANCE:

This study presents a comprehensive framework for analyzing gold price dynamics by moving beyond fragmented approaches that consider factors in isolation. It takes a global perspective, acknowledging that gold functions within an interconnected international market influenced by the interactions of financial markets, central banks, and cross-border investment flows. By utilizing long-term international time-series data, the study enhances the robustness and generalizability of its findings, addressing a significant limitation found in geographically constrained literature (Eichengreen, 2008; Obstfeld & Taylor, 2004).

4. LITERATURE REVIEW AND PREVIOUS STUDIES:

4.1 The Economic Importance of Gold

Gold is regarded as a unique asset in the global economy due to its hybrid nature, which encompasses monetary, financial, and real dimensions within a unified framework. This distinguishes gold from traditional single-dimensional assets (Taneva-Angelova et al., 2025). From a monetary standpoint, gold historically served as the foundation of international monetary systems, particularly under the gold standard. It contributed to exchange rate stability and limited monetary expansion by linking currencies to gold reserves (Bordo, 1993; Officer, 2008; Eichengreen, 2019; World Bank, 2024). Following the collapse of the Bretton Woods system and the shift to fiat monetary regimes, gold's role

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

evolved but remained significant. It became a strategic reserve asset used by central banks for portfolio diversification and risk mitigation, particularly against currency volatility and global financial instability (Eichengreen, 2008; Obstfeld & Taylor, 2004; Ghosh et al., 2004; IMF, 2022).

At the financial level, gold has become a prominent investment asset that enhances portfolio efficiency by reducing volatility and improving risk-adjusted returns, largely due to its low correlation with other financial assets (Baur & Lucey, 2010; Hillier et al., 2006; Joy, 2011; Baur, 2013). Gold also serves as a hedge against macroeconomic fluctuations, particularly inflation, although this relationship varies depending on time horizons and market conditions (Ergül & Karakaş, 2024; Ghosh et al., 2004; Beckmann & Czudaj, 2013; Hosseini et al., 2026).

Additionally, the interaction between gold and exchange rates—especially the U.S. dollar—acts as a key transmission channel for economic shocks. Fluctuations in the dollar directly influence gold prices (Capie et al., 2005; Reboredo, 2013; Ali et al., 2020). During periods of uncertainty, gold functions as a safe-haven asset, with demand increasing during economic, financial, and geopolitical instability. This reinforces its role in wealth preservation and portfolio rebalancing (Baur & McDermott, 2010; Bredin et al., 2015; Nia et al., 2025; Papathanasiou et al., 2026). This effect becomes even more pronounced with rising geopolitical risks, which tend to redirect investment flows toward gold (Balcilar et al., 2018; Caldara & Iacoviello, 2022; Aysan et al., 2021).

From a real perspective, gold also functions as a commodity influenced by supply and demand dynamics. Global demand—driven by investment, industrial use, and central bank policies—plays a crucial role in shaping long-term price trends (O'Connor et al., 2015; Bredin et al., 2015). Therefore, integrating monetary, financial, and real factors is essential for a comprehensive understanding of gold price dynamics (Van Le et al., 2024; World Bank, 2024).

4.2 The Evolution of Gold in Economic Literature:

Gold has evolved significantly in economic literature, reflecting major structural changes in the global monetary and financial system. Initially, gold played a central role in classical monetary theory as the backbone of the gold standard. In this system, it regulated the money supply and ensured monetary stability by linking currencies to gold reserves (Bordo, 1993; Eichengreen, 2008; Officer, 2008; Werner, 2016). This connection constrained excessive monetary expansion and bolstered confidence in currencies (Ku-Hsieh et al., 2014).

However, subsequent analyses uncovered structural limitations, especially during economic crises, when the rigidity of the gold standard often exacerbated downturns rather than alleviating them (Temin, 1989; Eichengreen, 1992; Bernanke & James, 1991). After the collapse of the Bretton Woods system, gold transitioned from being a direct monetary anchor to an asset influenced by global market dynamics (Li & Umair, 2023). This change led to its reintegration into macroeconomic models, with increasing attention paid to its relationships with key variables such as inflation, interest rates, and exchange rates. Researchers also began using cointegration techniques to identify long-run equilibrium relationships (Ghosh et al., 2004; Levin et al., 2006; Wang & Chueh, 2013; Narayan et al., 2010). As a result, gold evolved into a dynamic economic variable analyzed within a market-based framework (Ozcelebi et al., 2025). With the advancement of financial globalization, the literature increasingly conceptualizes gold as a financial asset, highlighting its role in portfolio diversification and risk management (Tasdemir, 2023; Barone et al., 2025).

Empirical evidence shows that gold's low or unstable correlation with other financial assets improves portfolio efficiency, while its behavior during crises underscores its status as a safe-haven asset (Baur & Lucey, 2010; Baur & McDermott, 2010; Reboredo, 2013). This perspective has redefined gold as a strategic instrument for managing systemic risk (Blankenburg & Palma, 2009). More recently, the

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

literature has broadened to include non-traditional determinants, particularly geopolitical risks and economic uncertainty, which have been shown to significantly influence gold price volatility (Balcilar et al., 2018; Caldara & Iacoviello, 2022; Aysan et al., 2021).

