Gold's Missing Anchor: The Real-Rate Decoupling and the Reserve-Safety Premium*

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Abstract

Gold has historically moved inversely with the real interest rate. That relationship broke after 2021: real yields rose to decade highs while gold doubled. On the pre-2022 anchor, by the end of 2025 gold trades at more than four times its real-rate-implied value. The break is in the *level*, not the mechanics: gold's high-frequency sensitivity to real rates barely moved, so a new, slow-moving demand sits on top. I interpret it as a repricing of reserve *safety*, with de-dollarization its leading component, and bring four kinds of evidence: a reserve-portfolio model with seizure risk that reproduces the pattern; gold-specificity against the metals complex and the sovereign safe havens; robustness to fiscal, monetary and retail explanations, with gold ETFs net sellers; and a price-based measure that recovers a demand shift the opaque official quantity data miss. A model pricing gold off real rates alone now misses an important component.

Keywords: gold; real interest rates; foreign reserves; de-dollarization; reserve seizure risk; safe assets; central-bank demand; financial sanctions.

JEL Codes: E44; F31; F33; F51; G12; G15.

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1 Introduction

Between 2021 and 2025 the ten-year real interest rate rose by more than three percentage points, a swing that, on its historical relationship with gold, should have cut the gold price by close to half. Gold instead doubled, past $4,000/oz. This paper is about that anomaly. The textbook price of gold is a real-rate story: gold pays no coupon, so in the Barsky–Summers logic its real price rises when real rates fall and falls when they rise (Barsky and Summers, 1988; Erb and Harvey, 2013). The real-rate anchor held tightly for decades; in the Treasury Inflation-Protected Securities (TIPS) era (2010–2021) the correlation between log gold and the ten-year TIPS yield was −0.81, and gold error-corrected toward the relation when it strayed. After 2021 it broke. Figure 1 shows the gap: fitting the pre-2022 relation and projecting it forward, by end-2025 gold trades at more than four times its real-rate-implied value, a residual that grew from about zero in 2021 to over 300%. This paper documents the decoupling, develops a mechanism consistent with it, and presents evidence that reserve-demand reallocation is the leading explanation. Four facts organize the argument.

First, the break is in the level, not the mechanics. The daily sensitivity of gold to real-yield changes is large, strongly significant, and, in a single interacted regression, essentially unchanged across 2022 (a modest attenuation of about a fifth, and the same at minute frequency around scheduled macro releases). Formally, gold and the real yield form an error-correcting system before 2022 whose error-correction term vanishes afterwards: gold still *reacts* to real rates day to day but no longer *returns* to the real-rate level. That points to a new, slow-moving demand level rather than a change in how gold is priced at the margin.

Second, a reserve-portfolio mechanism reproduces this. In a mean-variance model, a reserve manager holds dollar bonds (which yield r but can be frozen with probability δ) and gold (which yields nothing but cannot be seized). The optimal gold share falls in r (so the real rate still prices gold at the margin, preserving the high-frequency beta) and rises in δ. Against a near-fixed above-ground stock, a rise in δ revalues gold: matching the observed premium requires a perceived seizure risk of a few percent at central parameter values (the model fixes the signs, not the precise magnitude). Inverting the model maps the premium into an implied seizure risk that rises from near zero in 2021 to about 2% in 2025 and tracks measured geopolitical risk; and, fed an exogenous *ratcheting* risk path (a demonstrated freeze updates beliefs up but not back down), the model reproduces the shape of the premium's rise. The mechanism is gold-specific because, among traditional reserve assets, only gold has no issuer and no counterparty to freeze; bitcoin, the one non-sovereign alternative, behaves as a risk asset rather than a reserve hedge.

Third, the premium is empirically gold-specific. Silver, platinum and palladium are precious metals and inflation hedges, but central banks do not hold them as reserves. In 2022–24 gold rose 44% while silver rose 25%, platinum fell 6%, and palladium fell 52%. Treating gold as "treated" and the metals complex as the control in a difference-in-differences (with parallel trends confirmed before 2022 and a placebo treatment null), gold's excess over the complex opens only after 2021, and gold's deviation from the complex is 0.93-correlated with its deviation from the real-rate model. The residual gold carries over bonds and the residual it carries over other metals move closely together, pointing to a common omitted force that is specific to gold and consistent with its reserve role. Specificity also holds against the *safe-asset* complex: from end-2021 the Swiss franc, yen, euro and long U.S. Treasuries show no comparable re-rating, which separates gold's no-issuer, no-counterparty property from a generic flight to safety.

