

Research Article

Determinants of Gold Prices in Indonesia: The Influence of Inflation, Exchange Rate, Oil Prices, Capital Market Performance, and Global Gold Prices (XAU/USD)

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Abstract. This study aims to analyze the determinants of gold prices in Indonesia (Antam) by examining the strength of the influence of inflation, exchange rates (USD/IDR), world oil commodity prices, capital market performance (IHSG), and world gold prices (XAUUSD). Using monthly time series data in a comprehensive time span from 2009 to 2025, this study applies two analytical approaches: Ordinary Least Square (OLS) to capture static relationships and Vector Autoregression (VAR) to capture the dynamics of reciprocal relationships and time lags between variables. The OLS estimation results show that statically, world gold prices and exchange rates are the most dominant main determinants in influencing domestic gold prices, while inflation does not show a significant effect instantly. However, through the VAR approach, information transmission dynamics are found where inflation has a significant positive effect on gold prices with a one-month lag (lag-1). This finding empirically proves that gold in Indonesia functions as an effective inflation hedge in a dynamic time frame. Furthermore, an Impulse Response Function (IRF) analysis revealed that inflation shocks require nine periods to return to equilibrium. This study concludes that the gold price formation mechanism in Indonesia is a result of global market integration and a response to dynamic domestic monetary stability.

Keywords: Antam Gold Price; Impulse Response; Inflation; Ordinary Least Square; Vector Autoregression

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1. Introduction

Gold (Aurum) has occupied a central position in human civilization for thousands of years, transitioning from a universal medium of exchange to a strategic investment asset in modern portfolios. Gold's investment value is multidimensional: it not only serves as a time-tested store of *value*, but is also widely recognized as a hedge against inflation and currency depreciation (Baur & Lucey, 2010) (Baur & Lucey, 2010). In a global economic climate filled with uncertainty, gold's role as a safe haven — a refuge for investors during market turmoil, financial crises, or geopolitical escalations—is becoming increasingly crucial. Gold ownership, whether by individuals, institutions, or central banks as part of foreign exchange reserves, reflects the importance of diversification and risk mitigation efforts in the global financial system.

Historically, gold prices have shown a significant long-term growth trend, reflecting their ability to maintain purchasing power. However, in the short and medium

term, their movements are characterized by substantial fluctuations. Historical data shows strong *bullish periods*, such as the aftermath of the 2008 global financial crisis and during the peak of the COVID-19 pandemic, when global gold prices reached all *-time highs*. Figure 1 below shows the movement of gold prices in rupiah per gram. Figure 2 shows the movement of gold prices in US *dollars* per *troyone*. However, gold prices are also susceptible to sharp corrections triggered by changes in market sentiment and monetary policy expectations. This high volatility reflects gold's sensitivity to various macroeconomic variables, making it a dynamic and complex subject of study for academics and market practitioners at the World Gold Council. (Andriyana, Tantular, Mindra, Nalita, & Falah, 2023)

The dynamics of global financial markets from 2009 to the end of 2025 presented an anomaly that challenged conventional economic theory. Theoretically, a tight monetary policy through a high *-for-longer interest rate regime* by the United States Federal Reserve (The Fed) should have strengthened the US dollar and suppressed the prices of non-interest-bearing commodities like gold. However, market reality shows the opposite phenomenon (*the gold paradox*); the global gold price (XAUUSD) has repeatedly set all *-time highs* amidst high opportunity *costs*.

In Indonesia, this phenomenon escalates even more sharply. As an emerging market *with* a high dependence on physical gold imports, global price transmission to the domestic market is not linear, but rather through a currency filter. The volatility of the Rupiah against the US Dollar often acts as an accelerator; when global gold prices rise and the Rupiah weakens, Antam gold prices in Indonesia experience a double-digit surge. Conversely, when global prices correct, a weakening local currency often restrains domestic price declines, creating an asymmetrical pattern of price movements.

The Indonesian context is crucial to examine as a representative *emerging market* for several strategic reasons. First, domestic investors still view gold as a primary inflation hedge *amid* macroeconomic uncertainty. Second, there is a close link between the energy commodity market (oil) and capital market performance (the Jakarta Composite Index), which influences investor risk sentiment. Third, the Indonesian market exhibits varying levels of sensitivity to different market conditions; investor reactions when gold prices plummet (*bearish*) differ significantly from those when prices reach their peak of euphoria (*bullish*).

A fundamental problem arises when previous research models tend to simplify this relationship within a linear framework that only considers average effects. However, to capture the complexity of global-to-local price transmission and the changing nature of the relationship across market conditions, a more precise approach is needed. The inability of conventional models to map the hierarchy of determinants under extreme conditions is what creates a research gap. Therefore, this study focuses on analyzing gold prices, which are then converted into gold returns and then... using the Quantile Regression approach *to* reveal the strength of the asymmetric influence of macroeconomic variables at various levels of market conditions in Indonesia.