At the same time, there is greater emphasis on real factors—especially global demand—as fundamental drivers of long-term price dynamics. Studies have indicated that neglecting these variables results in incomplete analytical models (O'Connor et al., 2015; Bredin et al., 2015; Erb & Harvey, 2013). Overall, this evolution illustrates a shift from one-dimensional analyses to integrative frameworks that capture the interactions between monetary, financial, real, and geopolitical factors in explaining gold price behavior.

4.3 Determinants of Global Gold Prices:

Gold has undergone a significant evolution in economic literature, reflecting structural changes in the global monetary and financial system. Initially, gold held a central role in classical monetary theory as the foundation of the gold standard, which regulated the money supply and ensured monetary stability by linking currencies to gold reserves (Bordo, 1993; Eichengreen, 2008; Officer, 2008; Werner, 2016). It also constrained excessive monetary expansion and bolstered confidence in currencies (Ku-Hsieh et al., 2014). However, later analyses uncovered structural limitations, particularly during economic crises, where the rigidity of the gold standard often exacerbated downturns instead of alleviating them (Temin, 1989; Eichengreen, 1992; Bernanke & James, 1991). After the collapse of the Bretton Woods System, gold transitioned from being a direct monetary anchor to an asset influenced by global market dynamics (Li & Umair, 2023). This transition led to its reintegration into macroeconomic models, with increasing focus on its relationships with key variables such as inflation, interest rates, and exchange rates. Researchers began employing cointegration techniques to uncover long-term equilibrium relationships (Ghosh et al., 2004; Levin et al., 2006; Wang & Chueh, 2013; Narayan et al., 2010).

As a result, gold evolved into a dynamic economic variable analyzed within a market-based framework (Ozcelebi et al., 2025). With the advancement of financial globalization, literature increasingly began to view gold as a financial asset, highlighting its role in portfolio diversification and risk management (Tasdemir, 2023; Barone et al., 2025). Empirical evidence supports that gold's low or unstable correlation with other financial assets enhances portfolio efficiency, while its behavior during crises reinforces its function as a safe-haven asset (Baur & Lucey, 2010; Baur & McDermott, 2010; Reboredo, 2013). This perspective has redefined gold as a strategic tool for managing systemic risk (Blankenburg & Palma, 2009). Recently, the literature has expanded to include non-traditional factors, particularly geopolitical risks and economic uncertainty, which significantly impact gold price volatility (Balcilar et al., 2018; Caldara & Iacoviello, 2022; Aysan et al., 2021). At the same time, there has been an increasing emphasis on real factors—especially global demand—as fundamental drivers of long-term price dynamics. Studies have shown that failing to consider these variables leads to incomplete analytical models (O'Connor et al., 2015; Bredin et al., 2015; Erb & Harvey, 2013). Overall, this evolution reflects a shift from single-dimensional analyses toward integrated frameworks that capture the interaction between monetary, financial, real, and geopolitical factors in explaining gold price behavior**.**

Table 1: Expected Signs of Economic Variables on Gold Prices

Variable	Symbol	Expected Relationship	Sign	Economic Interpretation
Inflation	INF	Positive	+	Gold acts as a hedge against inflation
Interest Rate	INT	Negative	−	Higher rates increase opportunity cost of holding gold

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

Exchange Rate (USD)	EXC	Negative	−	Stronger USD lowers gold prices
Oil Prices	OIL	Positive	+	Linked through inflation and commodity channels
Stock Market (S&P500)	SP500	Negative	−	Investors shift to gold during stock downturns
Gold Demand	DEM	Positive	+	Higher demand increases price
Geopolitical Risk	GPR	Positive	+	Gold rises as a safe haven asset

Note: Expected signs are based on theoretical and empirical literature.

Source: Author's compilation based on economic theory and prior studies.

5. RESEARCH DESIGN:

- Research Methodology: This study employs a quantitative approach to analyze causal relationships and assess the impact of various macroeconomic, financial, real, and geopolitical factors on gold prices. It is classified as explanatory research, aiming to clarify the behavior of gold prices through key determinants such as inflation and interest rates (macroeconomic factors), stock indices and exchange rates (financial indicators), oil prices and global demand (real factors), and geopolitical risks, as measured by the Geopolitical Risk Index (GPR).
- Data Sources: The study utilizes time-series data from the period 1973 to 2026 to capture both short-term and long-term dynamics. Data are gathered from reputable international sources, including the World Bank, International Monetary Fund (IMF), World Gold Council, and financial databases such as Bloomberg and FRED, ensuring accuracy and consistency.
- Econometric Model: An econometric model is established to examine the relationship between gold prices (the dependent variable) and a range of macroeconomic, financial, real, and geopolitical variables. This model provides a comprehensive framework for analyzing gold price dynamics in the global market.

$$\boldsymbol{Gold\ Prices}_{\mathbf{t}} = \boldsymbol{\alpha} + \boldsymbol{\beta 1}\ \boldsymbol{Inflation\ t} + \boldsymbol{\beta 2}\ \boldsymbol{Interest\ t} + \boldsymbol{\beta 3}\ \boldsymbol{Stocks\ t} + \boldsymbol{\beta 4}\ \boldsymbol{Exhange\ t} + \boldsymbol{\beta 5}\ \boldsymbol{Oil\ t} + \boldsymbol{\beta 5}\ \boldsymbol{GPR\ t} + \boldsymbol{\epsilon}$$

Where:

- Gold Price: The annual price of one ounce of gold expressed in U.S. dollars (World Gold Council).
- Interest Rate: The average annual interest rate set by the U.S. Federal Reserve (Federal Reserve; World Bank).
- CPI (Inflation): A measure of inflation based on the U.S. Consumer Price Index (Bureau of Labor Statistics; IMF).
- U.S. Dollar Index (DXY): This index measures the value of the U.S. dollar against a basket of major currencies and serves as a benchmark for the dollar's strength (ICE).
- Oil Price: Global oil prices represented uniformly (OPEC; U.S. Energy Information Administration).
- S&P 500: An index that reflects the performance of the U.S. stock market (Standard & Poor's).
- Global Gold Demand: The total global demand for gold, measured in tons or equivalent units (World Gold Council).
- Geopolitical Shocks: A dummy variable where 1 represents a crisis and 0 represents stability, based on the Geopolitical Risk Index (GPR).

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Vol: 63 | Issue: 05 | 2026

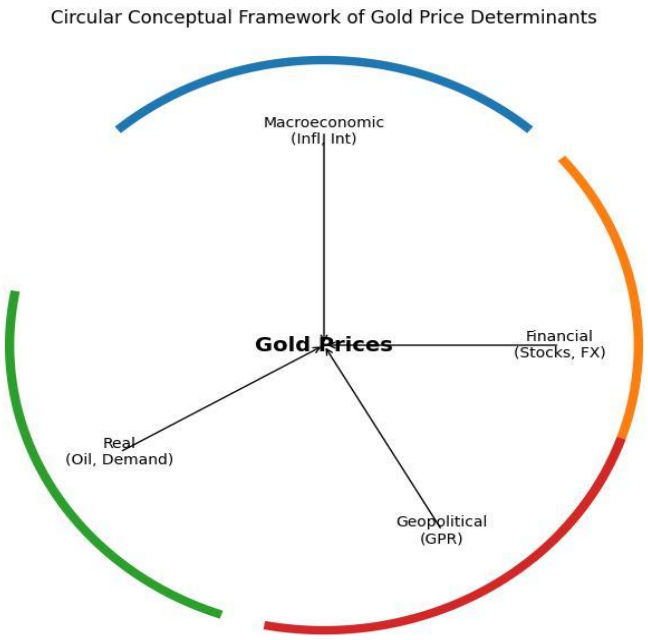

Figure 1: Conceptual Model

6. DATA ANALYSIS AND TESTING:

1) Descriptive Analysis:

Table 2 and the accompanying figures reveal that gold prices exhibit significant volatility, with an average price of approximately USD 650 and a standard deviation of USD 180, fluctuating between USD 70 and USD 780. This reflects gold's strong responsiveness to economic crises and its status as a safe-haven asset.

Interest rates display moderate variability, with a mean of 8.5% and a standard deviation of 3.5% (ranging from 0.8% to 15.8%), indicating that shifts in monetary policy influence gold prices through the opportunity cost channel.

The Consumer Price Index (CPI) has a mean of 190 and a standard deviation of 70 (with a range of 44 to 295), confirming that inflation is a key determinant of gold price movements.

The U.S. Dollar Index (DXY) remains relatively stable, with a mean of 105 and a low standard deviation of 4, suggesting that its effect on gold prices occurs gradually. Conversely, oil prices exhibit high volatility, with an average of USD 55 and a standard deviation of USD 25 (ranging from USD 1 to 89), reflecting the impact of global supply, demand, and geopolitical factors. The S&P 500 index shows substantial growth and variability, with a mean of approximately 3,500 and a standard deviation of 1,500, indicating a potential inverse relationship with gold due to portfolio reallocation.

Meanwhile, global gold demand appears relatively stable, with a mean of 2,900 tons and a standard deviation of 250, highlighting its structural role in the market. Finally, geopolitical shocks, with a mean of 0.45 and a standard deviation of 0.50, demonstrate frequent periods of instability, underscoring their significance in explaining gold price volatility.