Fourth, the evidence points to reserve de-dollarization, and the leading rivals fail. The premium moves with the dollar's falling reserve share (from 71% in 1999 to 57% in 2025) and with record official gold buying (1055 t/yr in 2022–24 against 496 t/yr in the 2010s); the central-bank-flow association survives controls for

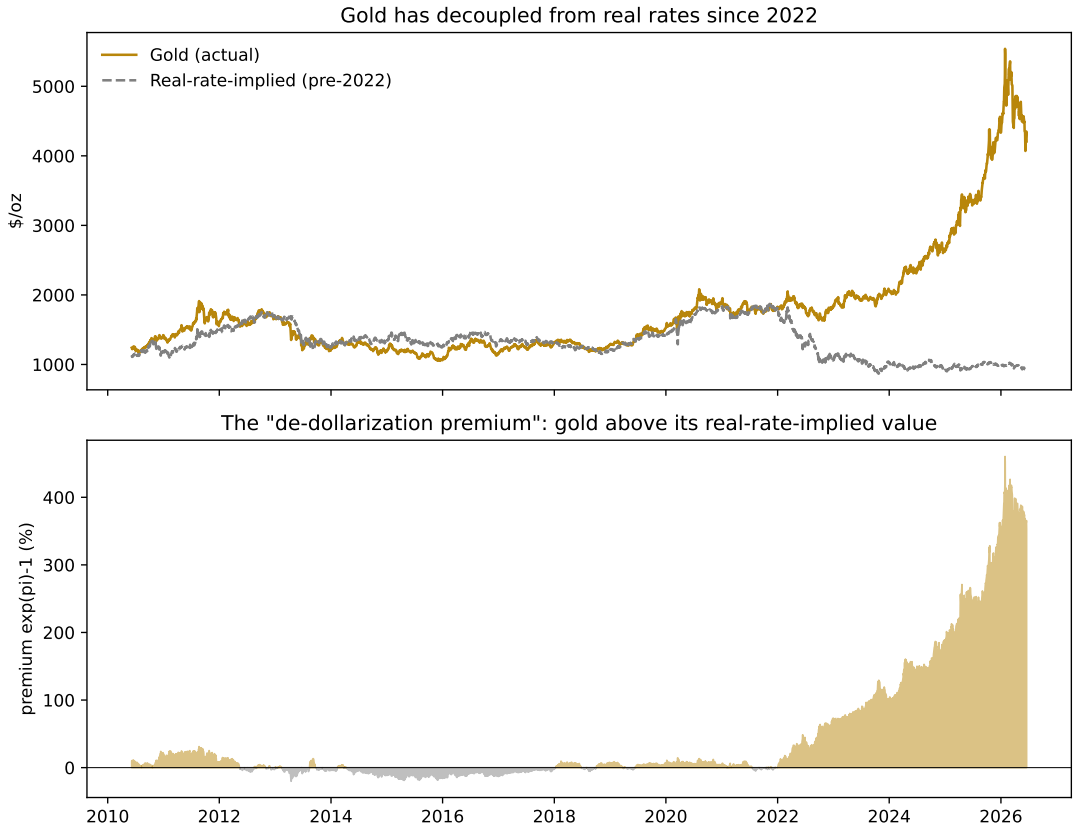


Figure 1: Gold versus its real-rate-implied value. Top: the actual gold price and the value implied by the pre-2022 relationship between log gold and the ten-year real yield, projected forward. Bottom: the gap between them, the premium $e^{\pi_t} - 1$, which rises from about zero before 2022 to over 300% by end-2025.

US debt, money growth and inflation expectations. It is not a dollar artifact (the premium is large in euro, yen and renminbi terms), and it is not a retail or ETF story: physically-backed gold ETFs were *net sellers* of 550 tonnes over 2021–24, while gold rose 44% over the same window, more consistent with official than with retail demand. Nor is it a scarcity story: gold's futures curve stayed in normal contango throughout, never the backwardation that a convenience-yield or lease-rate spike would produce. A further discriminating test is on the dollar side: foreign-official Treasury demand *falls* when geopolitical and reserve-seizure risk rise, the opposite of a generic safe-haven response, which a flight to safety cannot produce, and robust across financial-risk proxies. The evidence is most consistent with a repricing of reserve *safety*, with seizure risk its most plausible driver and dollar diversification its leading manifestation.

