

Gold Futures Price Dynamics Study in the United States

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Abstract

Gold is one of the investment instruments that has an important role as a hedge asset in the midst of global economic uncertainty. The development of financial markets and increasing global volatility have made gold futures an increasingly actively traded instrument, especially in the United States market. This study aims to analyze the influence of the US dollar index, the United States stock market index (S&P 500), the Federal Reserve's interest rate, United States inflation, and world crude oil prices on the movement of world gold prices. This study uses monthly time series data for the period January 2010 to December 2025 with a quantitative approach. The analysis method used is the Error Correction Model (ECM) to identify long-term and short-term relationships between variables. The results of the study show that in the long term there is a cointegration relationship between macroeconomic variables and world gold prices. Empirically, the S&P 500 index and world crude oil prices have a significant influence on world gold prices, while the US dollar index, the Fed's interest rate, and US inflation do not show a statistically significant influence. Meanwhile, in the short term, all independent variables do not have a significant effect on world gold prices, but significant and negative Error Correction Term (ECT) values indicate a process of adjustment towards long-term equilibrium. These findings imply that world gold price movements are more influenced by the dynamics of financial markets and the energy sector than by conventional monetary variables, so it is important for investors and market participants to consider these factors in their investment decisions for gold futures.

INTRODUCTION

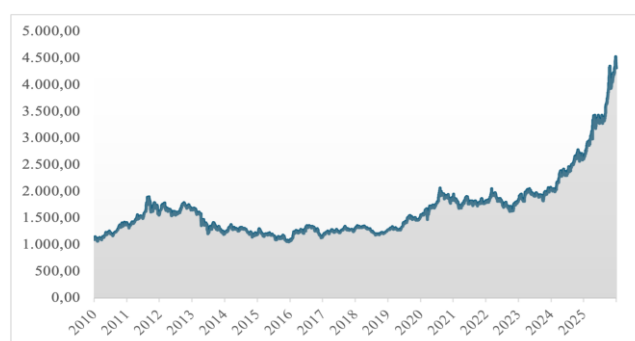
The development of the global economy in recent decades shows an increasing level of uncertainty due to various structural shocks, such as the international financial crisis, global pandemics, geopolitical conflicts, and changes in the monetary policies of developed countries. This condition triggers significant volatility in the financial market, especially the stock market, exchange rates, and commodities. This instability encourages global investors to shift their investment portfolios to instruments that are considered capable of maintaining the value of wealth and minimizing the risk of loss. One form of investment that has been known for a long time and is considered to remain relevant to this day is gold investment (Kalsum et al., 2021). In this context, gold occupies an important position as one of the assets *Safe Haven* which has historically been used as a hedge against inflation, currency depreciation, and global economic and political uncertainty (Purnawan & Puspitasari, 2021).

Theoretically, gold price movements are influenced by various macroeconomic variables that reflect the fundamental conditions of the world economy (Wahyuningtyas et al., 2025). The United States dollar exchange rate has a negative relationship with the price of gold because gold is traded in dollar denominations so that the strengthening of the dollar will reduce the purchasing power of non-dollar investors against gold. The Federal Reserve's policy interest rate also affects the price of gold through the mechanism *opportunity cost*, where rising interest rates increase the yield of interest-based assets thereby reducing the attractiveness of gold that provides less yield. On the other hand, inflation has a positive relationship with the price of gold because gold serves as a hedge against a decline in purchasing power (*Inflation Hedge*). In addition, the stock market

performance reflected in the S&P 500 index illustrates the level of investor confidence in risky assets, modern portfolio theory explains that investors diversify by including gold in their portfolios to reduce systematic risk, especially when the stock market experiences high volatility. Furthermore, oil prices also have a role in influencing the dynamics of gold prices through inflation and production costs. Rising oil prices increase transportation and production costs, which ultimately drives up the general price level (*cost-push inflation*). In conditions of rising inflation due to rising oil prices, investors tend to shift their portfolios to hedge assets such as gold. Thus, world oil prices can have an indirect effect on gold prices through inflation mechanisms and market expectations. These relationships are explained through several theories such as *Purchasing Power Parity*, *Opportunity Cost Theory*, *Inflation Hedge Theory*, and *Modern Portfolio Theory* which emphasizes diversification of investment risks.