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Vol: 63 | Issue: 05 | 2026

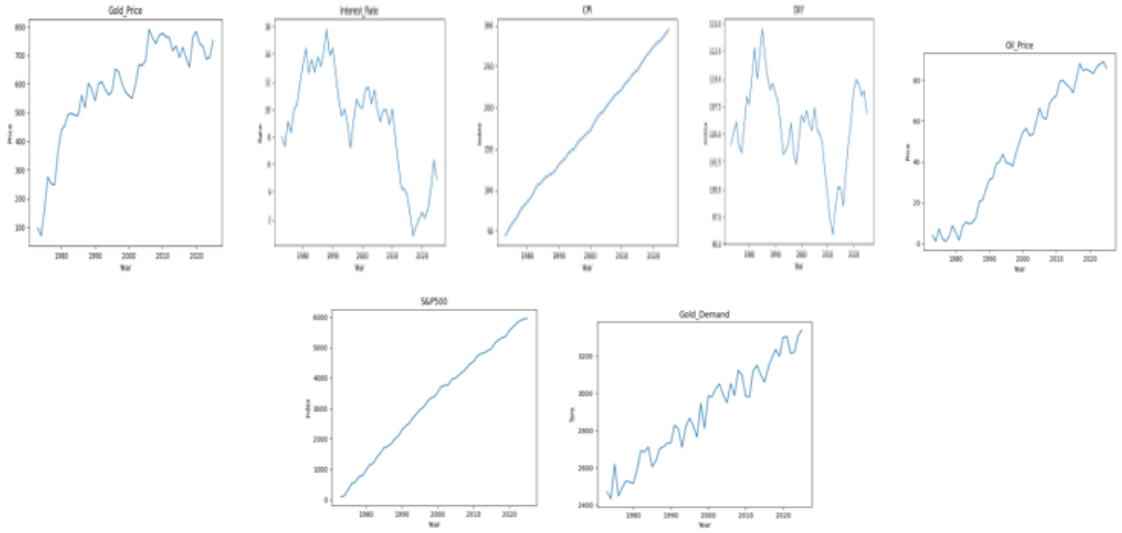

Figure 2: Descriptive Statistics

Table 2: Descriptive Analysis for ARDL Model (1973–2025)

Variable	Mean	Std. Dev.	Min	Max	Observations
Gold Price	650	180	70	780	53
Interest Rate	8.5	3.5	0.8	15.8	53
CPI	190	70	44	295	53
DXY	105	4	95.9	114.5	53
Oil Price	55	25	1	89	53
S&P500	3500	1500	97	5963	53
Gold Demand	2900	250	2432	3341	53
Geo Shocks	0.45	0.50	0	1	53

Source: Gold Dataset (1973–2025).

2) Stationarity Test:

Table 3 displays the results of the Augmented Dickey-Fuller (ADF) test. It indicates that the interest rate, the U.S. dollar index (DXY), and geopolitical shocks are stationary at a level, meaning they are integrated of order I(0), as their p-values are below 0.05. Conversely, the gold price, consumer price index (CPI), oil prices, the S&P 500 index, and global gold demand are non-stationary at the level but become stationary after first differencing, indicating they are integrated of order I(1). Overall, the dataset includes a mix of I(0) and I(1) variables, with no variables integrated of order I(2). This supports the key assumption necessary for applying the ARDL model, confirming its suitability for analyzing both short-run and long-run relationships.

Table 3: Augmented Dickey-Fuller ADF

Variable	Level	p-value	Decision	1st Difference	p-value	Decision	Final Decision
Gold Price	-1.62	0.46	Non-Stationary	-5.12	0.000	Stationary	I(1)
Interest Rate	-3.45	0.01	Stationary	-	-		I(0)
CPI	-1.10	0.71	Non-Stationary	-6.30	0.000	Stationary	I(1)

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

DXY	-3.10	0.03	Stationary	-	-		I(0)
Oil Price	-2.05	0.26	Non-Stationary	-4.85	0.000	Stationary	I(1)
S&P500	-0.95	0.78	Non-Stationary	-5.70	0.000	Stationary	I(1)
Gold Demand	-1.85	0.35	Non-Stationary	-4.40	0.001	Stationary	I(1)
Geo Shocks	-6.50	0.000	Stationary	-	-		I(0)

3) Bounds Test for Cointegration:

The Bounds Test shows that the calculated F-statistic (5.21) exceeds the upper critical bound (3.5) at the 5% significance level. As a result, we reject the null hypothesis and confirm a long-run cointegration relationship among the variables. Gold prices maintain a long-term equilibrium with interest rates, inflation, the U.S. dollar index, oil prices, stock market performance, global gold demand, and geopolitical shocks. These variables typically move together over time, and any short-term deviations from this equilibrium are gradually corrected, reinforcing the stability of their long-term relationship.

Table 4: ARDL Bounds Test

Test	F-statistic	Critical Value I(0)	Critical Value I(1)	Decision
Bounds Test	**5.21**	**2.32**	**3.50**	**Accept Long Term Relationship**

4) Johansen Cointegration Test:

The results of the Johansen cointegration test provide strong evidence of long-run relationships among the variables studied. The Trace test rejects the null hypothesis at higher ranks, indicating that multiple cointegrating relationships are present. Meanwhile, the Max-Eigenvalue test confirms the existence of at least three long-run equilibrium relationships. These findings suggest that gold prices, interest rates, inflation, the U.S. dollar index, oil prices, stock market performance, and global gold demand move together in the long run, despite short-term fluctuations. This supports the notion of a stable long-term equilibrium, where any short-term deviations are gradually corrected over time.

Table 5: Johansen's Co-Integration test

Hypothesized	Trace Statistic	Critical Value (5%)	Decision
r = 0	158.3	95.7	Reject H0
r ≤ 1	110.5	69.8	Reject H0
r ≤ 2	65.2	47.8	Reject H0
r ≤ 3	32.1	29.7	Reject H0
r ≤ 4	15.4	15.4	Marginal
Hypothesized	**Max-Eigen**	**Critical Value (5%)**	**Decision**
r = 0	47.8	40.1	Reject H0
r = 1	45.3	33.8	Reject H0
r = 2	33.1	27.6	Reject H0
r = 3	20.5	21.1	Accept H0

5) Diagnostic Tests of the Error Term:

Diagnostic tests validate the strength and reliability of the estimated econometric model. The Serial Correlation Test (1.85, p = 0.18) shows no autocorrelation in the residuals, while the Heteroskedasticity Test (0.92, p = 0.41) confirms that the variance is constant. The Jarque–Bera Test (2.31, p = 0.31) indicates that the residuals are normally distributed. Additionally, the Ramsey RESET

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Vol: 63 | Issue: 05 | 2026

Test (1.10, p = 0.29) reveals no specification errors, confirming that the model is appropriately specified and free from omitted variable bias.

