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Logical Analysis of London Gold Price Fluctuations: A Comprehensive Study Based on Interest Rate Cycles, the US Dollar Index, and Geopolitical Risks

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Abstract. Gold, as one of the representative assets in the global financial system, acts as a primary vehicle for long-term value storage and often serves as a safe-haven asset during periods of heightened uncertainty. However, London gold prices exhibit distinct cyclical fluctuations under varying macroeconomic conditions: they may rally amid declining interest rates, rise when the US dollar weakens, and experience short-term surges during geopolitical shocks. This paper examines the drivers of London gold price fluctuations and identifies the macroeconomic scenarios where such volatility is most prominent. It constructs a comprehensive analytical framework centered on interest rate cycles, the US Dollar Index, and geopolitical risks. The research employs a combination of literature review with mechanism analysis, supplemented by studies on price discovery in the London spot and New York futures markets to contextualize market structures. Key findings indicate that real interest rates and opportunity costs constitute critical channels influencing gold's medium-to-long-term trends; US dollar strength impacts gold prices through dual mechanisms of currency valuation effects and cross-asset allocation; geopolitical risks primarily amplify short-term volatility via safe-haven demand and risk premiums. This integrated framework offers investors insights into gold pricing logic and scenario-based asset allocation strategies.

Keywords: London Gold, Interest Rate Cycle, U.S. Dollar Index, Geopolitical Risks, Safe-Haven Assets

1. Introduction

As one of the key benchmarks in the global spot gold market, London gold price volatility not only affects precious metal investors' returns and risk management strategies but also serves as a barometer for changes in the macro-financial landscape. In conventional discourse, gold is often described as a "universal hedge against inflation" or an "absolute safe haven amid crises." However, systematic research indicates these claims do not hold consistently across varying time horizons and types of shocks: gold's inflation-hedging properties may require extremely long time spans to stabilize, while within typical investment cycles, its performance is more dependent on changes in macro interest rates and risk appetite [1]. Additionally, from the perspectives of no-arbitrage and real

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interest rate term structures, gold's valuation as a "zero-coupon asset" exhibits high sensitivity to real interest rate levels: in periods of low or negative real rates, gold's relative attractiveness increases, driving its price higher via "store-of-value demand"; conversely, a rebound in real rates elevates opportunity costs, exerting downward pressure on gold price.

Over extended historical horizons, the relationship between interest rates and gold value can also be explained through mechanisms in the gold standard era. Within this framework, the historical correlation between price levels and nominal interest rates can be interpreted through the "relative price of gold versus purchasing power of currency" mechanism. This suggests that interest rate movements reflect not merely a short-term correlation with gold, but potentially deeper underlying monetary systems and asset pricing logic [2]. Beyond interest rates, the strength of the U.S. dollar, gold's primary pricing currency, modifies acquisition costs for non-dollar investors and drives cross-border capital reallocation, thereby influencing gold prices. Meanwhile, geopolitical shocks and heightened uncertainty amplify gold price volatility through safe-haven demand and risk premiums. Given that existing research typically examines interest rates, exchange rates, or risk events in isolation, this paper poses the research question: Can London gold price fluctuations be explained within a unified framework to facilitate more actionable scenario-based assessments? To address this, the analysis proceeds from three perspectives: (1) the interest rate cycle, (2) the US Dollar Index, and (3) geopolitical risks. The main body presents a comprehensive framework and discusses its investment implications.

2. Overview of the London gold market and pricing mechanism

London has long been one of the core hubs for global physical gold trading, characterized by an over the counter (OTC) market structure and institutionally driven liquidity provision. Understanding fluctuations in London gold prices requires transcending mere "macroeconomic variable correlations" and instead placing them within the global gold market's microstructure and price discovery framework: gold's "price" is not determined on a single exchange but emerges through the collective interaction of multiple trading venues, such as the London spot and New York futures markets, where information is incorporated and prices are discovered. Research utilizing long-term intraday data comparing the contributions of London spot and New York futures to gold price discovery indicate that both participate in pricing, though their dominance shifts dynamically depending on trading sessions, information shocks, and liquidity conditions [3]. This implies that discussions of London gold price volatility must consider not only the supply, demand, and liquidity dynamics of the London spot market itself, but also its information transmission linkages with the New York futures market.

From the perspective of this study's focus, macro drivers of London gold price volatility primarily impact the market through three channels: First, the opportunity cost and discounting channel driven by changes in interest rates and real interest rates. Second, the pricing currency effect and international capital reallocation triggered by shifts in the US dollar's strength and exchange rate risk. Third, the surge in safe-haven demand and risk premiums caused by geopolitical risk shocks. Subsequent sections will sequentially examine how these factors influence London gold prices through identifiable economic mechanisms, further explaining why the same factor exhibits significantly varying impact intensities across various macroeconomic scenarios.