However, these theories have not been able to fully explain the dynamics of gold prices in rapidly changing and complex economic conditions. The relationship between macroeconomic variables and gold prices is not always linear or stable between periods. Changes in monetary policy regimes, geopolitical uncertainty, and global financial market integration have caused the transmission mechanism between variables to become more dynamic. Under some conditions, a strengthening dollar is not always followed by a decline in gold prices, while rising interest rates do not necessarily suppress demand for gold significantly. The discrepancy between theoretical predictions and empirical reality shows that there is a *theoretical gap* in explaining the behavior of gold prices in the past decade. The following is a graph of the trend of gold price increases in the last decade.

Figure 1 Gold Price Increase Chart

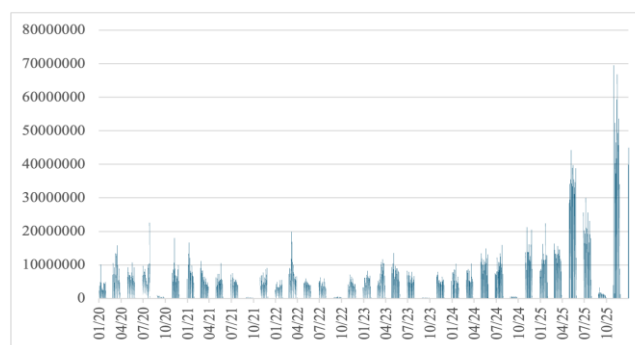


Source: Secondary Data processed

Factually, the world gold price has shown a significant upward trend in the past decade. In 2015, the world gold price was in the range of USD 1,073 per troy ounce, while in 2025 it will reach around USD 3,669 per troy ounce. This increase reflects that over a ten-year period, gold is able to provide relatively high returns compared to many other financial instruments. This condition strengthens gold's position as an asset that not only functions as a medium of exchange and store of value, but also as an attractive investment instrument for global investors, especially in periods of economic and financial uncertainty as expressed in portfolio theory (Fernando, 2017).

The increase in prices is not only influenced by physical demand factors, but also by increased trading activity in the derivatives market, in particular gold futures contracts (*Gold Futures*). A futures contract is an agreement between two parties to buy or sell an asset at a predetermined price and time in the future. This instrument allows market participants to make transactions without having to physically own gold, thereby increasing efficiency, liquidity, and market accessibility (Sharma et al., 2023). Among the various gold futures markets in the world, the United States market organized in COMEX (Commodity Exchange) has been the largest and most active since it was first introduced in 1974 (Xu & Zhang, 2019). The following is data on the volume of gold futures prices in the last 5 years.

Figure 2 Gold Futures Trading Volume



Source: Secondary Data processed

Based on the above data, gold futures trading on COMEX shows a high level of activity and reflects strong liquidity in the global commodity market. Based on trading statistics from CME Group over the past year, the average daily trading volume of gold futures contracts is generally in the range of 300,000 to 500,000 contracts per day, with fluctuations that can increase in periods of high market volatility. The high trading volume reflects the great interest of market participants in gold, both as a safe haven instrument and as a means of speculation in the global financial market. In addition, the fluctuating dynamics of trading volumes also show that the gold futures market is highly responsive to various global economic developments, such as changes in monetary policy, movements in the United States dollar exchange rate, inflation rates, and international financial market conditions (Fanchao Yu, 2023)..

A number of empirical studies have examined the factors that affect the price of gold, but have produced different findings. Studies conducted by (Qian et al., 2019) found that the US dollar exchange rate, US interest rates, oil prices, and the S&P 500 index had a negative effect on the price of gold, while inflation had a positive effect. (Haw et al., 2024) shows that the United States interest rate has a significant negative effect on the price of gold, while inflation has no significant effect. (X. Wang et al., 2022) proves that the S&P 500 index has a significant positive relationship with the price of gold, while interest rates, the U.S. dollar index, and world oil prices have a significant negative relationship, although the influence of interest rates is not always consistent. (Lucey et al., 2017) stated that in the long term gold has a significant positive relationship with inflation, but in the short term the relationship is unstable so that gold does not always serve as a hedge against momentary inflation spikes. Meanwhile, (Apergis et al., 2019) found that gold prices are able to function as a hedge instrument against real interest rate movements, especially in recession periods. The difference in the results of the study shows that the relationship between macroeconomic variables and gold prices is not single or constant, but varies depending on economic conditions and observation periods.

The inconsistency of the empirical findings indicates that there is an *empirical gap* that still needs to be studied further. Some studies only analyze long-term or short-term relationships separately, so they have not been able to explain the process of adjusting gold prices in a comprehensive way when economic shocks occur. In addition, the limitations of variables, the research period, and methodological approaches cause the results of previous research to not provide comprehensive conclusions regarding the determinants of gold prices, especially in the context of gold futures markets which have high volatility characteristics.