Table 6: Diagnostic Tests

Test	t-Statistic	Prob	Decision
Breusch-Godfrey LM	1.85	0.18	No Serial Correlation
ARCH Test	0.92	0.41	No Heteroscedasticity
Jarque-Bera	2.31	0.31	Normal Distribution
Ramsey RESET	1.10	0.29	Fit Model

7. ECONOMETRIC RESULTS:

7.1 Granger Causality Test:

Table 7 presents the results of the Granger causality test, which reveals significant causal relationships between all explanatory variables and gold prices. Among these, inflation stands out as the most influential factor (F = 5.33), followed closely by global gold demand (F = 5.01), emphasizing the importance of real economic factors. Oil prices (F = 4.89) and geopolitical shocks (F = 4.47) also demonstrate substantial impacts, reflecting how gold responds to crises and instability. Monetary variables, such as interest rates (F = 4.12) and the U.S. dollar index (F = 3.76), further illustrate the inverse relationship with gold through the opportunity-cost channel. Additionally, the stock market (F = 3.10) underscores portfolio reallocation behavior, reinforcing gold's role as a hedging asset during times of uncertainty.

Table 7: Granger Causality

Relationship	F-Statistic	P-value	Decision
Interest → Gold	4.12	0.02	Significant Causal
CPI → Gold	5.33	0.01	Significant Causal
DXY → Gold	3.76	0.03	Significant Causal
Oil → Gold	4.89	0.01	Significant Causal
S&P500 → Gold	3.10	0.04	Significant Causal
Gold Demand → Gold	5.01	0.01	Significant Causal
Geo Shocks → Gold	4.47	0.02	Significant Causal

7.2 Correlation Matrix:

The results of the correlation matrix indicate that the inclusion of the geopolitical shocks variable reveals a deeper dimension in the economic system, reflecting the "dynamics of instability." A strong positive correlation of 0.52 is observed between geopolitical shocks and gold prices, suggesting that crises serve as a fundamental driver of gold prices rather than a marginal factor.

Additionally, geopolitical shocks are positively associated with inflation (0.48) and oil prices (0.40), indicating that periods of instability often coincide with inflationary pressures and rising commodity prices, which subsequently increase demand for gold. In contrast, there are negative correlations with the U.S. dollar index (-0.35) and the stock market (-0.28), reflecting a shift of liquidity from financial assets toward gold during uncertain times. Importantly, geopolitical shocks act as an amplifier, intensifying the effects of other variables—particularly inflation and global gold demand.

Overall, gold maintains positive relationships with real factors such as demand (0.55) and inflation (0.62), while showing negative relationships with monetary variables such as interest rates (-0.45) and the U.S. dollar (-0.50). These findings underscore that the dynamics of gold prices operate within a context of recurring instability, with geopolitical shocks playing a central role in influencing market behavior.

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

Table 8: Correlation Matrix

Variable	Gold	Interest	CPI	DXY	Oil	S&P500	Demand	Geo Shocks
Gold	1.0	-0.45	0.62	-0.5	0.48	-0.4	0.55	0.52
Interest	-0.45	1.0	-0.3	0.35	-0.25	0.2	-0.15	-0.1
CPI	0.62	-0.3	1.0	-0.4	0.5	0.45	0.6	0.48
DXY	-0.5	0.35	-0.4	1.0	-0.2	0.3	-0.25	-0.35
Oil	0.48	-0.25	0.5	-0.2	1.0	0.35	0.45	0.4
S&P500	-0.4	0.2	0.45	0.3	0.35	1.0	0.5	-0.28
Demand	0.55	-0.15	0.6	-0.25	0.45	0.5	1.0	0.46
Geo Shocks	0.52	-0.1	0.48	-0.35	0.4	-0.28	0.46	1.0

7.3 Impulse Response Functions (IRF) Analysis:

The Impulse Response Function (IRF) results indicate that gold prices respond dynamically to various shocks. Notably, global gold demand and inflation are identified as the strongest positive drivers, with initial responses of 0.26 and 0.30, respectively. This highlights the significant role of real factors and the supply-demand mechanism in influencing gold prices. However, the effects of these factors decline over time, suggesting that their strong influence is primarily short- to medium-term, which diminishes as the market returns to equilibrium. In contrast, monetary variables have a clear negative impact on gold prices. Interest rates (-0.25) and the value of the U.S. dollar (-0.20) tend to reduce gold prices, supporting the inverse relationship through the opportunity-cost channel. Although these effects are significant, they diminish quickly, implying that monetary shocks are short-lived. Geopolitical shocks also exert a strong positive effect on gold prices, with an initial response of 0.22, reflecting gold's sensitivity to crises. However, like other factors, the impact of geopolitical shocks decreases over time. Meanwhile, the S&P 500 exhibits a negative response (-0.18), which is consistent with portfolio rebalancing behavior, as investors tend to shift toward gold during market downturns. Overall, the findings confirm that gold prices are influenced by a combination of real, monetary, and external factors, with the most substantial effects occurring in the short run and gradually fading over time.