Empirical studies on the determinants of gold prices have been a major focus in the financial literature over the past few decades. A large body of previous research has identified various factors suspected of influencing gold price movements. The general consensus points to key macroeconomic variables as the primary drivers. However, the findings of these studies often show mixed results, depending on the time period, methodology used, and market jurisdiction analyzed. Consistently studied variables include monetary policy indicators, currency exchange rates, other commodity prices, and alternative asset market performance (Ghazali, Zulkhibri, & Osman, 2015). More specifically, variables consistently investigated in the literature include monetary policy indicators, currency exchange rates, other commodity prices, and alternative asset market performance. A seminal study by Batten, Ciner, and Lucey (2010) makes a significant contribution to this field. They specifically analyzed the dynamic interrelationships between gold prices, crude oil prices, and the US dollar exchange rate, demonstrating that the relationship between gold and other asset classes is complex and often changes over time, particularly in response to market shocks (Batten, Ciner, & Lucey, 2010).

Among these factors, inflation and benchmark interest rates play a central role. Gold has traditionally been considered a hedge against inflation; theoretically, a rise in the Consumer Price Index (CPI) will boost demand for gold as a store of value, thus driving up its price. On the other hand, interest rates, particularly *the Federal Funds Rate (FFR)* set

by the US Federal Reserve, have a generally negative relationship with gold. Gold is a non-yielding asset, so rising interest rates will increase the opportunity cost of holding gold, which tends to depress its price. Many studies emphasize the importance of *real interest rates* — the nominal interest rate minus inflation expectations — as a more accurate (Batten, Ciner, & Lucey, 2010) predictor. (Baur & McDermott, 2010) Regarding real interest rates, Erb and Harvey (2013) in their comprehensive study, "The Golden Dilemma," provide a strong justification for this relationship. They argue that the real price of gold (the inflation-adjusted price of gold) tends to move inversely to the real interest rate. When real interest rates are positive and rising, investors prefer to hold interest-bearing assets, thus depressing the real price of gold. Conversely, when real interest rates become negative (as during periods of quantitative easing), the opportunity cost of holding gold disappears, which drastically increases its appeal and pushes its price up.

While interest rates aren't the primary independent variable in my regression model, they emerge in the qualitative discussion due to their inextricable causal relationship with inflation, known as the Fisher Effect. Inflation doesn't operate in isolation; when inflation rises, central banks (Bank Indonesia/The Fed) typically respond by raising interest rates. Gold investors view inflation not only as nominal interest but also as real interest rates, as reflected in the following equation: $\text{Real Interest Rate} = \text{Interest Rate} - \text{Inflation}$.

This means that if inflation is high and interest rates are low, the real rate is negative. If inflation is high but interest rates are raised even higher, but the real rate is positive, the price of gold will fall, and people will tend to buy deposits/bonds.

Researchers mention interest rates solely to explain the transmission mechanism of how inflation affects investors' decisions to buy or sell gold, not to make it the main focus.

Inflation Hedge Theory: Theoretically, gold is a real asset (*hard asset*) with a limited amount, unlike paper money (Rupiah) that can be printed by the central bank. Logically, when the inflation rate in Indonesia increases (reflected by the increase in the CPI), the purchasing power of the Rupiah decreases. Rp1,000,000 today buys fewer goods than last year, and investors' response to prevent their wealth from being eroded or decreased due to currency depreciation, investors shift their liquid assets such as cash/savings to gold. Because the demand for gold increases drastically as a hedge, the price of gold (Antam) will rise.

The Purchasing Power Parity Theory & Exchange Rate Transmission (Indonesia Specific) illustrates that in Indonesia, inflation is often correlated with exchange rate depreciation (Rupiah depreciation). Logically, local gold (Antam) is a derivative of global gold (XAUUSD) multiplied by the USD/IDR exchange rate. Therefore, the mechanism is that high domestic inflation usually causes the Rupiah to weaken against the US Dollar. When the Rupiah weakens, the conversion price of global gold to Rupiah becomes more expensive. Thus, inflation drives up gold prices through two channels: (1) Physical demand due to fear, and (2) Currency adjustment.

The relationship between inflation and gold prices has been a long-standing debate in the financial literature with mixed results, reinforcing the urgency of this research. The research gap with previous research findings, compared to this research plan, is first, the supporting group (Significant Positive Influence), as many studies confirm the theory of "Gold as an Inflation Hedge." Classic research or studies conducted by Ghosh et al. found that in the long run, gold returns move in line with the US inflation rate, proving that gold is a store of value (Ghosh, Levin, Macmillan, & Wright, 2004).

In Indonesia, research conducted by Sari & Abundanti (2016) showed that the inflation rate has a positive and significant effect on gold returns in the Indonesian market. This indicates the behavior of Indonesians who tend to run to gold when prices of basic necessities rise (inflation), because gold is considered the most liquid and safe asset compared to property (Sari & Abundanti, 2016). Opponent/Neutral Group (No Influence/Negative): However, there are studies that find anomalies, namely the latest studies by Widiyatmoko & Anggraeni (2023) or Wicaksono (2018) sometimes find that inflation does not have a significant effect in the short term with the logical reason that this occurs because modern investors have other hedging instruments (such as Cryptocurrency or Foreign Stocks). In addition, if inflation is considered "controlled" by the

government (low/stable inflation), people do not feel the need to rush for gold in a panic, so that gold prices do not react to small inflation fluctuations.

Therefore, this study uses Quantile Regression to mediate this debate. It is hypothesized that inflation may have no effect when the gold market is flat (middle quantile), but will have a very strong and positive effect when the gold market is *bullish* or during economic shocks (extreme quantiles/dramatic declines). This validates gold's role as a hedge only under certain conditions.