This condition shows the urgency of research that focuses on analyzing the relationship between macroeconomic variables and gold prices simultaneously in the short and long term. A more comprehensive understanding of gold price determinants is essential for investors in formulating portfolio diversification strategies, for futures market participants in managing trading risks, and for policymakers in maintaining financial system stability. Without adequate empirical analysis, economic decision-making has the potential to face greater uncertainty amid global market dynamics.

Based on this description, this study aims to analyze the influence of the United States dollar index, the S&P 500 stock market index, the Federal Reserve's interest rate, the United States

inflation rate, and world crude oil prices on world gold prices in the short and long term using the *Error Correction Model* approach (ECM). This approach was chosen because it is able to explain the long-term equilibrium relationship as well as the short-term adjustment mechanism, so it is expected to make a more comprehensive empirical contribution in understanding the dynamics of gold prices, especially in the gold futures market.

LITERATURE REVIEW

1. *Purchasing Power Parity*

Theory *Purchasing Power Parity* (PPP) explained that in the long run the exchange rate will adjust based on the difference in price levels between countries, so that changes in the purchasing power of a currency can affect international commodity prices (Mankiw, 2019). In the context of gold denominated in the United States dollar, fluctuations in the dollar index have direct implications for world gold prices. Theoretically, the strengthening of the dollar increases the price of gold for non-dollar investors so that it can affect global demand. A number of studies in the past decade have found a relationship between the dollar index and the price of gold, although it is not always consistent. (X. Wang et al., 2022) shows that the dollar index has a significant influence on the price of gold, while (He et al., 2020) found that the relationship is non-linear and can change in extreme market conditions. These findings suggest that although PPP provides a strong conceptual foundation, its transmission mechanism in the modern financial system is influenced by additional factors such as the dollar's role as a global safe asset and the dynamics of international capital flows.

2. *Modern Portfolio Theory*

Modern Portfolio Theory explains that investors can reduce portfolio risk through diversification of assets that have a low correlation (Ii et al., 2010). Within this framework, gold is often viewed as a diversified asset because its movement is not always in the same direction as stocks. When the stock market is under pressure or volatility increases, gold is often a relatively safer investment alternative. Empirical research shows mixed results. (Baur et al., 2010) Showing that gold can serve as a safe haven in periods of stock market turmoil. However, (X. Wang et al., 2022) found that under certain conditions stock indices and gold prices can move in the same direction, especially when global liquidity is high. This shows that the role of gold as a diversifier or safe haven is dynamic and depends on the economic regime and global market conditions.

3. *Opportunity Cost Theory*

Opportunity Cost Theory states that investment decisions are influenced by alternative yields available in the market. Because gold does not provide cash flows such as interest or dividends, rising interest rates increase the opportunity cost of holding gold and can affect its attractiveness relative to interest-based assets. Empirically, a number of studies have found a relationship between interest rates and gold prices, especially when real interest rates are a major indicator in investment decisions. (Apergis et al., 2019) indicates that gold prices react to changes in real interest rates, particularly in periods of economic uncertainty, while (Ergül & Karakaş, 2024) found that rising interest rates have an impact on the adjustment of gold prices within a given horizon. However, other research shows that the effect of interest rates is not always significant when monetary policy is expansionary or when inflation moves in tandem with interest rate hikes. This confirms that opportunity cost theory is relevant, but its effectiveness depends on the broader policy context and macroeconomic conditions.

4. *Inflation Hedge Theory*

Inflation Hedge Theory view gold as a hedge asset against a decline in purchasing power due to inflation. When the general price level rises and the real value of money decreases, investors tend to shift wealth to real assets such as gold which are considered more stable (Baur & Mcdermott, 2010; Mishkin, 2019). Several studies in the last ten years support gold's role as a hedge in the long term. (Lucey et al., 2017) shows that the relationship between inflation and gold prices is time-varying, where in the long run gold tends to retain purchasing power, but in the short term

the relationship is not always stable. (D'Silva et al., 2023) It also found that gold is more effective as a hedge against structural inflation than a temporary surge in inflation. These findings show that gold's role as an inflation hedge is not automatic, but is influenced by market expectations, the credibility of monetary policy, and the character of inflation itself.

