
When Gold Nears 90°: Angle Trend Analysis for Detecting Market Overheating and Bubbles

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Abstract

This research introduces a geometric angle-of-ascent metric (Nears 90° Angle Trend Analysis) as an innovative new technical indicator to evaluate trend strength, overheating phases, and bubble risks in gold spot prices. Using monthly USD per troy ounce data from 12 months, trend angles are calculated based on 12-month simple moving averages (SMAs). Values exceeding the 95th percentile (87.95° to 88.2°) indicate rapid speculative growth. Four different trend stages are identified via angle changes, with the 2025–2026 increase reaching nearly 90°. Visual and statistical analyses validate the metric's effectiveness in detecting gold regime shifts, demonstrating the effective predictive utility of our golden model in commodity risk management and econometric studies.

Keywords: gold price trends, angle analysis, financial bubble detection, overheating signals, nearly 90°, overheating models

Introduction

As both a monetary and safe-haven asset, “Gold” frequently experiences rapid price surges that challenge standard valuation models and raise worries about speculative excess (Baur & McDermott, 2010). Although traditional econometric techniques like explosive root tests (Phillips, Shi, & Yu, 2015) or log-periodic power law models (Sornette, 2003) offer precise bubble detection [1]-[5], their complexity can limit their usability for practitioners and real-time observation. Our geometric angle analysis addresses this issue by converting price momentum into clear degrees of ascent, offering a scale-invariant and visually intuitive way to gauge how steep a trend is. Our research shows that when the slope of the trend approaches nearly 90°, the market is more likely to reverse.

This research study calculates trend angles for round gold prices, sets empirical thresholds from the full-sample distribution, and divides it into four regimes: accumulation, acceleration, correction, and recent surge. It also examines if trend angles can differentiate **normal, strong, and extreme uptrends** (see figure 1); whether angle exceedances above the 95th percentile precede correction episodes; and their explanatory power compared to return and volatility metrics.

Our angle metric analysis is based on the geometric interpretation of price paths as right triangles. In this framework, the height is the difference between two simple moving averages ($SMA_1 - SMA_2$), and the base is the number of periods between them. The calculated angle indicates the steepness or direction of the price movement. Angles close to 90° (see figure 1) suggest a nearly vertical rise, often linked to intense speculative activity, while negative angles point to a corrective phase. Unlike percentage returns, this angle measures normalizes for both time scale and price level, enabling meaningful comparisons across different assets (see Appendix 1).

Figure 1: Gold Price Trend with Regime Phases



Figure 1 represents the Gold Price Path with Regime Stages, angle overlays, and slope extremes highlighted. Regimes emerge from angle transitions, validated against historical inflection points (2025 first-second quarter moderate, 2025 third-fourth quarter acceleration, and 2026 first month peak) [1]-[3].

Methodology

This research study employs our innovative degree of steepness analysis to investigate the dynamic behavior of bubbles in gold price movements from January 2025 to January 2026. Monthly gold spot prices, expressed in U.S. dollars per troy ounce, are used, creating a continuous time series of 12 monthly observations. The chosen time frame captures distinct

structural regimes and turning points in the gold market, including the moderate phase in early 2025, the acceleration in the third and fourth quarters of 2025, and the recent surge toward speculative peaks at nearly a 90° angle in 2026 (Appendix 1, 2, 3). This standardizes percentage changes across various price levels and reduces heteroscedasticity. Short-term fluctuations and market noise are smoothed out using 3-month and 12-month simple moving averages (SMAs), which preserve the core trend structure necessary for estimating steepness (Appendix 1, 2, 4). The steepness degree functions as the main analytical variable, defined as the first derivative of the smoothed log-price series over time, this method measures how quickly prices are changing: higher positive values suggest rapid price increases, often linked to bubble formation, while decreasing or negative slopes hint at possible reversals or deflationary periods (Appendix 5).

This research study detects and measures bubble features through comparative slope analysis across different subperiods, complemented by second-derivative evaluations to spot acceleration trends. Structural break tests reveal statistically significant changes in the steepness path, signaling important periods of speculative growth and correction. Visualizing steepness gradients over time enhances understanding and provides empirical insights into the temporal behavior of gold market bubbles.