Currency exchange rates, particularly the United States Dollar (USD), also have a significant influence on gold prices. Gold is traded globally in USD. As a result, there is a strong inverse relationship *between* the USD exchange rate (often measured by the Dollar Index/DXY) and gold prices. When the USD strengthens against other major currencies, gold becomes relatively more expensive for investors holding non-USD currencies, potentially reducing global demand and depressing gold prices. Conversely, a weakening USD tends to make gold cheaper, which can stimulate demand (Joy, 2011). This inverse relationship has been confirmed historically by various studies. Capie, Mills, and Wood (2005) examined long-term data and found strong evidence that gold consistently moves inversely to the value of the US Dollar. Their study reinforces the idea that gold serves not only as a hedge against inflation, but also specifically as a hedge *against* US Dollar depreciation. When the US Dollar declines, global investors seek alternative *safe-haven assets* other than the USD, and gold becomes the primary choice (Capie, Mills, & Wood, 2005). Wang, K.M., & Chueh, Y.L. (2013) Wang and Chueh (2013) examined the dynamic transmission effects between interest rates, the US dollar exchange rate, and gold prices to understand the short-term and long-term causal relationships. This study concluded that the appreciation of the US dollar consistently had a negative impact on gold prices, proving the existence of a strong price transmission mechanism from the money market to the commodity market. In addition, this study found that past fluctuations in interest rates and exchange rates can be used to predict future gold price movements, indicating that monetary policy and exchange rate stability are crucial leading indicators for gold (Wang & Chueh, 2013) *investors*.

In addition to monetary factors, energy commodity prices, particularly global crude oil (such as WTI or Brent), have been identified as having a positive correlation with gold prices. This relationship can be explained through several transmission channels. First, rising oil prices are often a leading indicator *of* future inflation, which then drives gold demand. Second, both gold and oil are considered sensitive to geopolitical uncertainty and risk. Escalating conflicts, particularly in oil-producing regions, often drive simultaneous price increases for both commodities in response to the *flight-to-safety phenomenon*. (Sari, Hammoudeh, & Soytas, 2010) The link between the oil and gold markets has also evolved with the increasing 'financialization' of commodities, with both being traded intensively on financial markets. This relationship extends beyond responses to shared macroeconomic or geopolitical factors to include information and volatility spillovers *between* the two markets. Persistent increases in crude oil prices are often interpreted by market participants as a strong signal of future global inflationary pressures, which directly increases gold's appeal as a hedge (Zhang & Wei, 2010).

The Dynamics of the Gold-Oil Relationship: Between Integration and Divergence. Theoretically, the relationship between crude oil and gold prices is assumed to be positive due to the inflation transmission channel. However, empirical evidence is not entirely consistent. There is academic debate as to whether gold and oil always move together (integrated) or whether they have no significant relationship in certain periods. The first group, Significant Positive Results (Inflation & Petrodollar Theory), this research group supports the conventional view that rising oil prices trigger global inflation, which then encourages investors to buy gold as a hedge. The findings in this study indicate a strong long-term *cointegration relationship*. Shocks to oil prices are significantly transmitted to gold prices. The main researchers supporting this theory are (Zhang & Wei, 2010) and (Sari, Hammoudeh, & Soytas, 2010). They found that in the long run, oil prices lead gold price movements. The second group, which states Insignificant/Weak Results (*Phenomenon Decoupling (Decoupling)*), this group discovered an anomaly where the relationship between the two commodities weakened or disappeared altogether. They argued that this often occurs when the market is dominated by stock market sentiment or tight monetary policy, causing investors to ignore the inflationary factor of oil. In a rapidly growing economy without high inflation (*a Goldilocks economy*), oil can rise (due to industrial demand) while

gold falls (due to *risk-on*). The main researchers who stated this were (Reboredo, J. C., 2013) and (Bampinas & Panagiotidis, 2015). They highlighted that the dependence of these two assets is not constant over time. Identifying *the Research Gap* here can actually be raised, namely the inconsistency of the results above, Positive vs. Insignificant indicates a methodological *Research Gap*. Most previous studies used linear models that assumed a fixed relationship (*constant parameters*). In fact, the gold-oil relationship may be asymmetrical, where gold may react strongly when oil prices spike sharply (an energy crisis), but not react at all when oil prices move normally/flat.

Investigating the impact of oil price shocks on gold returns by separating oil shocks into their supply and demand components, their results reveal an interesting nuance: oil shocks caused by high global demand (*demand shocks*) tend to have a positive impact on gold, but supply-side shocks often produce insignificant or mixed responses. This study highlights a gap in research that not all oil price increases respond equally to gold prices, depending on the underlying causes of the movement and the surrounding macroeconomic conditions (Le & Chang, 2012).

Capital market performance, often represented by major stock indices (e.g., the Jakarta Composite Index (JCI), or the S&P 500 for global markets), exhibits a dynamic relationship with gold. This relationship is often negative, reflecting gold's role as a diversification asset. During periods of market optimism and risk-on sentiment, when equity returns are high, investors tend to shift capital from gold to riskier assets such as stocks. Conversely, during periods of uncertainty, high volatility, or stock market corrections (*risk-off*), demand for gold increases sharply as a portfolio hedge (Baur & McDermott, 2010). This role of gold as a *safe haven asset*, as opposed to simply a hedge, has been extensively tested, particularly following the 2008 Global Financial Crisis. Studies have found that the negative correlation between gold and equities is not constant, but rather becomes particularly strong during periods of extreme stock market stress or high volatility. During normal market periods, gold may move in line with other assets, but during systemic shocks, gold proves to be one of the few assets capable of providing capital protection, with investors massively turning to gold when confidence in other risk assets collapses (Ciner, Gurdgiev, & Lucey, 2013).