5. *Cost-Push Inflation*

Theory *cost-push inflation* explained that rising production costs, especially energy prices such as crude oil, can drive inflation through increased distribution and production costs (Blanchard, O., & Johnson, 2023). Under these conditions, gold is often seen as an asset that can protect its value against inflationary pressures that come from the supply side. (Liang & Ullah, 2022) found the relationship between oil prices and gold prices in the context of global commodity dynamics, while Li et al. (2024) showed that the relationship can be asymmetrical and change depending on the level of energy market volatility. These findings indicate that oil prices are not only affecting gold through the path of inflation, but also through global risk sentiment and world economic growth expectations.

HYPOTHESIS DEVELOPMENT

1. The Influence of the US Dollar Index on Gold Price

The relationship between the US Dollar index and the price of gold can be explained through Purchasing Power Parity (PPP) which emphasizes that changes in exchange rates affect international relative purchasing power. Since gold is traded in dollar denominations, the strengthening of the dollar increases the price of gold in other currencies, lowering global demand and depressing gold prices. In addition, the dollar is also often seen as an alternative safe asset so that capital flows can shift from gold to dollar-based assets when the dollar strengthens. The empirical findings that support the tendency of such negative relationships are Research from (Seruni & Rizal, 2023) indicates that the dollar index has a negative effect on the price of gold in XAUUSD trading. In addition, other studies from (Afrian, 2025) It found that changes in the dollar exchange rate exert a significant and positive influence on the price of gold, although the direction of the relationship may differ under certain conditions. Furthermore, the research conducted by (Altarturi et al., 2018) indicates that changes in the USD exchange rate have a negative impact on the price of gold in the short to medium term. The difference in the strength of the relationship shows that there is a research gap that requires further testing in the context of global economic dynamics.

H1: The US Dollar Index has a negative effect on the price of gold.

2. The Influence of the S&P 500 Index on Gold Prices

In perspective *Modern Portfolio Theory*, rational investors will allocate a portfolio to a combination of assets that are able to maximize returns with a certain level of risk. Gold is generally positioned as a hedging asset (*Safe Haven*) whose performance tends to be the opposite of risky assets such as stocks. When the S&P 500 index gains reflecting increasing market optimism and risk preference, the allocation of funds to gold tends to decrease. This condition causes the price of gold to move in the opposite direction to the performance of the stock market. Empirical research conducted by (Jain & Biswal, 2016) shows a relationship that is not entirely consistent. Several studies have found a link between gold prices, exchange rates, oil, and the stock market in global economic dynamics. However, other research conducted by (Kurniawan & Zuhri, 2022) indicates that the influence of gold prices on the stock market or vice versa is not always significant, depending on economic conditions and observation periods. Then the research conducted by (Qian et al., 2019) shows the results that the stock market or the S&P 500 index has a negative and significant relationship to the price of gold, while other studies (X. Wang et al., 2022) show the opposite result, which is positive and significant. The variation in these results indicates that there is an empirical gap that needs to be reviewed.

H2: The S&P 500 Index has a negative effect on the price of gold.

3. The Effect of the FED Interest Rate on Gold Prices

The theoretical basis of this relationship is explained by Opportunity Cost Theory. Based on *The theory*, investment decisions are influenced by the comparison of returns between assets. The Federal Reserve's policy interest rate hike will increase the rate of return on interest-based instruments such as bonds and deposits, while raising the opportunity cost of holding gold which is considered to provide less income or yield. As a result, investors tend to shift their portfolios from gold to interest-bearing assets, which in turn suppresses demand as well as the price of gold. The results of empirical research show a tendency to negative relationships. Studies from (Qian et al., 2019; X. Wang et al., 2022) found that interest rate hikes have a negative and significant effect on gold prices, further research conducted by (Ergül & Karakaş, 2024) said that where an increase of 100 basis points the interest rate can lower the price of gold in real terms. In addition, the gold investment literature (World Gold Council, 2011) It also emphasized that the increase in real interest rates increases the opportunity cost of holding gold, thus depressing gold prices. Further research conducted by (Apergis et al., 2019) that gold prices can provide a hedge service against real interest rate movements, especially during recessions. However, there are other studies that show more complex relationships and are not always statistically strong, so there is still a research gap.

H3: The FED interest rate has a negative effect on the price of gold.