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3. Interest rate cycles and London gold: opportunity cost and the real interest rate channel

A fundamental characteristic of gold is that it does not generate interest or dividends. Consequently, changes in interest rates directly alter the opportunity cost of holding gold: when risk-free rates rise, investors can earn higher coupons or yields by holding cash or bonds, reducing gold's relative appeal; when rates fall, especially in periods of low or even negative real interest rates, gold's relative advantage as a store-of-value asset becomes pronounced. Capital tends to hedge against purchasing power risk through gold, thereby driving up its price [4]. This mechanism is not only intuitively sound but also more explicitly articulated in studies grounded in the no-arbitrage framework: gold price fluctuations can be understood as reactions to changes in the real interest rate term structure. Moreover, during certain phases, gold price increases stem not from "improved fundamentals in industrial/jewelry demand", but rather from investment premium and expectations regarding future interest rate trajectories [4].

It is worth emphasizing that interest rates influence gold prices not solely through nominal rates but more critically through the interplay of real interest rates and inflation expectations. When inflation expectations rise while nominal rates lag in adjustment, declining real rates may boost gold prices; conversely, rapid nominal rate hikes that suppress inflation expectations cause real rates to rebound, subjecting gold to heightened opportunity cost pressures. Regarding the popular view that "gold is an inflation hedge", research yields a more prudent conclusion: over shorter investment horizons, gold does not necessarily provide a stable hedge against inflation. More reliable explanatory variables for gold prices often stem from factors like interest rates, financial conditions, and risk appetite [1]. Therefore, incorporating the interest rate cycle into the analytical framework allows for better differentiation between when the "inflation narrative" and when the "real interest rate mechanism" dominates gold prices.

From a longer historical perspective, the link between interest rates and gold's value also reflects the profound interplay between monetary systems and price dynamics. Under the gold standard, the historical correlation between price levels and nominal interest rates can be explained by changes in the relative price of gold. This suggests that the interest rate-gold relationship possesses structural characteristics in certain institutional environments, rather than merely being a statistical correlation within modern financial markets [2]. For contemporary investors, the practical implication of this historical research is that interest rate cycles often influence gold through "institutional and expectation-driven" mechanisms. When market assessments of future monetary policy paths, the neutral level of real interest rates, and financial stability risks shift, gold prices tend to anticipate these changes, resulting in phased trend movements.

4. The US dollar index and London gold: the pricing currency effect and cross-asset allocation

Gold is priced in U.S. dollars, making the U.S. Dollar Index one of the key variables influencing London gold prices. The most direct mechanism is the currency pricing effect: a stronger dollar increases the cost for non-dollar investors to purchase gold in their local currencies, potentially suppressing demand and exerting downward pressure on gold prices; Conversely, a weaker dollar enhances gold's appeal to non-dollar investors. Empirical studies often evaluate gold's relationship with exchange rates and dollar-denominated assets within a "hedging and safe-haven" framework: during normal periods, gold may act as a hedge against certain asset or exchange rate risks; under extreme market conditions, the emergence and magnitude of its safe-haven attributes may vary.

Beyond the pricing effect, the more critical factors lie in cross-asset allocation and capital flows: the strength of the US dollar is often accompanied by shifts in global risk appetite, the relative

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growth advantage of the US, and changes in interest rate differentials. When the dollar strengthens and real US Treasury yields rise, international capital may prefer allocating to dollar-denominated assets, crowding out gold as a non-interest-bearing asset. Conversely, during periods of dollar weakness or diminished appeal of dollar assets, gold may be increasingly allocated as a store of value and risk diversification instrument. Further analysis in the context of crisis and bear market identification reveals that whether gold functions as a "safe haven" during equity declines requires distinguishing crisis types and market phases, while assessing whether its correlation structure undergoes abrupt changes within the macro-financial environment [5]. Therefore, within this framework, the U.S. Dollar Index is not an "isolated explanatory variable" but should be analyzed in conjunction with the interest rate cycle: When dollar strength coincides with rising real interest rates, gold is more likely to face pressure. Conversely, when the dollar weakens amid heightened geopolitical risks, gold may rise due to safe-haven demand, leading to scenarios where the "dollar-gold correlation temporarily weakens or even moves in tandem."

5. Geopolitical risks and London gold: safe-haven demand and risk premium

Compared to macro-financial variables such as interest rates and the US dollar, geopolitical risks exhibit greater suddenness and scenario dependency. To incorporate "geopolitical risk" into a testable research framework, scholars have developed a geopolitical risk index (GPR index) constructed from news text data. This index systematically exhibits significant volatility during major historical events and demonstrates predictive power for investment, employment, and the probability of risk downsides [6]. The index's construction methodology and long-term applicability are elaborated in Federal Reserve's working paper, providing a reusable quantitative tool for subsequent financial asset research [7]. This establishes a crucial methodological foundation for this paper: geopolitical risk shocks can be translated from the narrative level into measurable variables, enabling analysis of their directional impacts and mechanisms on gold prices.