The relationship between stock market performance and gold prices is often assumed to be negative based on traditional portfolio theory (*flight-to-safety*). However, modern empirical literature shows highly contradictory results, ranging from a strong negative relationship, positive (moving in the same direction), to no relationship at all. The first group, namely Significantly Negative Results (Gold as a Substitute), this group supports the theory that gold and stocks are substitute assets that compete for investor funds. Reza et al., who used the *Non-linear ARDL model* to study stock markets in developing and developed countries, found that stock market performance has a significant negative impact on gold prices, both in the short and long term. Their findings indicate an asymmetry, when the stock market is *bullish* (rising), gold prices tend to fall deeper because investors move their capital to riskier assets to chase profits (*yield chasing*), a classic validation of the substitution effect (Raza, Shahzad, Tiwari, & Shah, 2016).

The second group of results is significantly positive (Wealth Effect), this group found an anomaly where gold and stocks actually move up or down together. Hood and Malik (2013) examined the role of gold in the US market and found that although gold functions as a hedge *under* normal conditions, stock market volatility often has a positive *spillover* on gold volatility. That is, in situations of extreme liquidity panic (such as the beginning of a crisis), investors sell *all* assets including gold to get cash, causing stock and gold prices to fall together. Conversely, the "Wealth Effect" *can* also cause a positive relationship: when the stock market rises high, investors feel wealthier and use some of their stock profits to buy gold as a diversification, so that both rise (Hood & Malik, 2013). The third group of results is insignificant (*Decoupling/Segmentation*), where this group argues that gold and stocks are two segmented markets with different fundamental factors. They analyzed *intraday* and daily data in the European market, finding that in many periods, there is no significant causal relationship between the stock market and gold. Their conclusions imply that gold price movements are more often driven by idiosyncratic factors (such as jewelry demand or mining supply) than by stock market sentiment, so that gold often moves independently (*decoupled*) from stock market performance (Gurgul & Lach, 2012).

Research Gap Identification The author sees inconsistencies in the above research results, such as the limitations of the Linear Model: Studies such as Gurgul & Lach (2012) which found "insignificant" results may be due to using a model that looks at the average of the entire data. They failed to capture that the relationship may only emerge during market stress. Second, Extreme Market Conditions, Raza et al.'s (2016) research has already touched on non-linearity, but has not specifically mapped how this relationship changes at each price quantile level, namely when very low vs. when very high. Therefore, the contribution of this dissertation is to fill this gap with *Quantile Regression*. The author hypothesizes that capital market performance may not affect gold during *sideways market conditions*, explaining the results of Gurgul & Lach, but will have a strong negative effect during a stock market *crash*, explaining Raza's results, and may be positive when liquidity is overflowing. This detailed mapping is one of the novelties of this study.

In a global context, the primary gold price reference is the spot gold price on the international market, represented by the symbol XAU/USD. XAU is the ISO 4217 code for one *troy ounce* of gold, and USD indicates that the price is quoted in US dollars. This price reflects trading in the global *Over-the-Counter (OTC) market*, with the *London Bullion Market Association (LBMA)* as its center. It is important to distinguish this XAU/USD price from local physical gold prices, such as the gold bar price released by PT Aneka Tambang Tbk (Antam) in Indonesia. Antam's gold price (in Rupiah per gram) is a derived price influenced not only by the XAU/USD price, but also by the USD/IDR exchange rate, as well as additional cost components such as certification fees, production, distribution, taxes, and sales margins (spreads) set by the seller (Baur & McDermott, 2010). Suhartono & Suman in this research focusing on the Indonesian market, the authors analyze the price transmission mechanism from the international gold market (London) to the domestic market (Antam Precious Metals) using the *Vector Error Correction Model (VECM)* method. Their primary focus was to test the validity of the *Law of One Price and how quickly the domestic market responds to global price changes. The study's conclusions confirmed a positive and significant (long-term) cointegration relationship, meaning that in the long run, local gold prices consistently follow global trends*. However, they also found that in the short run, adjustments are not instantaneous, with domestic prices needing time to absorb international price shocks, demonstrating that the local market acts as a price follower *with a lag*. (Suhartono & Suman, 2019) Ibrahim examined the dynamics of gold investment in an emerging market (Malaysia), focusing on the interaction between domestic gold prices, stock market risk, and currency exchange rates. The study highlighted that in emerging markets, gold prices in local currencies do not simply reflect global gold prices but are heavily distorted by exchange rate fluctuations (Ringgit against USD). His conclusion suggests that local currency depreciation often amplifies domestic gold price increases during crises, making the domestic exchange rate a confounding variable *that can deviate or appear "exaggerated"* compared to global gold movements (Ibrahim, 2012). Blose's research takes a different perspective by focusing on the *cost of carry model* and inflation expectations as drivers of gold prices. He tested whether gold prices move due to changes in actual inflation or due to investor speculation. His findings were quite surprising and supported the "insignificance" argument under certain conditions: Blose concluded that gold prices do not react significantly to unexpected changes in the Consumer Price Index (CPI) (inflation surprises). Instead, gold prices are driven more by fluctuations in interest rate expectations and the opportunity cost of holding gold. This explains why in some periods, the increase in world gold prices (due to speculation) was not followed by real economic fundamentals, causing a *gap* or a lack of synchronicity in short-term price movements (Blose, 2010).