4. The Effect of United States Inflation on Gold Prices

The relationship between inflation and gold prices is explained by *Inflation Hedge Theory*, explaining that gold has historically been used as a hedge against a decline in purchasing power due to inflation. When the inflation rate increases, the real value of the currency decreases so investors look for assets that are able to maintain the value of their wealth. As a result, demand for gold increased in response to higher inflation expectations, which ultimately drove up gold prices. Previous research has shown mixed results. Studies conducted by (D'Silva et al., 2023; Lucey et al., 2017) found that inflation is positively and significantly correlated with long-term volatility in gold prices. But other research (Ergül & Karakaş, 2024; Haw et al., 2024) suggests that inflation can have a significant negative impact on gold prices in certain contexts, suggesting an unstable relationship between periods. Research conducted in Indonesia by (Kesarditama et al., 2020), indicating that inflation has even a significant negative effect on gold prices, although other variables such as oil and exchange rates remain influential. From these differences in findings, it confirms that there is a research gap that needs to be retested.

H4: US inflation has a positive effect on the price of gold.

5. The Effect of World Oil Prices on Gold Prices.

Rising world oil prices are often a source of inflationary pressure through the *cost-push inflation*, as rising energy costs will raise production and distribution costs broadly. In the framework *Inflation Hedge Theory* As well as global macroeconomic linkages, rising inflation due to surging oil prices encourages investors to increase their ownership of hedge assets such as gold. Empirically, research conducted by (Liang & Ullah, 2022) found that oil prices have a positive correlation with gold prices in the energy and commodity literature. Then the study of (X. Wang et al., 2022) shows the opposite, namely negative and significant. Furthermore, Other studies (Alfiyanti et al., 2016; Sajid, 2019) It also shows a dynamic relationship between oil prices, gold, and inflation in the long run. However, the relationship has not always been stable throughout the crisis period, so there is still empirical uncertainty that requires further testing.

H5: World oil prices have a positive effect on gold prices.

METHODS

This study applies a descriptive method with a quantitative approach that aims to describe and analyze the causal relationship between the variables studied in a clear and measurable manner. This approach is also known as the scientific method because it has fulfilled basic scientific principles, such as being concrete. Empirical, objective, measurable, rational, and systematic tau

(Scott, 2015). This research is focused in the United States on the analysis of factors that affect world gold prices during the period January 2010 to December 2025. The main focus of this study is to analyze the influence of independent variables, namely the US Dollar Index, the United States Stock Market Index, the S&P 500, the FED Interest Rate, US Inflation, and Crude Oil Prices. to the dependent variable, namely the World Gold Price, by reviewing historical relationships to predict future trends both in the long and short term.

The secondary data used in this study includes information about world gold prices, the US Dollar Index (DXY), the US stock market index (S&P 500), the Federal Reserve interest rate, the United States inflation rate, and world crude oil prices. The data analyzed is time series data with a monthly period starting from January 2010 to December 2025. All data used is obtained from official and credible institutions that provide international economic and financial data, such as Investing.com, Trading Economics, and international institutions such as the World Bank through its official website.

The time series data analysis method used in this study is the Error Correction Model (ECM). This approach acts as an econometric analysis tool used to measure the relationship between variables in the short and long term. In addition, this analysis is supported by a descriptive approach that aims to identify short-term and long-term relationships that arise due to the cointegration relationship between the variables studied (Basuki & Prawoto, 2016).

RESULTS AND DISCUSSION

Stationariness testing aims to ensure that time series data, both from dependent and independent variables, is in a stationary condition. One of the approaches used is the Augmented Dickey-Fuller (ADF) test. In this test, if the probability value is below the significance level of 5% ($\alpha = 0.05$), then the null hypothesis (H_0) is rejected, indicating that the data has been stationary. Conversely, if the probability value exceeds 0.05, then H_0 is not rejected, indicating that the data is non-stationary (Gujarati, 2003).

Table 1
Stationary Test Results

Variable	Level		Difference 1	
	Sig	Remarks	Sig	Remarks
World Gold Price (Y)	0.0040	Stationary	0.0000	Stationary
US Dollar Index (X1)	0.0000	Stationary	0.0000	Stationary
S&P 500 (X2)	0.6502	Not Stationary	0.0000	Stationary
The FED Interest Rate (X3)	0.4972	Not Stationary	0.0002	Stationary
United States Inflation (X4)	0.5862	Not Stationary	0.0000	Stationary
Crude Oil Price (X5)	0.3696	Not Stationary	0.0000	Stationary

From table 2, it can be seen that the results of the stationary test using the ADF method show that the world gold price and the dollar index are stationary at the level level, namely with a probability value of < 0.05 while for the S&P 500 variable, the United States interest rate, US inflation, and crude oil prices are not stationary with a probability value of > 0.05 . Because the data is not all stationary at the level level, a re-stationary test is carried out at the first difference level. The results of the stationarity test on difference 1 show that the World Gold Price, the US

Dollar Index, the United States Stock Market Index, namely the S&P 500, the FED Interest Rate, United States Inflation, and also the World Crude Oil Price, are all stationary with a probability value of < 0.05 each. After all the data has been stationary, the next ECM testing step can be carried out.