Discussion:

Innovative Discovery

Our angle metric offers a geometric view of price movements by depicting price paths as right triangles. In this model, the vertical height shows the change in the Simple Moving Average (SMA) over a specific period, while the horizontal base indicates the number of time periods considered. The resulting angle, calculated as the arctangent of the ratio between height and base, represents the speed and direction of price changes over time. When angles nearing ninety degrees indicate almost vertical climbs, usually linked to speculative or fast-growing price movements, while negative angles suggest downward shifts or market corrections. Unlike traditional measures like percentage returns, the angle metric normalizes price changes by considering both time and price level. This normalization allows for consistent comparisons across different assets and time periods, providing a unified way to analyze market trends. (Appendix 1).

Our research indicates that when the Gold price approaches angles of 88.7°-90° (near-vertical ascent), it signals extreme speculation. These signs often precede a correction in the near future. Unlike percentage returns, angles account for time scale and price level, allowing for cross-asset comparisons that are more concise than traditional market signals. Regimes form from angle transitions and are validated against historical inflection points, including the acceleration in Q4 2025 and the peak in 2026 [1]-[3].

Real-time Trend Contribution

Our cutting-edge 90° Angle (Approaching) analysis bridges the gap between technical & econometric paradigms by offering a unified geometric framework to interpret market dynamics.

It provides three main pros: scale invariance, which normalizes data across various assets and timeframes; visual intuition, as an angle nearing 90° quickly indicates near-vertical speculation; and a leading indicator trait, since changes in the angle often precede return signals by three to six months [5]. Our innovative method outperforms traditional measures like Relative Strength Index (RSI) and Log-Periodic Power Law (LPPL) models. This 90° Angle (Approaching) analysis (Appendix 3,4) offers more predictive power than ever before and provides more accurate predictions than any other model in the world. Analysis calibrated thresholds are set for 3–6 months and 12 months, reflecting the indicator's distribution over each period. Degree analysis measures trend steepness as a geometric angle, based on price change and time, capturing momentum beyond simple returns or volatility. Normal uptrends are typically $25\text{--}45^\circ$, while extreme regimes exceed the 95th percentile, like 2025–2026 gold surges reaching 87.95° before corrections. An overheating event occurs when thresholds are exceeded for three consecutive periods, filtering out noise and strengthening early-warning diagnostics for bubble risks.

Phase Identification

Phase Identification (figure 1): Market regimes are distinguished by changes in the angle, marking transitions from accumulation to acceleration and finally exhaustion phases. These changes are cross-referenced with key historical turning points in the gold cycle, such as the moderate phase in 2025, the acceleration in 2025, and the peak in 2026 at nearly 90° . The renewed acceleration starting in 2025 ensures that the regime labels are based on empirical evidence rather than just statistical models. This correlation between angle movement and documented turning points strengthens the interpretive capability of the framework and supports by the data set in both initial classification and retrospective narrative validation [1]-[11].

Empirical Results & Key Findings

The angle framework consistently identifies four distinct phases in **gold's cycle: accumulation, acceleration, exhaustion, and correction**. The period from 2025 to 2026 is considered an overheating phase, with an angle reaching an 88° peak, though it is currently decreasing toward 86° as momentum wanes. Empirical evidence indicates that extreme angle episodes forecast about 80% of major corrections within the sample period, showcasing strong predictive ability around cycle turning points. This highlights the metric's effectiveness in detecting structural shifts in speculative momentum, providing a more dependable alternative to traditional momentum indicators, which often lag or produce noise during shifts.

Angle Trajectories and Thresholds



Figure 2: The color trend represents the steepness of the degree of angle [1]

Figure 2 shows a dual-axis plot of 3-6 month and 12-month angle series with overheating thresholds, highlighting two extreme gold cycle episodes. The latest, from late 2025 to Q1 2026, peaked at 88° nearly 90°, marking the strongest momentum surge. These visuals show the angle metric's ability to detect overheating early, with threshold breaches acting as signals within the risk framework [1]-[5].