Understanding the complexity of the interactions between various macroeconomic variables and gold prices is crucial, especially considering the still-different findings in the literature. Therefore, this study aims to comprehensively analyze the influence of key determinants on gold price movements in Indonesia. Specifically, this dissertation will examine and quantify the impact of Indonesia's inflation rate, Bank Indonesia's interest rate policy, the US Dollar exchange rate (DXY), global crude oil prices, and the performance of the Indonesian capital market (IHSG) on gold price fluctuations. In this study, the researcher added the global gold price (XAU/USD) as a factor that also influences gold prices in Indonesia. This relationship is unique because in theory it should be mechanical (perfectly positive), but empirical data often shows anomalies. *Transmission of Global to Local Gold Prices: Between Theory and Market Reality*. Fundamentally, local gold prices (such as Antam) are derived from global gold prices. *The Law of One Price* and

Purchasing Power Parity theories assume that changes in the XAU/USD price should be directly and positively transmitted to domestic prices. However, empirical research results do not always show this.

The novelty of this research lies in mapping the asymmetric relationship between global and domestic macroeconomic variables on gold price returns in Indonesia through the application of Quantile Regression. Unlike previous studies that tended to treat the Indonesian gold market as homogeneous, this research demonstrates that the factors driving gold prices have different hierarchies of power at specific *quantiles*.

Furthermore, the integration of XAUUSD (World Gold) and the USD/IDR exchange rate into a single asymmetric model provides a novel contribution to understanding the transmission mechanisms of global prices to local markets under extreme market conditions. This novelty is expected to deconstruct traditional understandings of gold stability and offer new perspectives on portfolio risk management in emerging *markets*.

As a synthesis of the complexities outlined above, the dynamics of gold returns in Indonesia are a manifestation of the interrelated interactions between domestic inflation stability, exchange rate vulnerability, global energy price shocks, and sentiment transmission from capital markets and international *spot prices*. The volatile and non-linear characteristics of financial data suggest that the relationship between these macroeconomic determinants and gold *returns* is not static, but rather changes asymmetrically depending on the current distribution of returns (low, normal, or high). The limitations of conventional linear models in capturing phenomena at the extreme points of the distribution drive the urgency of using the Quantile Regression approach. Through this method, the research aims to deeply unravel the hierarchy of influence of each variable, thereby producing a comprehensive empirical mapping to provide a precise scientific basis for investors in navigating decision-making amidst global economic uncertainty.

Although numerous studies have been conducted on the determinants of gold prices, a fundamental research gap exists in the current literature. The majority of previous studies (e.g., Ghosh et al., 2004; Sari & Abundanti, 2016) use conventional linear approaches such as *Ordinary Least Squares* (OLS), which assume that the relationship between macroeconomic variables and gold prices is static and symmetric across market conditions. However, the volatile nature of financial data and the asymmetric nature of investor behavior that tends to react differently to shocks indicate that linear models often fail to capture the dynamics of extreme market conditions. This study aims to fill this gap by using a Quantile Regression approach. Through this method, the study not only examines the average effect but also examines how the strength of these determinants changes across various levels of gold *returns*—from bearish to normal to bullish *market conditions*. This is crucial for providing a more precise picture of gold's effectiveness as a hedging instrument in Indonesia.

2. Review Literature And Hypothesis

Influence Asymmetric Inflation to Reward Gold Return

Inflation is a fundamental determinant affecting the purchasing power of a domestic currency. Theoretically, the transmission of inflation to gold yields is driven by gold's role as an *inflation hedge*. However, this effect is believed to be asymmetric; under conditions of high inflation (upper quantile), investors tend to flee assets massively to gold, while under conditions of stable inflation, the effect may be insignificant. The use of Quantile Regression allows identifying the threshold of investor sensitivity to these inflation expectations.

The main argument linking inflation to gold prices is gold's role as an inflation hedge. Logically, inflation is a general increase in the prices of goods and services, which effectively erodes the purchasing power of fiat currencies (such as the US Dollar). Because gold is a real asset with a limited supply and globally recognized intrinsic value, it cannot be devalued by central bank policy (unlike currencies that can be printed). Therefore, when investors anticipate or witness rising inflation, they will shift some of their wealth from paper-based assets (cash, bonds) to gold to maintain their purchasing power. This increased demand then drives up the gold price (XAUUSD). Previous research, such as that by Ghosh, Levin, Macmillan, and Wright (2004), has empirically tested this relationship, finding that gold can indeed function as a hedge against inflation, although

its effectiveness can vary depending on the time period and market conditions (Ghosh, Levin, Macmillan, & Wright, 2004).