The cointegration test is used to identify the long-term relationship between economic variables. In this study, the cointegration test method was applied using the criterion that if the Trace Statistic value exceeds the Critical Value at a significance level of 5%, then it can be concluded that there is a cointegration relationship between the variables studied (Gujarati, 2003).

Table 2
Cointegration Test

Eigenvalue	Trace Statistic	0.05	
		Critical Value	Prob.
0.390513	164.7842	95.75366	0.0000
0.354987	106.8531	69.81889	0.0000
0.221926	55.55038	47.85613	0.0080
0.138008	26.19115	29.79707	0.1231
0.061805	8.815558	15.49471	0.3827
0.011483	1.351253	3.841466	0.2451

Based on table 3, it shows that the Trace Statistic value is greater than the Critical Value value which is $164.7842 > 95.75366$, so the variables in this study have been integrated, which means that there is a balance relationship in the long term. To determine the long-term impact of independent variables on dependent variables in this study, regression analysis using the Ordinary Least Squares (OLS) method was used through the EViews10 software. This test aims to identify the extent of the influence of the variables of the US Dollar Index, the United States Stock Market Index, namely the S&P 500, the FED Interest Rate, United States Inflation, and also the World Crude Oil Price on the World Gold Price which is the dependent variable.

Table 3
Long-Term Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.181297	0.424120	5.143115	0.0000
X1	0.000214	0.014731	0.014559	0.9884
X2	0.941834	0.034253	27.49627	0.0000
X3	-0.009848	0.005595	-1.760139	0.0811
X4	0.001554	0.005597	0.277637	0.7818
X5	-0.280658	0.043972	-6.382683	0.0000

Referring to Table 4, it can be seen that the variables of the S&P 500 (X2) and World Oil Prices (X5) have a significant influence, namely with a probability value of < 0.05 each, while the variables of the US Dollar Index (X1), the FED Interest Rate (X3) and also US Inflation (X4), which are shown with a probability value above 5% or 0.05.

The long-term regression equation from table 4 above, can be interpreted as follows:

1). The US dollar index, shows that the increase in the dollar index correlates with the increase in world gold prices, but the relationship is not statistically significant. Theoretically, based on

Purchasing Power Parity (PPP), currency exchange rates reflect the relative purchasing power between countries, so the strengthening of the US dollar indicates an increase in the purchasing power of the currency. Within this framework, an increase in the purchasing power of the dollar should reduce the attractiveness of gold as a hedge asset against currency depreciation, so it is theoretically expected that there is a negative relationship between the dollar index and the price of gold.

These results are also in line with (Zhou et al., 2018) and (Zhang et al., 2025) which found that the relationship between the value of the dollar and the price of gold is time-varying and tends to weaken when gold functions predominantly as a safe haven asset. In conditions of increasing global uncertainty, gold demand is more influenced by systemic risk factors, market sentiment, and investor expectations, than by changes in the purchasing power of the US dollar alone.

2). The S&P 500 index indicates that the increase in the US stock index correlates with the rise in world gold prices and that the effect is statistically significant. These findings are not in line with the initial hypothesis that predicted a negative relationship based on the assumption of gold as a safe haven asset that moves in the opposite direction to stocks. Nevertheless, these results do not contradict the framework of Modern Portfolio Theory. In the theory, the benefits of diversification are not determined solely by the direction of the relationship positively or negatively, but rather by how the combination of assets affects the total risk of the portfolio. As long as the movement of gold and stocks is not perfectly identical, gold can still act as a diversifier. The positive relationship found in this study is in line with the research conducted by (Drake, 2020; Mensi et al., 2023) which reflects the conditions of global liquidity expansion during the observation period, where the increase in demand for financial assets occurred simultaneously in both the stock and gold markets. Thus, these findings show that the role of gold is dynamic, not only as a safe haven in times of crisis, but also as an investment instrument that can move in the direction of the stock market in certain economic conditions.