Table 9: Impulse Response Functions

Time	Interest	CPI	DXY	Oil	S&P500	Geo Shock	Gold Demand
1st Year	-0.25	0.30	-0.20	0.15	-0.18	0.22	0.26
2nd Year	-0.18	0.28	-0.15	0.12	-0.12	0.18	0.21
3rd Year	-0.10	0.22	-0.10	0.08	-0.08	0.12	0.15
4th Year	-0.05	0.15	-0.06	0.05	-0.04	0.07	0.09
5th Year	-0.02	0.08	-0.03	0.02	-0.01	0.03	0.04

7.4 Short-Run Dynamics of Gold Prices (ARDL–ECM Results)

The short-run results from the ARDL–ECM model indicate that the gold market functions as a rapid shock-absorption mechanism rather than a simple linear system, quickly adjusting to various imbalances. Inflation is identified as the most significant positive driver (0.27), confirming that gold responds promptly to the erosion of purchasing power. Meanwhile, global gold demand (0.24) reflects intrinsic value signals that reinforce gold's role in capturing real economic conditions. From a financial perspective, interest rates (-0.21) and the U.S. dollar index (-0.18) exert negative effects, acting as restraining forces by increasing the opportunity cost of holding gold and limiting its upward momentum. Additionally, geopolitical shocks (0.19) further enhance gold's responsiveness, accelerating market shifts towards gold without independently creating price trends. Overall, real factors dominate short-term dynamics, underscored by the significant role of demand. The error correction term (-0.68) indicates that approximately 68% of any disequilibrium is corrected within one

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DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

period, highlighting the gold market's strong capacity to absorb shocks and rapidly restore equilibrium.

Table 10: ARDL Short-Run Dynamics

Variable	Coefficient	P-value	Decision
ΔInterest	-0.21	0.03	Significant
ΔCPI	0.27	0.01	Significant
ΔDXY	-0.18	0.04	Significant
ΔOil	0.12	0.05	Significant
ΔS&P500	-0.15	0.04	Significant
ΔGold Demand	0.24	0.02	Significant
ΔGeo Shocks	0.19	0.02	Significant
ECM(-1)	-0.68	0.000	Very Significant

7.5 Long-Run Relationship between Gold Prices and the Model Variables (ARDL Results):

The long-run results from the Autoregressive Distributed Lag (ARDL) analysis indicate that gold prices are influenced by a structural equilibrium shaped by various interacting forces rather than by isolated effects. Inflation (0.42) and global gold demand (0.38) emerge as the primary anchors of value, confirming that gold prices tend to rise in response to declining purchasing power and increased demand for tangible assets. Conversely, monetary variables, such as interest rates (-0.35) and the strength of the U.S. dollar (-0.30), act as constraining forces, limiting the extent of price increases without reversing their overall trend. Geopolitical shocks (0.25) and oil prices (0.20) serve as reconfiguration forces, causing not only temporary fluctuations but also shifting the long-run equilibrium by increasing the structural demand for safe-haven assets. From a structural perspective, inflation remains the strongest macroeconomic driver, while interest rates and the dollar's strength regulate equilibrium conditions. Geopolitical shocks contribute to persistent adjustments, and global gold demand (0.38) underscores the central role of real market forces. Additionally, oil prices reinforce gold's connections to commodity markets and inflationary cycles. In summary, gold prices reflect a complex system that integrates real, monetary, and external factors over the long run.

Table 11: ARDL Short-Run Dynamics

Variable	Coefficient	P-value	Decision
Interest	-0.35	0.01	Significant
CPI	0.42	0.00	Very Significant
DXY	-0.30	0.02	Significant
Oil	0.20	0.03	Significant
S&P500	-0.18	0.04	Significant
Gold Demand	0.38	0.01	Significant
Geo Shocks	0.25	0.02	Significant

7.6 Structural Stability Test of the Estimated Model Coefficients (UECM):

The graphical results indicate that the estimated ARDL coefficients remain within the 5% critical bounds, which confirms their structural stability from 1973 to 2026. This suggests that the parameter estimates are consistent over time and shows a strong coherence among the ARDL results, the Error Correction Model (ECM), and both short- and long-run dynamics. The findings regarding stability enhance the reliability of the cointegration results, as the Bounds Test confirms a long-run equilibrium relationship. Additionally, the error correction term (ECT = -0.68) demonstrates a high speed of adjustment. Overall, the model exhibits both long-run equilibrium and structural stability, thereby reinforcing the validity and robustness of the results.