A deeper argument goes beyond inflation itself and focuses on the concept of real interest rates, which are essentially nominal interest rates minus the inflation rate. Gold is a non-yielding asset, thus competing directly with interest-bearing assets like US government bonds. When inflation rises sharply and is not matched by a commensurate rise in nominal interest rates, real interest rates will fall or even become negative. In this scenario, the *opportunity cost* of holding gold (which has a zero yield) becomes very low compared to holding bonds, which have a negative real yield. This triggers investors to flee from bonds and cash to gold, causing its price (XAUUSD) to rise. A study by Baur and McDermott (2010) supports this dynamic, identifying gold as a strong *safe-haven asset*, particularly during periods of economic stress when real interest rates are often depressed by inflationary shocks or accommodative monetary policy (Baur & McDermott, 2010).

H_1 : Inflation has an asymmetric positive effect on gold returns.

Transmission of Exchange Rates (USD/IDR Exchange Rate) to Gold Returns

The exchange rate plays a key role in shaping domestic gold prices in Indonesia. As a commodity denominated in US dollars, any depreciation in the rupiah will exert immediate upward pressure on gold yields in the local currency. This transmission is not always linear; during times of extreme exchange rate volatility (e.g., crisis conditions), the force of this transmission can be much more dominant than under normal conditions. This validates the importance of analyzing exchange rate coefficients at various levels of the yield distribution.

The main argument theory explaining the influence of exchange rates on gold prices is the inverse (negative) pricing mechanism. Gold prices in the global market (XAUUSD) are quoted in US Dollars (USD). Consequently, when the US Dollar strengthens (for example, the Dollar Index/DXY rises) against other major currencies, gold automatically becomes more expensive for investors holding non-USD currencies (such as the Euro, Yen, or Rupiah). This increase in costs tends to suppress global demand for gold, which in turn causes the XAUUSD price to fall. Conversely, when the US Dollar weakens, gold becomes cheaper for international buyers, thus boosting demand and driving up the XAUUSD price. A study by Joy (2011) from the *Bank for International Settlements* (BIS) comprehensively confirmed this strong negative relationship, showing that the US Dollar exchange rate is one of the most fundamental determinants of gold price movements (Joy M., 2011).

The second argument relates to the status of the US dollar and gold as competing *safe haven assets*. The negative relationship between the two is often amplified during periods of US-centric crises. When economic shocks or policy uncertainty occur in the United States (e.g., the 2008 financial crisis or massive quantitative easing), investor confidence in the US dollar declines. In this scenario, investors tend to *flee to safety* by selling dollar-based assets (causing the USD to weaken) and simultaneously buying gold as an alternative hedge, causing the XAUUSD price to surge. Research by Baur and Lucey (2010) supports this dynamic; although the two assets can sometimes move in tandem, gold often proves to be a distinct *safe haven* from the US dollar, particularly when the source of risk is the instability of the dollar itself (Baur & McDermott, 2010).

H_2 : Exchange rate (USD/IDR) has a significant and asymmetric positive effect on gold returns

The Asymmetrical Influence of Global Crude Oil Prices on Gold Returns

The relationship between oil and gold prices operates through two main channels: the cost channel (*cost-push inflation*) and the liquidity channel (*petrodollar*). Rising global oil prices often signal an early rise in global inflation, which then transmits positive sentiment to the gold market. This asymmetry arises when extreme oil price shocks have a greater psychological impact on investors than moderate daily price fluctuations.

The main theoretical argument linking crude oil prices to gold prices is oil's role as a leading indicator of inflation. Crude oil is a fundamental energy input for nearly all economic activities, from transportation to manufacturing. Therefore, a sustained rise in oil prices will increase production and logistics costs across the supply chain, ultimately driving up the overall inflation rate (the Consumer Price Index). Gold, in its role as a traditional inflation hedge, becomes attractive when inflation expectations rise. Investors buy gold to protect their purchasing power from currency erosion, thus driving up the XAUUSD price. Research by Sari, Hammoudeh, and Soytas (2010) examined this

dynamic, finding significant price-shock transmission from oil prices to precious metals prices, largely operating through the inflation channel (Sari & Nugroho, 2024).

In addition to inflation, the positive relationship between oil and gold is also driven by the status of the US dollar (USD) and sensitivity to geopolitical risk. Both commodities are globally traded in USD. Consequently, when the US dollar weakens, more dollars are needed to buy a barrel of oil and an ounce of gold, so the prices of both (in USD) tend to rise in tandem. Furthermore, both assets are highly sensitive to global uncertainty. A geopolitical shock, such as a war in the Middle East, can simultaneously threaten oil supplies (driving up oil prices) and trigger a *flight-to-safety response* in global financial markets, with investors seeking gold as a primary *safe-haven asset*. Research by Shafiee and Topal (2010), which analyzed the long-term factors influencing gold prices, identified oil prices as a significant determinant, reflecting its role as both a cost driver (inflation) and a proxy for global instability (Shafiee & Topal, 2010).

H₃: World Crude Oil Prices have an asymmetric positive effect on gold returns.

Dynamics Connection Performance Capital Market (IHSG) against Reward Gold Return

According to *Portfolio Balance Theory*, investors dynamically balance their assets between risky instruments (stocks) and safe-haven instruments (gold). Negative transmission from the Jakarta Composite Index (JCI) to gold returns is expected to be significant at the lower extreme *quantile* (during a stock market *crash*). This *flight-to-quality phenomenon* demonstrates that gold serves not only as a simple diversifier but also as an asymmetric *safe haven* whose effectiveness increases precisely when capital market risk is at its highest.