3). The Fed's interest rate indicates that the policy of raising interest rates correlates with a decline in world gold prices. These findings reflect a negative relationship between interest rates and gold prices but are not significant. Economically, the condition can be explained through *Opportunity Cost Theory*, when interest rates rise, interest-based financial instruments such as government bonds and deposits become more attractive because they offer higher rates of return with relatively lower risk. As a result, the *opportunity cost* of holding gold increases, so investors tend to shift their portfolios from gold to interest-bearing assets. This shift lowers the demand for gold and ultimately depresses the price of gold in the global market. The mechanism is in line with the Keynesian view of liquidity preferences, where investment decisions are influenced by the ratio between the rate of return and risk between assets.

The results of the study showing that interest rates have a negative but not significant relationship to the price of gold are in line with several previous studies. (Aloui & Anis, 2023) found that interest rates have a negative relationship direction to the price of gold, but the influence is not always significant because the price of gold is also influenced by other macroeconomic variables such as the US dollar exchange rate and oil prices. In addition, (Lefatsa et al., 2025) It shows that the correlation between interest rates and gold prices tends to be weak, so its influence in empirical models is often insignificant. The findings reinforce the view of Opportunity Cost Theory which states that rising interest rates increase the opportunity cost of holding gold, although in practice this effect is not always statistically significant.

4). United States inflation, indicates that the increase in inflation correlates with the increase in the price of gold. Theoretically, based on *Inflation Hedge Theory*, gold is seen as an asset that is able to protect the value of wealth from a decline in purchasing power due to inflation. However, the results of this study are not significant and are in line with the research conducted by (Lucey et al., 2017) which states that it shows that the relationship between inflation and gold changes depending on the time period and economic conditions. This means that in certain periods inflation can increase the price of gold and in other periods the relationship weakens or is insignificant. Further research conducted by (Hong et al., 2020) that gold is not always a hedge against inflation in the long run, so the statistical relationship is often insignificant, this is because investors often buy gold not only because of inflation alone, but also because of financial crises, geopolitical uncertainty, and portfolio diversification.

5). World oil prices, these findings indicate that the increase in oil prices was followed by a decrease in gold prices during the observation period. These results are not in line with the initial hypothesis that predicts a positive relationship through the mechanism of inflationary pressure. But economically, this negative relationship can be explained through several transmission channels. Significant increases in oil prices often raise expectations of tightening monetary policy to tame inflation, such as rising interest rates. This is in line with research conducted by (D'Silva et al., 2023; Liang & Ullah, 2022) that the policy can strengthen the US dollar and increase the opportunity cost of holding gold which is considered to be less yielding, so that gold prices are under pressure. In addition, the surge in oil prices may reflect strengthening global economic activity that drives investors' preference for risky assets over hedge assets. In these conditions, the flow of funds can shift from gold to other financial markets.

Table 4
Short-Term Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.157663	0.261046	-0.603965	0.5471
DL(X1)	-0.008711	0.006844	-1.272872	0.2058
DL(X2)	0.138549	0.097164	1.425929	0.1568
DL(X3)	-0.012966	0.021677	-0.598140	0.5510
DL(X4)	0.002768	0.011058	0.250340	0.8028
DL(X5)	-0.022258	0.038610	-0.576485	0.5655
ECT	-0.129548	0.044933	-2.883102	0.0048

Based on table 5 above, it can be seen that in the short term all variables, namely the US Dollar Index (X1), S&P 500 (X2), the FED Interest Rate (X3), US Inflation (X4), and World Oil Price (X5) do not have a significant influence, this is shown by a probability value greater than the significance of 0.05 or 5%.

Furthermore, the short-term regression equation from table 5 above can be interpreted as follows:

1). The results of short-term regression show that the US Dollar Index has a negative influence on world gold prices, but this influence is not statistically significant. Theoretically, the negative relationship between the US dollar and the price of gold can be explained because gold is traded using the US dollar, so when the value of the dollar strengthens the price of gold tends to decrease. However, empirically, this influence is not always significant in the short term because the price

of gold is influenced by various other macroeconomic factors such as real interest rates, inflation, and global economic uncertainty. (Y. S. Wang & Chueh, 2013) explains that the price of gold is influenced by various macroeconomic factors so that the relationship with certain financial variables is not always significant. In addition, (Shaliha et al., 2025) indicates that the relationship between the US dollar and the price of gold is dynamic and can change according to market conditions. Therefore, although the direction of the relationship between the dollar index and the price of gold is in accordance with the theory, its effect in the short term may be insignificant.