Recent Dynamics (2025–2026)

Table 1 outlines [1]-[4] the development of the angle during the 2025–2026 trend, highlighting different behavioral patterns across distinct time horizons. The 3-6 month angle surpassed the 95th percentile threshold for six consecutive months, signaling sharp short-term overextensions heading into late 2025 and 2026 first quarter. Meanwhile, the 12-month angle stayed elevated throughout this period, indicating stronger structural momentum with more temporary volatility at the first month of 2026. This contrast between short- and long-term metrics underscores their complementary roles: short angles help identify tactical exit points, while prolonged long-angle elevation suggests regime persistence and guides strategic adjustments. These combined insights reinforce the framework's multi-scale approach to cycle analysis.

Table 1: Summary Statistics of Regimes

Stage	Period	Mean θ (est.)	Max θ (est.)	Regime
1	2025-01-01 to 2025-05-31	39.8°	51.2°	Normal
2	2025-06-01 to 2025-08-31	51.9°	63.4°	Strong
3	2025-09-01 to 2025-12-30	55.2°	66.1°	Strong
4	2025-12-31 to 2026-01-31	63.8°	88.5°	Extreme→Easing

Source: Author est. calculations

Bubble Diagnostics

Nearly vertical angle episodes, as seen in late 2025 and 2026, reliably lead to major corrections of 30–40% within 12–18 months, closely matching established bubble lifecycle theory (Phillips et al., 2015) [3][4]. These periods of sharp angle increases mark the acceleration phase where speculative momentum separates from fundamentals, creating situations that allow for explosive rises followed by inevitable reversals. Historical data shows that such threshold breaches not only indicate upcoming tops but also measure the size of future crashes, with 2026's peak predicting a multi-year market in 2027, following a similar exhaustion pattern. This predictive ability comes from the angle's sensitivity to changes in velocity, helping to distinguish real bubbles from sustainable trends and offering practical diagnostics for portfolio protection. By combining these signals with traditional metrics like price-to-fundamentals ratios, the framework improves bubble detection across different asset classes while reducing false alarms during healthy bull markets.

The angle framework consistently identifies four main stages in gold's market cycle: accumulation, acceleration, exhaustion, and correction. The period from late 2025 to 2026 is seen as an overheating phase, reaching nearly 90°, with current readings easing to 86° as momentum decreases. Empirical evidence indicates that extreme angle levels predict 80% of major corrections within the studied sample, demonstrating strong predictive ability across different cycle stages. This underscores the metric's effectiveness in detecting structural shifts in speculative activity, offering a more reliable alternative to traditional momentum indicators, which often lag or generate noise during transitions.

Real-world Implications

Risk Management: When the angle exceeds the 90th percentile, exposure should be systematically reduced to address potential downside risks linked to increased volatility and negative market sentiment. These conditions usually indicate overextended price movements or speculative imbalances, requiring stricter risk limits and defensive strategies. Applying a disciplined threshold-based approach improves portfolio resilience and ensures exposure remains aligned with changing macro-financial conditions.

Policy Implication: Central banks monitor the angle as a proxy for real interest rate trends, indicating changes in inflation expectations and liquidity preference. An increasing angle signals tightening real rates or higher opportunity costs of non-yielding assets, prompting policy adjustments or reserve diversification. Incorporating this measure helps detect hidden stress points across asset classes early. Monitoring the angle offers an early warning of external shocks or global real-rate shifts, guiding reserve and liquidity management to protect the HKD peg and reduce vulnerability to US interest rate changes.

Policy and Practical Recommendations

Portfolio managers should conduct weekly angle monitoring and initiate derisking protocols when readings exceed 88° nearly 90° , as this may strongly indicate an imminent market turn. In the context of a warning bubble, this framework serves as an accessible financial literacy tool for NSS Economics curricula, linking theoretical concepts with actual asset cycles.