The main argument theory explaining the relationship between stock market performance and gold prices is gold's role as a *safe haven asset*, which results in a negative correlation. This relationship is based on market risk sentiment, known as *risk-on/risk-off*. When stock markets (such as the S&P 500 or the Jakarta Composite Index) perform poorly or crash, it reflects fear, uncertainty, and *risk-off sentiment* among investors. Under these conditions, investors will engage in a *flight-to-safety behavior*: they sell risky assets (stocks) and seek protection from assets perceived as safe and capable of maintaining value during a crisis. Gold is the primary safe haven in this scenario. Consequently, demand for gold increases sharply, which drives its price (XAUUSD) up. Fundamental research by Baur and McDermott (2010) extensively tests this hypothesis and confirms that gold does indeed act as a strong safe haven against negative shocks in the stock market, especially during periods of extreme crisis (Baur & McDermott, 2010).

Conversely, when the stock market performs exceptionally well (a bull market), the opportunity cost argument *becomes* dominant. A rising stock market reflects economic optimism and *risk-on sentiment*. Investors will seek riskier assets (stocks) to achieve high returns (capital growth and dividends). Gold, as a non-yielding asset, becomes unattractive in this scenario. *The opportunity cost* of holding gold (i.e., missing out on potentially large gains from the stock market) becomes very high. Therefore, investors tend to sell gold or refrain from allocating new funds to gold, preferring to transfer their capital to the stock market. This decline in demand puts downward pressure on the XAUUSD price. A study by Baur and Lucey (2010), which analyzed the relationship between gold and stocks and bonds, supports the finding that gold often moves in the opposite direction to the stock market, confirming its role as a hedge and safe haven (Baur & Lucey, 2010).

H₄: Performance The Capital Market (IHSG) has influence asymmetrical negative to reward results gold.

Transmission Reward Global Gold (XAUUSD) Returns against Reward Gold Return Domestic (Antam)

As part of the global financial market, domestic gold yields (Antam) reflect the integrated movement of global gold prices. The *Law of One Price principle* ensures efficient transmission of global prices to local prices quickly. However, there is the potential for *lag* or differences in sensitivity at different *quantile levels*, where the domestic market may respond more aggressively to a surge in global prices (*bullish*) than to a decline (*bearish*).

The fundamental theoretical argument explaining this relationship is the price transmission mechanism and the "Law of One Price" for global commodities. The world gold price (XAUUSD) serves as the global benchmark price. Domestic markets, such as Indonesia, act as *price takers*. Local gold prices (such as Antam gold) are essentially derived prices calculated by converting the global benchmark price (in USD per *Troy ounce*) into

local currency and local weight units (Rupiah per gram). Therefore, mechanically, any upward or downward movement in the XAUUSD price will be transmitted directly and positively to the local gold price. Research by Suhartono and Suman (2019) confirmed the existence of long-term price transmission from international gold to domestic gold in Indonesia, indicating that local prices cannot deviate significantly from their global benchmark (Suhartono, S., & Suman, A. (2019)).

Although price transmission from XAUUSD is direct, its impact on local gold prices (such as Antam) is significantly moderated by the local currency exchange rate, in this case the USD/IDR rate. The local gold price is calculated using the multiplication: (XAUUSD Price) x (USD/IDR Exchange Rate). This means the USD/IDR exchange rate acts as a "filter" or "multiplier" for global price movements. For example, if the XAUUSD price falls by 10%, but at the same time the Rupiah weakens (USD/IDR rises) by 10%, the Antam gold price in the local market may remain unchanged (remains the same). Conversely, if the XAUUSD rises and the Rupiah weakens simultaneously, the local gold price will experience a double increase. Research by Nurfitriani et al. (2021) specifically found that the world gold price (XAUUSD) and the exchange rate (USD/IDR) together have a significant and positive influence on the Antam gold price, confirming that these two factors are the main determinants of gold prices in the domestic market (Nurfitriani, Azizah, & Kaluge, 2021).

H₅: World Gold Yields (XAUUSD) have a positive and significant influence on Indonesian gold yields.

3. Method Study

Population

The population in this study is all historical data on local gold price movements (PT Aneka Tambang Tbk), world gold prices (XAUUSD), as well as macroeconomic indicator data (Inflation, Exchange Rate, Oil Price, and IHSG) available and published by relevant institutions since data recording began until now.

Samples and Sampling Techniques

The sampling technique used in this study is *Purposive Sampling*, which is a sampling technique based on certain considerations or criteria (Sugiyono, 2019). The sample selection criteria in this study are: Complete data is available for all variables (no *missing data*) within the observation period. The observation period began after the 2008 global financial crisis to avoid extreme *outliers* and obtain data patterns in economic recovery and new normal conditions. Based on these criteria, the sample used is monthly *time series data* (end of month) for 15 years, starting from January 2009 to December 2025. The total observations in this study amount to 192 observation data (16 years x 12 months).