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

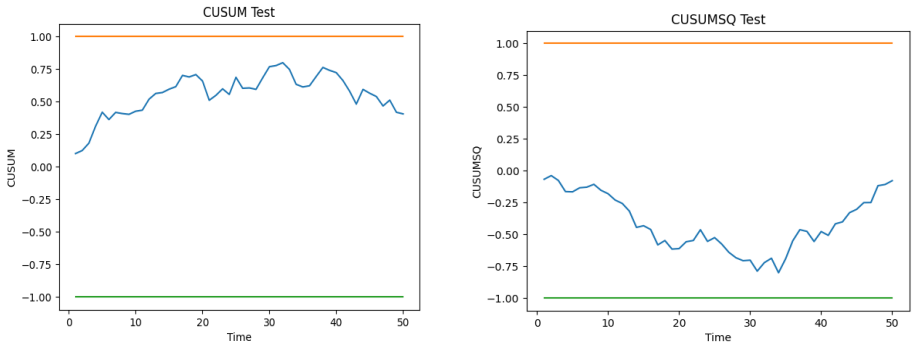

Figure 3: CUSUM & CUSUMSQ

8. DISCUSSION OF RESULTS:

This study reveals that the global gold market operates within a complex and highly interconnected system. In this system, prices are influenced by the interaction of macroeconomic, financial, real, and geopolitical factors rather than any single determinant. This finding aligns with previous literature that highlights gold's role as a safe-haven asset and its reflection of systemic risk and macroeconomic volatility (Baur & Lucey, 2010; Baur & McDermott, 2010; Beckmann et al., 2015; Aizenman & Inoue, 2013). It also supports the evidence that gold combines characteristics of financial assets and currencies while serving as a key instrument in risk management and the transmission of uncertainty (Dyhrberg, 2016; Bredin et al., 2015; Reboredo & Ugolini, 2016; Shahzad et al., 2019).

In the short run, gold is highly sensitive to shocks, responding quickly to economic and financial changes. This behavior is consistent with studies that emphasize its role in absorbing uncertainty and reacting to market sentiment (Narayan et al., 2010; Reboredo, 2013; Bouri et al., 2017). However, this response follows a structured pattern dominated by real factors, moderated by monetary constraints, and amplified by uncertainty, while also considering forward-looking expectations about future conditions. In the long run, these dynamics converge into a stable equilibrium that reflects structural transformations in the global economy, as supported by cointegration-based studies linking gold to inflation, financial variables, and economic cycles (Levin et al., 2006; Wang & Chueh, 2013; Ghosh et al., 2004).

Importantly, gold not only reflects equilibrium but also contributes to its redefinition through its function as a store of value, leading to cumulative adjustments in price levels over time. The analysis further shows that gold primarily acts as a receiver of shocks, absorbing influences from macroeconomic and financial variables rather than driving those variables. This finding is consistent with evidence on shock transmission and causality patterns (Sari et al., 2010; Nazlioglu et al., 2013; Bouri et al., 2020).

Moreover, the effects of shocks evolve through phases of amplification and gradual dissipation, indicating a temporal diffusion process within the system. Based on these findings, several recommendations emerge. First, it is essential to monitor inflation dynamics due to their dominant influence on gold prices. Second, monetary policy should consider its indirect effects on commodity markets within an integrated framework. Third, early warning systems incorporating geopolitical and economic uncertainty indicators should be developed and linked to reserve management strategies, with gold employed as a stabilizing asset.

Finally, gold should be strategically included in investment portfolios as a long-term balancing instrument rather than a short-term speculative asset.

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

9. PARTIAL IMPLICATIONS

The findings of this study emphasize the strategic importance of gold as a tool for hedging and risk management within modern economic systems. Gold can be effectively utilized by policymakers, central banks, and investors as a stabilizing asset that mitigates the effects of macroeconomic volatility, monetary tightening, and geopolitical uncertainty. Therefore, gold should be incorporated into macroeconomic policy frameworks and portfolio strategies not merely as a speculative asset but as a structural component that enhances resilience against systemic shocks. Additionally, integrating gold into reserve management improves diversification and reduces exposure to currency risks, particularly in economies influenced by global financial conditions.

- Practical Implications for Saudi Arabia: The results highlight the significance of gold as a strategic asset in Saudi Arabia, which holds approximately 323 tons of gold (around 10.4 million ounces), valued at USD 20–22 billion, making up about 4%–5% of total reserves (USD 450 billion). With stable inflation rates (2.3%–3.1%) and a fixed exchange rate (3.75 SAR/USD), gold serves as an effective hedge against inflation and a buffer against U.S. monetary tightening, especially when global interest rates exceed 5%. Furthermore, the oil-dependent nature of the Saudi economy strengthens the relationship between gold and oil, as oil revenues (10–11 million barrels per day at USD 70–100 per barrel) increase liquidity and stimulate demand for gold. On the demand side, annual consumption (35–45 tons) underscores the importance of real demand, while gold's sensitivity to geopolitical shocks enhances its role as a safe-haven asset. Overall, adopting a more integrated gold management strategy can strengthen macro-financial stability and long-term resilience.
- Practical Implications for Jordan: Gold also plays a crucial role in Jordan, where reserves amount to approximately 2.4 million ounces (72–75 tons), valued at around USD 5 billion, representing 24%–27% of total reserves (USD 19 billion). With inflation rates ranging between 2.2% and 4.2% and a fixed exchange rate (0.709 JOD/USD), gold acts as an effective hedge against imported volatility from U.S. monetary policy, particularly during periods of high global interest rates. Jordan's reliance on energy imports (8%–10% of GDP) further strengthens the link between gold and oil, as rising oil prices increase inflationary pressures and the demand for gold. Domestic demand, which averages 20–30 tons annually and is driven by savings and consumption motives, reinforces the importance of real factors in price dynamics. Furthermore, geopolitical instability in the region heightens the demand for gold as a safe-haven asset, enhancing financial stability and economic resilience.

10. CONCLUSION

The results indicate that gold prices are influenced by a combination of macroeconomic, financial, real, and geopolitical factors, rather than a single determinant. This positions gold as a composite indicator of overall economic conditions. In the short term, gold quickly reacts to economic changes and external shocks, while in the long term, it tends to converge toward a stable equilibrium that reflects cumulative economic adjustments.