2). The short-term regression results of the S&P 500 Index show a positive relationship to world gold prices, but these effects are not statistically significant. This indicates that in the short term, the movement of the United States stock index has not been able to have a strong impact on changes in world gold prices. Nonetheless, the positive correlation direction found suggests a tendency that an increase in the S&P 500 index could be followed by an increase in the price of gold. This condition may reflect the dynamics of the global financial market where increased liquidity and market optimism can drive an increase in demand for various financial assets simultaneously, both in the stock and gold markets. Research by (Drake, 2020) suggests that the relationship between gold and the stock market can change depending on economic conditions, and that in certain periods the two can move in the same direction especially when real interest rates are low or global liquidity increases.

3). The short-term regression results for the Fed's interest rate variable (X3) show a negative relationship to world gold prices, but these effects are not statistically significant. This indicates that in the short term the Fed's interest rate hike is likely to be followed by a decline in gold prices, although the impact is not strong enough to significantly affect gold price movements. Theoretically, the negative relationship is in line with the Opportunity Cost Theory, which states that an increase in interest rates will increase the attractiveness of interest-based financial instruments such as bonds or deposits because they offer a higher rate of return than gold which is considered less yielding. This condition increases the opportunity cost in holding gold, so investors tend to shift their investments to interest-bearing assets. However, in the short term the influence has not shown statistical significance and this is in line with the research conducted by (Y. S. Wang & Chueh, 2013) because the price of gold is also influenced by various other macroeconomic factors so that the relationship with certain financial variables is not always significant. Therefore, although the direction of the relationship between the Fed's interest rate and the price of gold is in accordance with economic theory, its influence in the short term is still relatively weak.

4). The short-term regression results for the United States inflation variable (X4) show a positive relationship to world gold prices, but these effects are not statistically significant. This shows that in the short term an increase in inflation tends to be followed by an increase in gold prices, although the influence is not strong enough to have a significant impact on the movement of world gold prices. Theoretically, this positive relationship is in line with Inflation Hedge Theory, which states that gold is often seen as an asset that is able to protect the value of wealth from a decline in purchasing power due to inflation. However, in the short term in line with research (Wijaya et al., 2025) that the influence of inflation on gold prices may be insignificant due to the dominant role of currency dynamics compared to inflationary conditions and oil price fluctuations in determining the behavior of gold prices during the observation period. Therefore, although the direction of the relationship found is in line with economic theory, the influence of inflation on gold prices in the short term is still relatively limited.

5). The short-term regression results for the world oil price variable show a negative relationship to the world gold price, but the effect is not statistically significant. This shows that in the short term oil price changes have not been fully reflected in the movement of gold prices in the global market. In line with research (Escribano et al., 2023) This condition can occur because the transmission mechanism between the energy market and the financial market usually takes time before influencing investment decisions and asset price movements. In the early stages, rising oil prices are likely to have an impact on the real sector through increased energy and production costs, while the impact on financial markets and the prices of other commodities, including gold, is only gradually visible. Research shows that the relationship between oil prices and gold prices is not always stable in the short term and often changes depending on economic conditions and a certain period of time (Liang & Ullah, 2022). In addition, some studies have also shown that changes in oil prices can affect the price of gold through various economic transmission channels so that the relationship between the two is not always direct and consistent over a shorter time horizon (Chen, 2025). Therefore, although in the short term the relationship found is negative and insignificant, the accumulated impact of oil price changes on global economic conditions can make the relationship between oil prices and gold prices clearer and more significant in the long term.

CONCLUSION

This study aims to analyze the influence of the US dollar index, the United States stock market index (S&P 500), the Federal Reserve's interest rate, United States inflation, and world crude oil prices on world gold prices using the Error Correction Model (ECM) approach. The results of the analysis show that in the long term there is a balanced relationship between these macroeconomic variables and the world gold price. Empirically, the S&P 500 index and world crude oil prices have proven to have a significant effect on world gold prices, while the US dollar index, the Fed's interest rate, and US inflation do not show a statistically significant influence in the long run. Meanwhile, in the short term, all independent variables did not show a significant influence on world gold prices, but the significant and negative Term Error Correction (ECT) values confirmed the existence of an adjustment mechanism towards long-term equilibrium when there were deviations due to economic shocks.

This research has several limitations, such as the limited use of macroeconomic variables. Therefore, further research is recommended to add other variables such as global economic uncertainty, financial market volatility, fiscal policy, and geopolitical factors. In addition, advanced research can also expand the scope of analysis by comparing the spot gold and gold futures markets or conducting cross-border analysis to gain a deeper understanding of gold's role as an investment and hedging instrument in various global economic conditions.

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