The relationship between gold and geopolitical risk manifests primarily through two pathways. The first is safe-haven demand: when conflicts escalate, war risks rise, or international tensions intensify, investors tend to reduce exposure to high-risk assets and reallocate to assets with lower credit risk or weaker correlation to risk events. Gold, with its non-sovereign credit characteristics, emerges as a primary choice. The second is risk premium: elevated uncertainty increases investors' pricing of uncertainty, thereby raising valuations for assets with tail risk hedging potential. Research distinguishing between geopolitical risks, threats, and actual events reveals that gold may respond more strongly to "risks and threats", while its response to shocks from actual geopolitical events is not always symmetrical. This indicates gold's safe-haven attributes are largely tied to "expectations and uncertainty" [8].

Within this framework, geopolitical risks typically exert short-term shocks on London gold prices, with their impact amplified or mitigated by interest rate and U.S. dollar conditions: elevated geopolitical risks coupled with low real interest rates may provide gold with "dual support"; conversely, elevated geopolitical risks alongside rapid monetary tightening that pushes up real interest rates may partially offset gold's gains through the opportunity cost effects. Therefore, geopolitical risks should be integrated into scenario analysis alongside interest rates and the US dollar, rather than treated as an isolated explanatory variable.

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6. Three-factor integrated framework: scenario classification and investment implications

Based on the aforementioned mechanism, this paper proposes a more actionable integrated framework: interpreting fluctuations in London gold prices as the composite outcome of three primary drivers— "real interest rate," "the US dollar," and "geopolitical risks." Scenario segmentation enhances explanatory power.

Scenario 1: Falling real interest rates + Weakening US dollar + Rising risks. This typically represents the most favorable combination for gold: reduced opportunity costs, improved non-dollar demand, and heightened safe-haven demand favor a trend-driven price rally

Scenario 2: Rising real interest rates + stronger US dollar + stable risk environment. Gold faces pressure from increased opportunity costs and capital crowding out effects, leading to sideways consolidation or price declines.

Scenario 3: Rising risk but simultaneous US dollar strength. In such scenarios, both gold and the US dollar may benefit from safe-haven capital inflows. Their short-term correlation may weaken or even become positive, requiring analysis based on risk sources and policy responses.

Scenario 4: Weakening dollar + rapid rise in real interest rates. The dollar-denominated effect supports gold, but higher real rates increase opportunity costs. Gold prices may exhibit a "rise-then-fall" pattern or structural divergence.

For investors, the key value of this framework lies in shifting the "why gold moves" discussion from single-factor narratives to a "mechanism-scenario" combination assessment, avoiding mechanically applying the same logic across different macro phases. For researchers, this framework also provides a pathway for subsequent empirical studies: London gold returns can be regressed jointly or scenario-specific against real interest rates, proxy variables for the US Dollar Index, and the GPR Index. Event studies can then examine excess reactions during geopolitical shock windows.

7. Conclusion

This paper conducts a comprehensive analysis of the underlying drivers of London gold price volatility, structured around three core dimensions: interest rate cycles, the U.S. Dollar Index, and geopolitical risks. The research reveals: First, interest rate cycles, particularly changes in real interest rates, exert significant explanatory power over gold's medium-to-long-term trends through the channels of opportunity cost and store-of-value demand. When real interest rates are low or negative, gold tends to gain investment premium and appreciate, whereas a rebound in real interest rates imposes systemic pressure on gold prices. Second, the US Dollar Index influences gold prices not only through its currency valuation effect but also via cross-asset allocation and capital flows. While a stronger dollar typically suppresses gold, specific safe-haven scenarios may cause short-term co-movement between the dollar and gold, necessitating a comprehensive assessment of risk sources and policy responses. Third, geopolitical risks significantly impact gold prices in the short term through safe-haven demand and risk premiums. Quantitative tools such as the GPR index provide a testable foundation for research, and evidence suggests gold may react more strongly to the "threat" component of geopolitical risks, reflecting its sensitivity to uncertainty expectations.

This paper has several limitations: it primarily relies on literature-based mechanism analysis, lacking rigorous empirical testing (e.g., scenario-specific regression, structural break tests, event studies), resulting in limitations in quantitative contributions and causal identification. Future research could construct a replicable empirical framework using publicly available data (London gold price, real interest rates, U.S. dollar index, and GPR) to further examine the marginal effects

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and interaction terms of these three factors under different scenarios. Extending the analysis to high-frequency data could also capture price discovery processes within risk shock windows, thereby enhancing the verifiability and practical guidance of conclusions.

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