Gold as a Hedge Against Anticipated Tail Inflation

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Research Question: What drives the price of gold?

• **Traditional driver: the real interest rate (2000–2021).** Gold, a long-duration real asset, rises as rates fall, more so when low rates ⇒ investors enter the market (Jermann 2025)

• Since 2022 it has **broken down**: real rates rose sharply, then held flat near 2% since 2024, yet real gold still spiked ∼95% over 2024–2025. *What is gold pricing instead?*

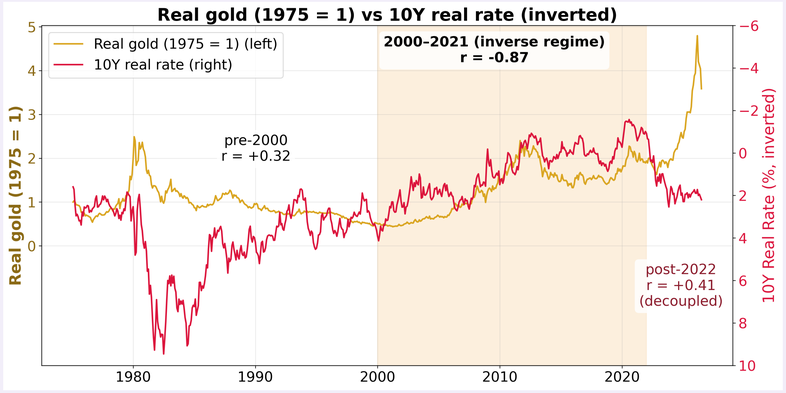


Fig. 1. Real gold price (indexed, 1975:01 = 1; left axis) and the 10Y real rate (%, *inverted* right axis). Sample: 1975:01–2026:06. The inverse link is a **2000:01–2021:12 regime** (shaded, $r = -0.87$); absent before ($r = +0.32$), *broken* after ($r = +0.41$). *Source:* gold, LBMA, deflated by US CPI; 10Y real rate from the Livingston survey and TIPS.

Gold Moves with the Right Tail of Inflation Beliefs

Tail measure: the household share expecting inflation above 10% per year over the next 5–10 years (Michigan Survey of Consumers, 1979–2026).

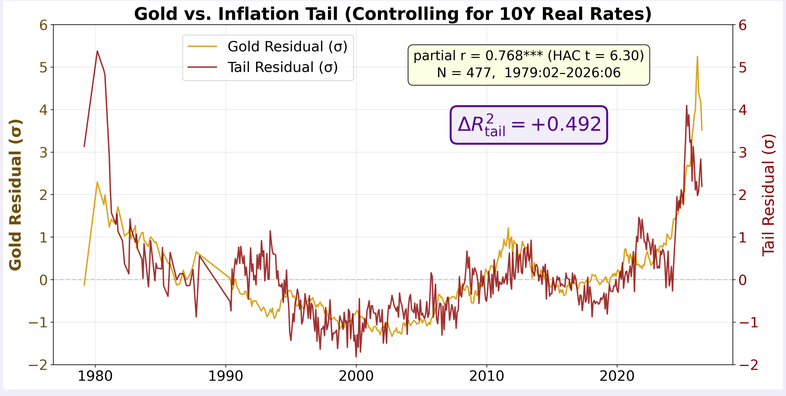


Fig. 2. Gold residual (gold, left axis) vs. inflation-tail residual (red, right axis), both in σ units, *partialled on the 10Y real rate*. Sample: 1979:02–2026:06 ($N = 477$). $r = 0.77^{***}$ (HAC $t = 6.30$), adj. $R^2 = 0.66$, $\Delta R^2_{\text{tail}} = +0.49$. *Source:* gold, LBMA, deflated by US CPI; 10Y real rate from the Livingston survey and TIPS; inflation tail, Michigan SoC.