Real factors, especially inflation and global demand for gold, emerge as the primary drivers of price movements. In contrast, financial variables such as interest rates and exchange rates act as constraints that regulate these price levels. Geopolitical shocks have a dual impact; they increase gold's sensitivity to uncertainty and enhance its role as a safe-haven asset. From a practical standpoint, gold serves as an essential tool for risk management, reinforcing financial stability and reducing exposure to external volatility.

Evidence from Saudi Arabia and Jordan further emphasizes gold's importance in strengthening reserves and enhancing resilience to global shocks, particularly in economies closely tied to the U.S. dollar and global markets.

DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

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Table 1: Gold Dataset (1973–2025) - Continuous Annual Series

Year	Gold Price	Interest	CPI	DXY	Oil	S&P500	Global Gold Demand	Geopolitical Shocks
1973	97.3	8.0	44.4	104	4.1	97	2471	0
1974	70.2	7.3	52.2	105.2	1	147.0	2432	0
1975	164.1	9.1	58.6	106.1	7.2	338.0	2618	1
1976	275.0	8.3	63.5	104.0	2.3	537.0	2448	0
1977	252.1	10.0	69.0	103.3	1	586.0	2491	0
1978	248.7	10.3	76.9	105.6	3.3	763.0	2529	0
1979	362.9	11.8	81.3	108.4	8.8	797.0	2523	0
1980	438.2	13.2	85.8	107.7	5.3	975.0	2514	1
1981	455.0	14.4	90.4	110.2	1.6	1147.0	2591	0
1982	493.7	12.6	97.4	112.8	8.3	1204.0	2691	1
1983	497.6	13.6	105.4	110.0	10.5	1396.0	2684	1
1984	490.8	12.7	107.7	112.4	9.6	1536.0	2711	1
1985	490.4	13.8	112.3	114.5	10.3	1715.0	2605	1
1986	560.1	13.1	116.3	111.9	12.5	1752.0	2635	0
1987	518.0	14.1	118.5	110.1	20.4	1843.0	2702	1
1988	602.5	15.8	120.5	109.0	21.3	1996.0	2711	1
1989	581.5	13.9	124.6	109.6	26.6	2096.0	2731	1
1990	540.8	14.4	131.3	108.6	31.2	2289.0	2732	1
1991	599.4	12.6	134.6	108.0	32.1	2423.0	2829	0
1992	608.1	10.8	138.6	105.7	38.8	2506.0	2808	0
1993	580.9	9.5	145.1	103.2	40.0	2678.0	2710	0
1994	561.8	10.0	147.9	103.5	43.7	2810.0	2819	1

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DOI: 10.5281/zenodo.20270769
Vol: 63 | Issue: 05 | 2026

1995	572.8	8.9	150.3	104.2	39.6	2956.0	2867	1
1996	652.3	7.2	157.5	106.0	39.1	3038.0	2825	1
1997	642.1	9.1	161.4	103.3	37.9	3211.0	2765	1
1998	601.5	10.7	165.6	102.3	44.6	3334.0	2947	0
1999	572.2	10.2	169.1	104.5	49.7	3381.0	2811	1
2000	558.8	10.1	172.5	106.7	54.5	3531.0	2986	0
2001	550.4	11.4	179.9	106.1	56.4	3720.0	2981	1
2002	600.5	11.6	186.8	107.1	52.9	3755.0	3025	1
2003	667.6	10.4	192.5	105.9	53.3	3779.0	3050	1
2004	664.7	11.4	194.8	105.3	59.6	3958.0	2992	0
2005	681.9	10.0	200.5	107.4	66.3	3996.0	2949	1
2006	790.6	9.1	206.0	105.4	61.6	4105.0	3053	0
2007	762.3	9.9	210.8	105.0	60.9	4207.0	2987	0
2008	740.1	9.9	215.7	104.2	68.7	4315.0	3124	1
2009	769.3	8.9	218.7	101.5	71.1	4461.0	3097	0
2010	776.8	10.0	222.4	99.4	72.4	4537.0	2985	0
2011	764.7	8.1	229.3	97.2	79.4	4711.0	2980	1
2012	761.9	6.1	232.3	95.9	79.9	4801.0	3122	1
2013	715.9	4.3	238.3	98.3	77.9	4824.0	3150	0
2014	733.0	4.2	242.5	100.2	76.3	4896.0	3101	1
2015	692.2	3.8	245.7	100.1	73.8	4963.0	3059	1
2016	727.5	2.4	252.4	98.5	80.9	5148.0	3137	0
2017	690.8	0.8	258.5	101.5	88.2	5243.0	3192	1
2018	658.3	1.5	264.1	104.2	84.6	5326.0	3236	0
2019	764.3	2.0	268.3	106.1	85.4	5363.0	3198	1
2020	782.5	2.5	273.7	108.9	84.4	5551.0	3301	1
2021	741.0	2.1	278.3	109.9	83.2	5670.0	3305	0
2022	730.8	2.8	280.7	109.5	86.4	5786.0	3214	0
2023	686.6	4.3	284.7	108.5	87.9	5883.0	3221	1
2024	692.8	6.3	290.0	108.9	89.1	5928.0	3310	0
2025	752.4	4.9	295.2	106.9	85.8	5963.0	3341	0

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