A natural worry is that official purchases respond to the price rather than the other way round, and that the slow-moving reserve variables co-trend spuriously with the premium. I address both. The premium and the dollar reserve share are *not* cointegrated, so I do not lean on their levels regression; the de-dollarization evidence rests on central-bank purchase *flows* (which lead the premium and survive a leave-one-out and a wild bootstrap), the cross-asset specificity test, and the model. The cross-country reported-quantity data cannot settle it, for an instructive reason: official buying is opaque. The IMF-reported world gold stock rose 2,302 tonnes less than the World Gold Council's estimate over 2022–24 because the principal buyers do not report transparently: China books gold in occasional lumps, Russia stopped reporting in 2022, and over-the-counter purchases escape the IMF template. That opacity is why a price-based measure is

informative: reported quantities understate a demand shift that still clears in the market price.

This paper connects the literature on gold valuation to the literature on reserve de-dollarization, which have developed in parallel; Section 2 places it precisely. The rest of the paper proceeds as follows. Section 3 sets out the reserve-portfolio model; Section 4 describes the data and documents the decoupling; Section 5 establishes gold-specificity against the metals and safe-asset complexes; Section 6 traces the reserve-demand channel, asks who is buying, and brings the dollar-side mirror to bear; and Section 7 concludes.

2 Related literature

This paper sits at the junction of three literatures that have developed largely in parallel, and its contribution is to connect them.

The first is the valuation of gold. The workhorse anchor is the real interest rate: because gold pays no coupon, its real price should rise when real rates fall, a no-arbitrage logic for a zero-coupon real asset whose roots trace to Barsky and Summers (1988) on Gibson's paradox under the gold standard. The empirical literature has largely borne this out and has mapped gold's portfolio role: Erb and Harvey (2013) document the long-run mean reversion of the real gold price and the "golden dilemma" facing investors who buy after large run-ups, while Baur and Lucey (2010) and Baur and McDermott (2010) establish gold's hedge and safe-haven properties against equities. This work was written, however, in a world where the real-rate anchor held. The central fact of this paper is that the anchor broke after 2021 at the level while surviving at high frequency, which neither the valuation benchmark nor the safe-haven framing anticipates.

The second is the economics of the dollar's reserve role. A large literature explains why the dollar and US Treasuries function as the world's safe asset: the exorbitant privilege of the issuer (Gourinchas and Rey, 2007; Gourinchas et al., 2019), the convenience yield investors pay for safe and liquid dollar claims (Krishnamurthy and Vissing-Jorgensen, 2012), the link from foreign safe-asset demand to the exchange rate (Jiang et al., 2021), and the equilibrium structure of a system organized around a single reserve currency (Farhi and Maggiori, 2018; Caballero et al., 2017). This literature prices the dollar's monetary premium with precision. It has had much less to say about gold, the one reserve asset that is nobody's liability: it tells us what a reserve manager gains from holding dollars but not what happens to the price of the bearer alternative when that calculus shifts.

The third, and closest, literature studies reserve composition directly. Eichengreen et al. (2022) document the "stealth erosion" of dollar dominance and the rise of nontraditional reserve currencies; Ilzetzki et al. (2019) place the dollar's anchor role in long historical perspective. Most directly, Arslanalp et al. (2023) show that central banks have returned to gold, that financial sanctions and diversification motives help account for it, and, crucially for what follows, that official buying is badly underreported. This work establishes the *quantity* side of reserve de-dollarization. What it does not do is link these reserve quantities to gold's price *level*. Whether this official demand is large enough to move the market-clearing price of gold and detach it from its macro-financial anchor remains an open question, in part because the buyers who matter most do not report. The macro-finance literature on the changing covariance of real assets with rates and inflation (Campbell et al., 2020; Cieslak and Pflueger, 2023) supplies the benchmark against which the break is measured.

The gap, then, is a missing link: the gold-pricing literature lacks a driver for the post-2021 level shift, and the de-dollarization literature documents a quantity shift whose price consequences are unmeasured.

This paper supplies that link, and makes three contributions. First, it establishes the fact and gives it a mechanism: gold has decoupled from real rates at the level while the high-frequency beta is intact, and a reserve-portfolio model with seizure risk on dollar reserves reproduces this pattern: real rates still price gold at the margin, while a rising probability of reserve immobilization shifts the desired gold share and revalues the price. Second, it supplies price-based evidence on the driver where the quantity literature cannot, precisely because official buying is opaque: the premium is specific to the one metal central banks hold (not silver, platinum or palladium), is large in every numeraire, and rises while ETF investors sell, more consistent with official than with US financial demand. Third, it provides the asset-pricing counterpart to Arslanalp et al. (2023): where they document that central banks are buying gold, I provide evidence that this demand is now priced: large enough that a model valuing gold off real rates alone misses its level by a factor of four. Methodologically, the paper argues that when reserve quantities are hidden, a price-based measure is informative about the demand shift they understate.