Model Environment: Agents, Assets, and States

• Time is discrete, infinite horizon, one real consumption good

• **Two investor types** $j \in \{1, 2\}$ hold **two assets**:

  ◦ **Gold**: fixed supply $\bar{A}$, *no dividend*, **no short sales**; resale price p

  ◦ **Consol**: fixed supply $\bar{B}$, real coupon $c(\tau) = \bar{c}\big(1 - h\,\frac{\tau - \tau^*}{\bar{\tau} - \tau^*}\big)$ (*inflation erodes nominal bonds' real coupon*); ex-coupon price q

• **Users** have an endowment and rent gold for use (jewellery/industry)

• **Inflation state** τ_t, on a bounded grid from τ^* (calm) to $\bar{\tau}$, step size Δ:

$$\tau_{t+1} = \begin{cases} \tau_t + \Delta & \text{with probability } \phi(\tau_t)\,(1 - f) \\ \tau_t & \text{with probability } 1 - \phi(\tau_t) \\ \tau_t - \Delta & \text{with probability } \phi(\tau_t)\,f \end{cases}$$

• $\phi(\tau)$: *how often* inflation moves. **Forward variance rises with inflation** up to a cap (Friedman 1977; Ball 1992: "high inflation is uncertain inflation")

• f: *which way* moves go, switching slowly between f_{cred} and f_{imp} ⇒ a **regime-switching AR(1)** for τ; $\rho_{\text{cred}} < 1$ *reverts* to target, $\rho_{\text{imp}} > 1$ *drifts*

  ◦ **Disagreement about** f **only**: the types watch *different things*. We only require *crossing*: neither type is more fearful in *every* state

Model: Agents' Problems and Equilibrium

• **Users** (OLG, *static*): consume c_u, rent gold a at price p:

$$\max_{c_u,\, a \geq 0} \underbrace{c_u}_{\text{consume}} + \underbrace{\frac{\phi_u}{1-\eta} a^{1-\eta}}_{\text{use value}} \quad \text{s.t.} \quad \underbrace{c_u + p\,a}_{\text{consumption}} = \underbrace{e_u}_{\text{user endow.}} \quad \Rightarrow \; a_u = (\phi_u/p)^{1/\eta}\,(p\uparrow,\; a_u\downarrow).$$

• **Investors**: CRRA $u(C) = \frac{C^{1-\sigma}}{1-\sigma}$ ($\sigma > 1$); the two types differ only through $\mathbb{E}^j$ over f:

$$V^j(a^j, b^j; s) = \max_{C_j,\, a'_j \geq 0,\; b'_j} u(C_j) + \beta(z)\,\mathbb{E}^j_s\big[V^j(a'_j, b'_j; s')\big] \;\text{ s.t.}$$

$$\underbrace{C_j}_{\text{consume}} + \underbrace{p\,a'_j}_{\text{gold at } t} + \underbrace{q\,b'_j}_{\text{consol at } t} = \underbrace{Y}_{\text{endowment}} + \underbrace{p(s)a^j}_{\text{gold at } t-1} + \underbrace{\big(c(\tau) + q(s)\big)b^j}_{\text{consol at } t-1}$$

• **States**:

$$s = \big(\underbrace{z}_{\text{patience}},\; \underbrace{f}_{\text{anchor}},\; \underbrace{\tau}_{\text{inflation}},\; \underbrace{A}_{\text{investor gold}},\; \underbrace{\omega}_{\text{type 1's share}}\big)$$

• **Recursive equilibrium**: prices $p(s), q(s)$, policies $\{C_j, a'_j, b'_j\}$, and a law of motion $\Gamma(s' \mid s)$ s.t. individuals optimize *under their own beliefs* $\mathbb{E}^j$ taking prices as given; markets clear; and policies with the *objective kernel* generate Γ

Key Model Results

1. Gold's investment premium

$$\underbrace{\frac{p(s)}{\text{Gold price}}}_{\text{Gold price}} = \underbrace{\frac{p}{\phi_u \bar{A}^{-\eta}}}_{\substack{\text{use-value floor} \\ \text{(if no investors)}}} \times \Big(1 + \underbrace{\frac{\mathcal{G}(s)}{(1 - A/\bar{A})^{-\eta} - 1 \geq 0}}_{\text{premium}}\Big)$$

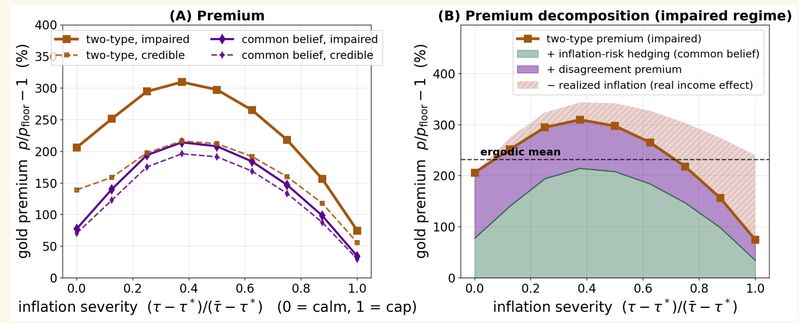
Channel: hedging demand crowds users out of the fixed stock: $\mathcal{G}$ rises in $A/\bar{A}$.