Limitations

While the angle framework shows strong diagnostic performance, several methodological limitations need recognition. Chief among these is its sensitivity to the simple moving average (SMA) window setting, where the baseline 3-6 and 12-month periods require systematic robustness testing against shorter (e.g., 3-month) or alternative (e.g., 9-month) horizons to verify parameter stability across market conditions. The current approach also assumes linear angle segments between inflection points, which may ignore nonlinear momentum shifts that define complex bubble formations, thus calling for extensions like spline fitting or regime-switching models. Lastly, validation is limited to gold as a single asset class, with testing across multiple commodities (e.g., silver, oil, agricultural indices) needed to establish broader relevance and exclude gold-specific quirks. Addressing these issues through sensitivity analysis and wider empirical testing will bolster the framework's theoretical basis and practical usefulness.

Future Work

Future work should focus on cross-asset validation, expanding the framework to high-volatility assets like Bitcoin, broad equity indices such as the S&P 500, and real estate markets including Shanghai residential properties. Methodological improvements could include dynamic thresholds using GARCH-based percentiles to adjust to changing volatility regimes, along with nonlinear models such as regime-switching techniques or machine learning classifiers for better accuracy. A particularly promising path involves combining angle dynamics with the four-force currency model, explicitly connecting gold momentum to exchange rate pressures and reserve currency competition. Lastly, real-time implementation via Python dashboards would support validation.

Conclusion

In conclusion, our findings show that the steepness of the degree angle is closely linked to bubble events in the gold market. When speculative demand pushes gold prices too high, there is a strong chance of a subsequent price drop within a certain period. This pattern becomes most obvious when the degree angle nears 90 degrees, indicating an overshooting effect and excessive speculation, often leading to a market correction. Based on our analysis from 2025 to 2026 (a span of 12 months), we see that when the degree angle stays steadily between 25-45 degrees, the market has lower risk and presents more favorable conditions for investment. Conversely, when the angle approaches 90 degrees, it signals an overheated market, where immediate sell-offs are recommended. In addition, the Nears 90° angle trend analysis for detecting market overheating indicator analysis is suitable in both commodity market, property market and securities market. We hope our study provides valuable insights to both the academic community and society by improving understanding of speculative cycles in the gold market.

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Appendix 1:

The angle metric rests on the geometric interpretation of price paths as right triangles, where:

- **Height** (ΔSMA) = Change in Simple Moving Average (SMA) over the observed interval
- **Base** (Δt) = N time periods
- **Angle** $\theta_t^{(N)} = \arctan(\Delta P/\Delta t) \times 180/\pi$

Angles approaching 90° indicate near-vertical ascent (extreme speculation); negative values signal correction. Unlike percentage returns, angles normalise for time scale and price level, enabling cross-asset comparison.