3 A reserve-portfolio model with seizure risk

Consider a risk-averse reserve manager who allocates reserves between a dollar safe asset and gold. The dollar asset pays a real return r but, with probability δ, is frozen and lost; gold pays $\mu_g \approx 0$ (no coupon, small carry), has return variance σ_g^2, and cannot be seized. Seizure both lowers the dollar asset's expected return and adds jump risk to its variance:

$$E_d = (1-\delta)(1+r) - 1, \qquad V_d = (1-\delta)\sigma_d^2 + \delta(1-\delta)(1+r)^2. \tag{1}$$

With mean-variance preferences (Markowitz, 1952) (risk aversion γ) and gold uncorrelated with seizure, the optimal gold share is

$$\omega^*(\delta, r) = \frac{(\mu_g - E_d) + \gamma V_d}{\gamma(\sigma_g^2 + V_d)}. \tag{2}$$

Two comparative statics matter. First, $\partial\omega^*/\partial r < 0$ for the empirically relevant range of small δ: a higher real rate raises the opportunity cost of gold and lowers its share: the real rate still prices gold at the margin, so the high-frequency beta survives. Second, $\partial\omega^*/\partial\delta > 0$ over the calibrated range: higher seizure risk raises the desired gold share. Taking gold's return moments as given and clearing the market against a near-fixed above-ground stock, the official demand $\omega^* R/P$ and a downward-sloping private demand (developed below) jointly pin the price; as a local approximation that isolates the official block (the full clearing with finite private elasticity η is developed below), $P \propto \omega^*$, so

$$\underbrace{\frac{\partial P}{\partial r} < 0}_{\text{daily beta intact}}, \qquad \underbrace{\frac{\partial P}{\partial \delta} > 0}_{\text{the level premium}}. \tag{3}$$

The premium is gold-specific because, among traditional reserve assets, gold alone carries no issuer and no account to freeze: a rise in δ raises the relative demand for gold but not for rival reserve currencies, which remain seizable, nor for the other precious metals, which central banks do not hold. Figure 2 plots (2): calibrated to a baseline gold share of $\approx 14\%$ ($r = 2\%$, $\sigma_d = 10\%$, $\sigma_g = 15\%$, $\gamma = 3$, baseline $\delta = 0.1\%$, $\mu_g = 0$), a rise in δ from ~ 0 to 2% lifts the desired gold share several-fold and revalues the price by roughly +300%. I do not read this as a point estimate. Matching the observed premium requires a seizure risk whose median

across plausible risk aversion and volatilities is about 2.4%; at central volatilities it ranges from 0.5% to 10% as risk aversion γ moves over $\{2,3,5\}$ (Table 1). The model disciplines the *signs* and gold-specificity, not the precise level, which is sensitive to risk aversion and to the elasticity of the above-ground stock. Two further checks give the channel empirical content. First, inverting the model maps the premium into an implied seizure risk rising from near zero in 2021 to about 2% in 2025. Because the inversion is monotone in the premium at a fixed real rate, this implied-δ series is a transformation of π_t; its 0.60 correlation with the Caldara and Iacoviello (2022) index is therefore essentially the premium's own co-movement with measured geopolitical risk, a descriptive consistency check that the latent state moves with observed risk, not an independent validation. Second, embedding a downward-sloping private demand $Q^p = AP^{-\eta}$ with a fixed above-ground stock, a rise in δ that lifts official demand must clear through a higher price, *crowding out* private holders, so the model predicts net private/ETF outflows during an official-led rally, exactly the pattern documented in §6.1. The same market-clearing logic bounds how much of the premium the official *flow* can mechanically explain, which sharpens the magnitude question. The above-ground stock is about 212,000 tonnes, of which roughly 175,000 are privately held; the official sector's incremental accumulation over 2022–24 (about 5,500 tonnes once the under-reported buying of §6.3 is included) is only some 3% of the private stock. With $Q^p = AP^{-\eta}$ that flow raises the log price by $(1/\eta) \times 3\%$; rather than commit to one elasticity I report the bound. Across the plausible range $\eta \in [0.1, 0.5]$ the flow accounts for between 4% and 21% of the log premium $\pi = 1.48$, and for at most 28% even under the highest accumulation estimate, a minority at every plausible elasticity (Figure 3). Matching the *whole* premium would require $\eta \approx 0.02$, far more inelastic than any plausible value. Private demand revealed itself far more elastic than that: gold ETFs sold about a seventh of their holdings as the price rose, a revealed arc elasticity of $\eta \approx 0.43$, at which the flow accounts for only about 5% of the premium. A flow-only explanation is thus quantitatively insufficient under plausible elasticities and the observed ETF behavior. The flow is real but an order of magnitude too small; the bulk of the premium is a *re-rating* of the existing stock (the rise in δ shifting the demand curve out), not a scarcity created by the flow. That is why a few thousand tonnes can sit beneath a +341% price move. If private demand is heterogeneous (price-elastic ETF investors, who sold, alongside more inelastic strategic and retail holders), the re-rating clears not by shifting the whole private demand curve but by crowding the elastic segment out until the marginal holder is an inelastic one. This is consistent with the observed ETF outflows and the model's market clearing, though the segment-level elasticities are not separately identified here. The model assumes gold returns are uncorrelated with seizure; if anything seizure events raise the gold price (as in 2022), so this is conservative.