• **If dynamic users**: additional premium from users' option to resell to investors

2. What raises gold

• Higher patience $\beta(z)\uparrow$ (a *lower real rate*) lifts gold

• **New: an inflation-risk premium** $\mathcal{G}$, from a **fatter right tail of inflation** + **disagreement** around it (two-type with different information sets as below)



• **Why the tail?** No short sales + small float ⇒ gold is priced by the *most fearful* investor, so it tracks the right tail of beliefs; Treasuries price the average

• **Model prediction**: linearizing returns in the two shocks (real rate, tail belief), **the gold–rate link weakens as tail-belief shock volatility rises** (empirically validated: conditional gold–rate correlations fall with tail-belief shock volatility)

3. When bonds disagree with gold: a possible explanation

• **The two types** $j \in \{N, D\}$: N reads the *regime news*, D the *inflation level only*

• **1980–85: gold leads down.** Volcker shock: news says *restored* while the data still run hot ⇒ N *exits* and gold crashes; D's fear decays only as the CPI does

• **2022–26: gold leads up.** News says *impaired* while the data stay calm ⇒ N *enters* and gold roughly doubles; breakevens (the average) hold $\approx 2.3\%$

Gold on the Tail: Regression & Cointegration

	(1)	(2)	(3)
Inflation tail	**0.87**	**0.60**	**0.61**
	(7.0)	(11.0)	(12.7)
Real rate (10Y)	−0.97	−0.21	−0.12
	(−10.8)	(−2.8)	(−1.5)
Controls (Z_t)		✓	✓
Time trend			✓
R^2	0.66	0.84	0.86
N	473	473	473

(1) no controls; (2) + controls Z_t (debt/GDP, USD, CB purchases, EBP); (3) + linear time trend. Standardized (σ-on-σ), HAC t in ( ). Sample: 1979:02–2026:02, monthly. *Source:* as Figs. 1–2, plus controls.

$$\text{real gold}_t = \alpha + \beta_1 r_t + \beta_2 \text{Tail}_t + \gamma' Z_t + \varepsilon_t$$

• **Regression:** a 1σ rise in the **tail** is associated with a $\mathbf{0.6}\sigma$ increase in the real gold price, holding real rates and controls fixed

• **Cointegration** rules out spurious regression: {gold, rate, **tail**} passes all four tests (Engle–Granger, Johansen trace, max-eigenvalue, KPSS)

  ◦ gold ∼ rate *alone* does not cointegrate; nor does {gold, rate, X} for other thirds X (e.g. debt/GDP, CB demand)

• **Gold moves before measured fundamentals.** The residual predicts future **rates** and **tail beliefs**, not gold returns

Additional Empirical Exercises

• **Measurement.** Robust to the tail measure (when using HH survey), real-rate proxy, frequency, sample period, and the controls

• **External validity.** UK: gold in GBP vs. the BoE tail ⊥ UK real rates (2009–2025): $r = 0.69$, HAC $t = 4.9$, $\Delta R^2 = +0.47$

• **Horse race.** Tail and mean are correlated, yet only the **tail** survives head-to-head: its sign is *stable*, while the mean/median *flips sign*

• **Predictability.** The household–market **belief wedge** predicts forward gold returns (Hodrick-corrected, ∼12m)

Related Literature

Topic	Literature	This paper adds
Gold & real rates *Jermann 2025*	Gold as a long-duration real claim: it rises as real rates fall when rates are low and investors enter the market	The real-rate link is **one 2000–2021 regime**; the belief **tail** prices gold before *and* after
What drives gold? *Barsky et al. 2021; Erb & Harvey 2013; Barro & Misra 2016; Arslanalp et al. 2023*	Candidate drivers: real rates, the dollar, pessimism, CB/geopolitical demand; realized/mean inflation is weak	The **right tail** of household inflation beliefs, and it survives all of these as controls
Credibility & inflation anchoring *Goodfriend & King 2005; Ball 1992; Piazzesi & Schneider 2007*	Volcker's stubborn long yield = imperfect credibility; high inflation = regime uncertainty; perceived *regime* probability prices bonds	Credibility = a **hidden anchor regime**, priced by **two assets**; their split identifies *who believes what*

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