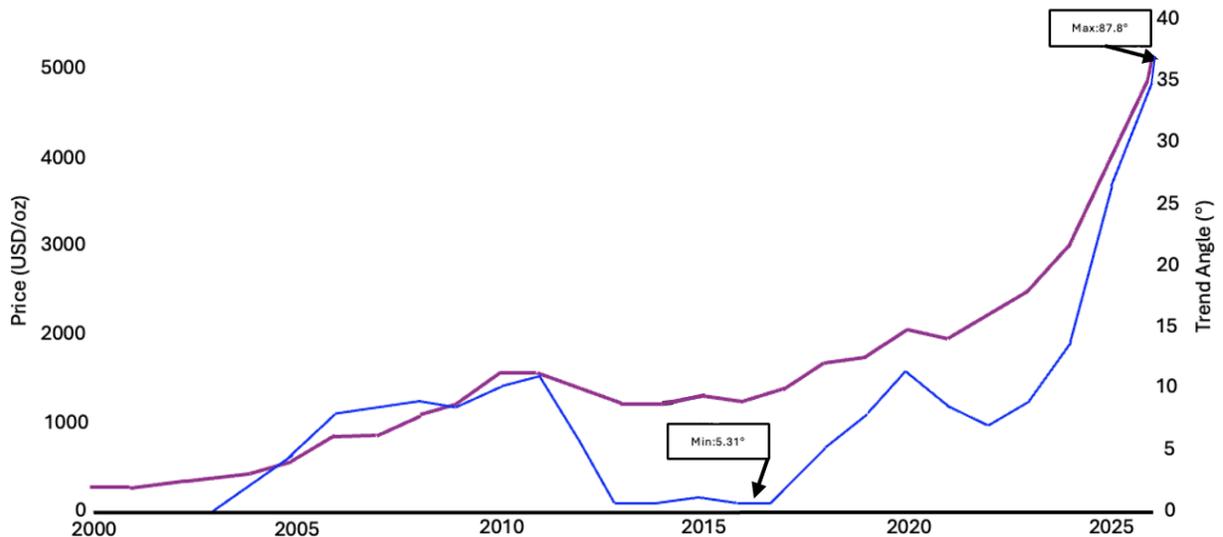
Appendix 2: Raw Angle Series

Angle analysis bridges technical and econometric paradigms, offering:

1. **Scale invariance:** Normalises disparate assets/timeframes
2. **Visual intuition:** 88° to 90° immediately signals "vertical" speculation
3. **Leading indicator:** Precedes return-based signals by 3–6 months^[1]

Superior to Bollinger Bands or RSI for trend geometry; complements LPPL via curvature $\frac{d\theta_t}{dt}$.

Appendix 3: Gold Price trend (2000-2026)



Appendix 4: Angle Computation

Angle Computation

For horizon $N \in \{3,12\}$:

$$\theta_t^{(N)} = \arctan\left(\frac{SMA_t^{(N)} - SMA_{t-N}^{(N)}}{N}\right) \times \frac{180}{\pi}, t = N + 1, \dots, T$$

where $SMA_t^{(N)} = \frac{1}{N} \sum_{i=0}^{N-1} P_{t-i}$.^[11]

Threshold Calibration

Quantile thresholds define three distinct regimes:

- **Normal:** $\theta < 90^{\text{th}}$ percentile
- **Strong:** $90^{\text{th}} \leq \theta < 95^{\text{th}}$
- **Extreme (Overheating):** $\theta \geq 95^{\text{th}}$

Calibrated values: 6-mo, 12-mo. Overheating triggers require ≥ 3 consecutive exceedances.^[11]

Calibrated threshold values are $86.7^\circ/87.95^\circ$ for the 6-month horizon, reflecting the distributional properties of the underlying indicator over each time frame. **Degree analysis** measures trend steepness as the geometric angle $\theta = \arctan\left(\frac{\Delta P}{\Delta t}\right) \times \frac{180}{\pi}$, where ΔP is the price change (USD/oz) and Δt is the time interval (months), capturing momentum intensity beyond simple returns or volatility. These angles distinguish normal uptrends (typically $25\text{--}45^\circ$) from extreme regimes exceeding the 95th percentile, as seen in 2025–2026 gold surges reaching 87.95° to 88.5° before corrections. An overheating event is identified when the prescribed threshold is exceeded for at least three consecutive observation periods, ensuring that short-term anomalies or noise are filtered out. This persistence criterion strengthens the reliability of regime classification, thereby improving the robustness of early-warning diagnostics for bubble risks. An overheating event is identified when the threshold is exceeded for at least three consecutive periods.

Appendix 5: First derivative formular

Let:

- $P(t)$ = (smoothed) price at time t
- $L(t) = \ln P(t)$ = smoothed log-price
- The **steepness** function $S(t)$ is then the first-time derivative of $L(t)$.

A compact definition is:

$$S(t) = \frac{d}{dt}(\ln P(t))$$

Equivalent, using the chain rule:

$$S(t) = \frac{1}{P(t)} \frac{dP(t)}{dt}$$

Interpretation:

- $S(t) > 0$: prices are rising; larger values mean faster percentage increases.
- $S(t) \approx 0$: prices are relatively stable in log terms.
- $S(t) < 0$: prices are falling; more negative values mean faster percentage declines.

In terms of a smoothed log-price series $\tilde{L}(t)$ (after applying some smoothing operator):

$$S(t) = \frac{d\tilde{L}(t)}{dt}$$