The calibration above is static: it solves for the δ consistent with the end-2025 level. A complementary, non-circular check feeds an *exogenous* seizure path into the model and asks whether the implied premium tracks the data over time. Mapping the Caldara and Iacoviello (2022) geopolitical-risk index into δ_t (scaled to a single moment, so that only the *shape* of the path is tested) and simulating $\pi_t = \ln[\omega^*(\delta_t)/\omega^*(\delta_0)]$, a contemporaneous map tracks the premium only loosely (correlation +0.58): the premium kept climbing through 2024–25 while geopolitical risk receded from its 2022 peak. A *ratchet* map (in which a demonstrated freeze is not subsequently un-demonstrated, the asymmetric-belief logic of §6.4) reproduces the trajectory well (correlation +0.79, and 92% of the end-2025 level; Figure 4). The premium tracks a slow *ratchet* of seizure salience driven by exogenous risk, not the spiky risk level, a dynamic counterpart to the static calibration. The running maximum is the reduced form of asymmetric belief updating: a demonstrated freeze is permanent information about reserve safety, so managers revise δ up on such news but do not revise it back down when

headline risk recedes. This is an in-sample consistency check on the *shape* of the path, not a forecast; the genuine out-of-sample evidence comes from the forecast comparison in §4.

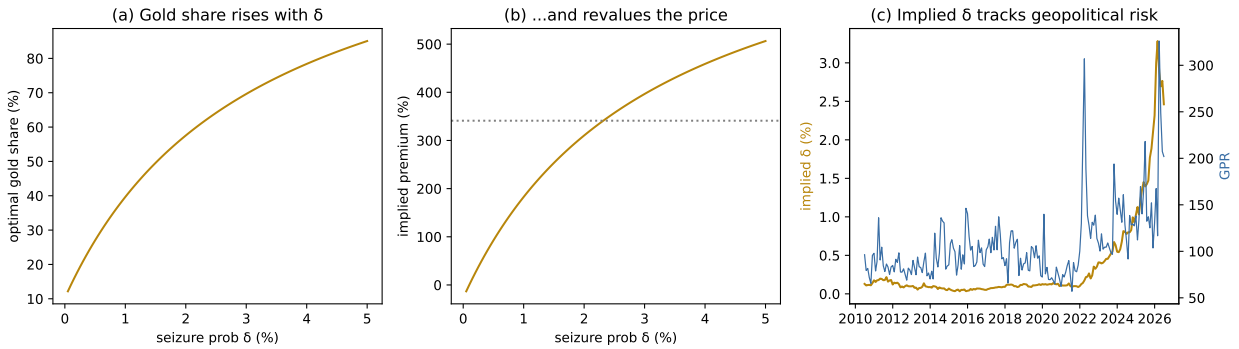


Figure 2: Reserve-portfolio model. (a) the optimal gold share rises with the perceived seizure risk δ; (b) with a near-fixed official stock this revalues the price (the premium; dotted line marks the observed +341%); (c) the seizure risk implied by the observed premium tracks the geopolitical-risk index. The real rate enters with the opposite sign, preserving the daily beta.