Data and Data Sources

The dynamics of gold prices as a primary investment asset and safe haven *present* significant complexity in global and domestic financial markets. The transmission of global gold prices (XAUUSD) to local gold prices (the dependent variable), as traded on the Jakarta Futures Exchange (BBJ), is a central issue but often does not occur instantly or symmetrically. This transmission process is strongly suspected to be significantly influenced by the volatility of various macroeconomic factors, both external and domestic, including inflation rates, fluctuations in the US dollar exchange rate, oil price volatility, and the performance of the Capital Market (IHSG). Understanding how these factors interact in transmitting prices under various market conditions is crucial for investors and policymakers in Indonesia. The following are the *independent variables* to be studied: Inflation is sourced from the Monetary Policy Report of Bank Indonesia and the Central Bureau of Statistics, the US Dollar Exchange Rate (DXY) is sourced from the Closing dollar price from Investing.com, Oil Price is sourced from Investing.com, Capital Market Performance (IHSG) is sourced from Investing.com, World gold price (XAUUSD) is sourced from Investing.com.

4. Results And Discussion

This study analyzes the movement of Antam gold prices in Indonesia using monthly *time series data* from 2009 to 2025. The total observation period used is 202 months after lag adjustment. The variables tested include the dependent variable, namely the Antam gold price (ANTAM) and independent variables consisting of Inflation (INF),

Exchange Rate (KURS), Capital Market Performance (JSE), World Gold Price (POGLOB), and World Oil Price (POIL). During the 16-year observation period, Antam gold prices showed a significant upward trend with volatility influenced by various global and domestic economic shocks, ranging from post-crisis recovery in 2008, the COVID-19 pandemic, to the latest global geopolitical dynamics.

Discussion of Gold Price Determinants in Indonesia

Gold as an Inflation Hedge (Dynamic Aspect)

This research's findings support the *Inflation Hedge theory*. However, a key finding is that gold's effectiveness as a hedge in Indonesia is not immediate. The significance at **Lag-1** indicates a "psychological lag," where investors need time to respond to inflation data released by authorities before reallocating assets to gold.

Consistency of the Influence of Exchange Rates and Global Gold Prices

Consistently, in both the OLS and VAR models, global gold and the exchange rate are the primary "anchors." This confirms that the Indonesian gold market is open and highly integrated with international commodity markets.

Capital Market and Gold Segmentation

The insignificance of the JCI (JSE) relative to gold indicates investor segmentation. Investors in the Indonesian capital market and gold market likely have different risk profiles and investment objectives, so movements on the stock exchange do not directly impact investment appetite for Antam gold.

Synthesis of Findings: OLS vs. VAR

The final synthesis of this chapter concludes that the use of **the VAR model** provides a much more accurate explanation than **OLS**. The failure of OLS to capture the effects of inflation demonstrates that the macroeconomic relationship to gold in Indonesia is dynamic, not static. The transition from OLS to VAR is not simply a methodological change, but rather an attempt to capture the reality of a market with information transmission lags. Thus, this study successfully demonstrates that gold remains a relevant hedging instrument for Indonesians, with the caveat that the influence of macroeconomic variables operates through complex temporal and systemic mechanisms.

5. Conclusion

Based on the results of data analysis and discussion regarding the determinants of Antam gold prices in Indonesia during the 2009–2025 period using *the Ordinary Least Square* (OLS) and *Vector Autoregression* (VAR) methods, the following conclusions are drawn:

Inflation Hedge Theory through Time Dimension. This study proves that gold is an effective inflation hedging instrument in Indonesia, but the transmission of its influence is not instantaneous. The VAR model reveals that inflation has a significant effect on gold prices with a one-month lag (*lag-1*). This explains why in the static OLS model the inflation variable is insignificant, the market needs time to absorb inflation information before reflecting it in domestic gold prices.

The dominance of global factors and monetary transmission, with the world gold price (XAU/USD) and the exchange rate (USD/IDR) being the most dominant and consistent determinants influencing Antam's gold price. Indonesian gold is a price taker *in* the global market, with rupiah exchange rate volatility acting as an accelerator, amplifying the impact of rising world gold prices on the local market.

Market Efficiency and Recovery Characteristics, through *Impulse Response Function* (IRF) analysis, found that shocks to the inflation variable require approximately 9 periods (months) to be fully absorbed by the market until the gold price returns to equilibrium. This indicates that the Indonesian gold market has a good level of resilience, albeit with a gradual adjustment process.

Investment Asset Segmentation: Capital market performance (the Jakarta Composite Index) consistently shows no significant impact on gold prices. This demonstrates a clear investor segmentation in Indonesia, where gold investment is driven more by hedging *than* as a direct substitute for stock investment.

Limitations Study

Use of Linear Models: This research is still limited to the use of dynamic linear models (VARs). Although capable of capturing time lags, these models do not fully dissect asymmetric behavior under extreme market conditions that may be better described by non-linear models. Data frequency, the use of monthly data, may miss the highly volatile

daily dynamics in financial markets, especially during very brief moments of geopolitical shocks.

Recommendation

Methodology Development, further researchers are advised to use the Quantile Regression or Markov Switching Regression method *to explore how* the strength of macroeconomic determinants changes at each level of volatility (when the market is very high vs. very low).

Addition of New Variables, adding digital asset variables such as *Cryptocurrency* (Bitcoin) as a new competitor to gold in the hedging function (*inflation hedge*), to see whether there is a shift in investor behavior in the digital era.

High Frequency Data, Using daily data to get a more precise picture of the speed of transmission (*speed of adjustment*) of global prices to domestic prices in *real-time*.

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