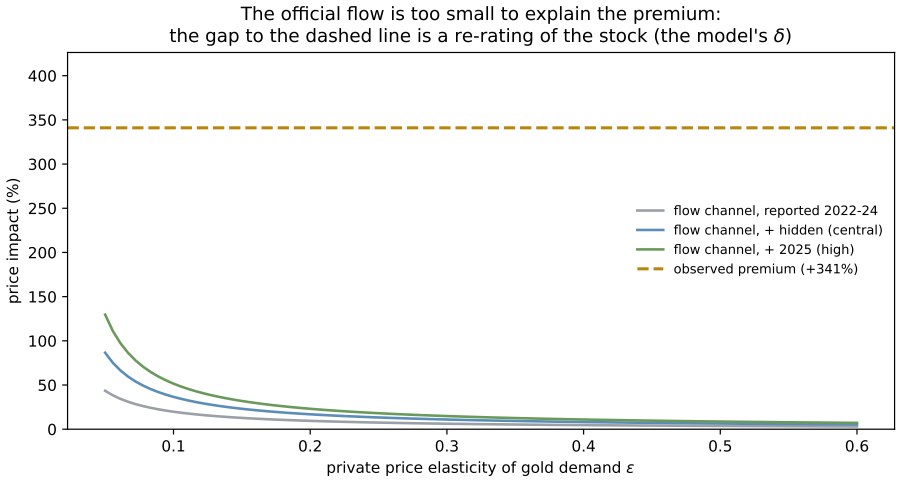


Figure 3: The official flow is too small to be the premium. Price impact of the 2022–25 official accumulation under a private demand $Q^p = AP^{-\eta}$, across the plausible elasticity range and three estimates of the flow; the dashed line is the observed +341% premium. The gap is a re-rating of the existing stock (the model's δ channel), not a flow-driven scarcity.

4 The real-rate decoupling

The gold price is the continuous front-by-volume CME gold future (Databento `GLBX.MDP3`; Databento, Inc., 2025), daily June 2010–June 2026; I build matching front-by-volume series for silver, platinum, palladium and copper for the cross-asset tests, so all five metals share one construction (a robust roll, despiked for erroneous settle prints). The real rate is the ten-year TIPS yield (five- and thirty-year for robustness), and I use the broad nominal dollar, ten-year breakeven, the VIX, US public-debt-to-GDP, M2, industrial production, and the USD/EUR, JPY/USD and CNY/USD exchange rates (all FRED) as controls. Reserve-currency composition is IMF COFER (quarterly allocated-reserve shares; International Monetary Fund, 2026); country-level official

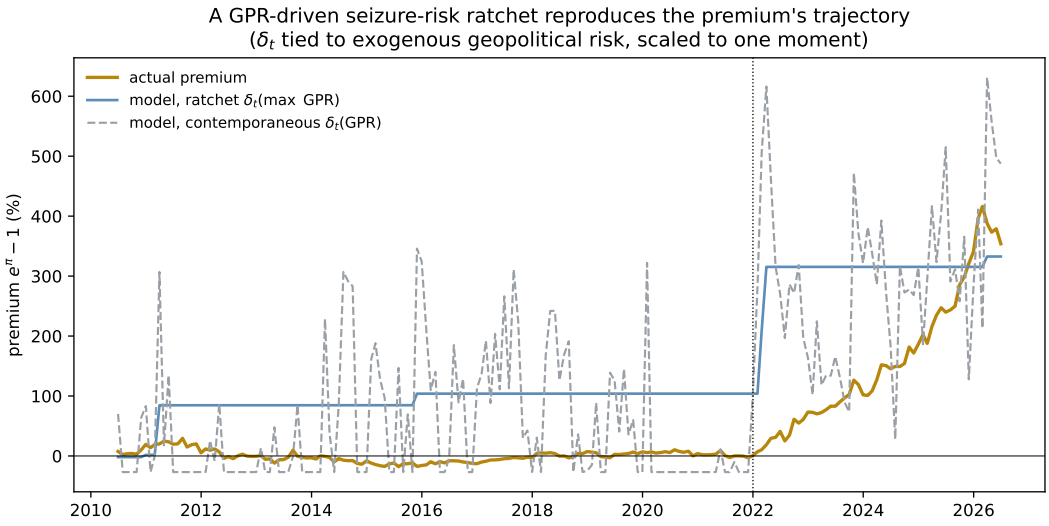


Figure 4: Dynamic fit. An exogenous, GPR-driven seizure path δ_t fed into the model (scaled to one moment) reproduces the premium's trajectory when δ_t ratchets with the running maximum of geopolitical risk (corr. +0.79), but not when it tracks the contemporaneous level (corr. +0.58), consistent with a belief ratchet (§6.4), and with δ_t tied to exogenous risk rather than to the premium.

Table 1: Calibration sensitivity: seizure risk δ^* needed to match the +341% premium.

Risk aversion γ	$\sigma_d = 8\%$	$\sigma_d = 10\%$	$\sigma_d = 12\%$
2	–	0.5%	2.6%
3	0.4%	2.3%	10.9%
5	1.9%	10.0%	60.7%

Each cell is the seizure probability δ^* that, through (2), generates the observed end-2025 premium, holding the gold-return volatility at $\sigma_g = 15\%$ and varying risk aversion γ and the dollar-asset volatility σ_d. "–" means the premium is unattainable for any $\delta \in (0,1)$ at that pair. The wide range across parameters is deliberate: the model identifies the *sign* and gold-specificity of the δ channel and the order of magnitude, not a point value of δ. At the central calibration ($\gamma = 3$, $\sigma_d = 10\%$) it implies $\delta^* \approx 2.3\%$; the table is a sign-discipline device, a mapping of the premium into plausible parameter values, not a structural estimate of seizure risk.

gold is IMF IRFCL (gold volume in fine troy ounces); central-bank and ETF gold flows are World Gold Council totals (World Gold Council, 2026); geopolitical risk is the daily Caldara and Iacoviello (2022) index; and UN voting positions are the Bailey et al. (2017) ideal points. Daily series are aligned to the relevant analysis frequency by taking quarter- or year-end values for stocks (yields, the premium, reserve shares) and period averages for flows and indices (GPR, the VIX); COFER and the purchase series enter at their native quarterly and annual frequencies. Everything is pulled programmatically and reproduced by `run_all.sh`.

I estimate the pre-2022 level relationship between log gold and the real yield,

$$\ln(\text{gold}_t) = \alpha + \beta\, r_t^{\text{real}} + \varepsilon_t, \qquad t \le \text{2021-12-31}, \tag{4}$$

obtaining $\hat{\alpha} = 7.29$, $\hat{\beta} = -0.21$ ($R^2 = 0.66$): a one-percentage-point higher real yield historically went with

a gold price about −19% lower (i.e. −0.21 log points). Projecting (4) forward defines the implied price $\widehat{\text{gold}}_t = \exp(\hat{\alpha} + \hat{\beta} r_t^{\text{real}})$ and the *premium* $\pi_t = \ln(\text{gold}_t) - \ln(\widehat{\text{gold}}_t)$, a log object; throughout, the percentage premium I report in tables is $e^{\pi_t} - 1$ (so $\pi = 1.48$ at end-2025 is the +341% in Table 2). I use "premium" only as a label for this residual; that it reflects reserve demand rather than another omitted force is argued in §5–§6, not assumed by the name.

Table 2 traces the result. Through 2021 the premium is negligible; it then reaches +102% (2023), +187% (2024), +341% (2025), and +362% by mid-2026. The same picture appears in split-sample correlations: $\text{corr}(\ln \text{gold}, r^{\text{real}})$ is −0.81 over 2010–2021, +0.18 in 2022–23, and −0.12 in 2024–26. The premium is robust to the maturity used (end-2025 premium of +317%, +341%, +329% for the five-, ten- and thirty-year real yields) and to the estimation window: re-estimating the anchor only through 2019 (before any COVID-era distortion) still gives a +320% premium by end-2025, so the result is not an artifact of including 2020–21. Nor is it an artifact of the TIPS market. The premium is built off the ten-year TIPS yield, which embeds a time-varying liquidity premium; re-estimating it with real-rate measures that never touch the TIPS market (the Cleveland Fed's model-implied real rate, and the nominal ten-year yield less model-implied expected inflation) leaves an end-2025 premium of +315% and +290% (the daily TIPS baseline is +341%; re-estimated at the monthly frequency these alternative measures use, the TIPS measure gives +346%) and reproduces the same split-sample decoupling. The decoupling is not a TIPS-liquidity artifact. Nor is it a mechanical artifact of the residual construction: a placebo in time (anchoring the relation on 2010–2015 and projecting it to 2016–2019, years with no reserve-seizure shock) yields a premium within a few percent of zero, against the +341% after 2022.

Two further concerns bear on the anchor itself. It is bivariate, so an omitted gold driver could load onto the residual; and the post-2021 real yield (+1.93%) sits above its pre-2022 range ([−1.16%, +1.15%]), so projecting the negative slope forward is partly out-of-support extrapolation. Table 3 confronts both at monthly frequency. Enriching the anchor barely moves the premium: adding the broad dollar gives +370%, and a deliberately over-controlled anchor that also includes inflation expectations and real-rate volatility (letting these absorb whatever they can) still leaves +353%. (This is conservative: the dollar is itself partly endogenous to de-dollarization, so handing it to the anchor understates the premium.) Removing the extrapolation entirely (clipping the projected real rate to its pre-2022 maximum so that no part of the implied price relies on the slope beyond the data) still leaves a +278% premium; of the +346% monthly baseline, only 68 points come from extrapolation, and a flexible quadratic anchor gives +235%. The premium is neither a missing-control nor an extrapolation artifact. Its existence does not even require the real-rate counterfactual: gold's gold-specific deviation from the metals complex (§5), which projects no anchor at all, is an independent +56% by end-2024. One caveat points the other way and is worth stating: if the post-2022 flight from Treasuries itself raised real yields, the real rate on the right-hand side is partly endogenous to the same shock; but the bias is conservative, since a seizure-driven rise in yields makes the anchor predict *lower* gold, enlarging the residual rather than creating it.

The decoupling is a break in the long-run *level* relation, not in gold's short-run pricing. A single interacted daily regression, $\Delta \ln \text{gold}_t = a + b\,\Delta r_t + c\,\text{post}_t + d\,(\Delta r_t \times \text{post}_t)$, gives $b = -7.8\%$ per percentage point (HAC standard errors, Newey and West, 1987; $t = -13$) and a small post-2022 change $d = +1.7$ ($t = 2.0$): the daily sensitivity attenuates by about a fifth but stays large and strongly negative. The long run is where the break lies. The same conclusion holds at intraday frequency. Using one-minute gold and ten-year Treasury-note futures (ZN, whose intraday moves around these releases are dominated by real-rate news) in tight windows

Table 2: The real-rate decoupling: actual gold vs. its pre-2022 real-rate-implied value.

Year-end	Real 10y (%)	Gold ($/oz)	Implied ($/oz)	Premium $e^{\pi}-1$
2019	+0.15	1,520	1,422	+7%
2021	-1.04	1,830	1,821	+1%
2023	+1.72	2,072	1,026	+102%
2024	+2.24	2,639	921	+187%
2025	+1.93	4,332	982	+341%
2026:H1	+2.15	4,337	938	+362%

Implied price from (4) estimated through 2021. The premium column is $e^{\pi_t}-1$, where π_t is the log residual used in the regressions.

Table 3: Robustness of the premium to the anchor specification and to extrapolation (end-2025).

Pre-2022 anchor specification	End-2025 premium $e^{\pi}-1$
Bivariate (real rate only)	+346%
+ broad dollar	+370%
+ dollar, inflation exp., real-rate vol.	+353%
Support-restricted (no extrapolation)	+278%
Quadratic in the real rate	+235%
Memo: gold-specific deviation from metals (no real-rate counterfactual)	+56%

Each row re-estimates the pre-2022 anchor and projects it forward at monthly frequency. "Support-restricted" clips the projected real rate to its pre-2022 in-sample maximum, so the implied price uses no extrapolation of the slope beyond the estimation range. The memo row is gold's deviation from a pre-2022 projection on the other four metals (§5), a magnitude that needs no real-rate counterfactual. The premium is large and positive under every specification.

around scheduled FOMC and payrolls releases (where the dominant shock is an exogenous rate surprise), gold's beta to the rate move is −8.0% per percentage point before 2022 and −5.7% after (Figure 5). Two features are notable. The pre-2022 intraday estimate reproduces the daily one (−7.8%) almost exactly, which validates the daily identification at a frequency where misspecification is implausible; and although the post-2022 attenuation is now precisely estimated (a statistically significant quarter, $t=-4.7$), a quarter is nowhere near enough to rationalize a level premium that reached +341%. Around clean rate shocks, minute by minute, gold is still priced off real rates much as before; what moved is the level, not the marginal mechanics. In an error-correction representation ($\Delta \ln \text{gold}_t$ on the *lagged* disequilibrium ($\ln \text{gold}_{t-1} - \hat{\alpha} - \hat{\beta} r^{\text{real}}_{t-1}$)), the error-correction coefficient is −0.075 ($t=-2.0$) before 2022, so gold reverts toward the anchor, and −0.002 ($t=-0.1$) after, so it no longer does (a single-equation version with a post interaction points the same way, though it is imprecise at monthly frequency, $p=0.18$). A rolling five-year estimate of (4) shows its intercept stepping up after 2020 (Figure 6), and a QLR test rejects a stable intercept decisively (max Wald = 297). In short, gold still *reacts* to real rates day to day; what broke is the long-run level to which it used to *return*.

The timing of the break is informative. A sup-Wald test (Andrews, 1993) on (4) dates the break in the *level relationship* to mid-2020, around the post-COVID real-rate trough. A sequential test in the spirit of Bai and Perron (1998) on the *premium* dates its trend break to mid-2021, with a further break in early 2022. These are distinct objects (one is the breakdown of the gold–real-rate relation, the other the acceleration of the residual), and they tell a consistent story. The initial break coincides with the post-COVID collapse of real rates to deeply negative territory, which compressed the opportunity cost of holding gold and met a pickup in central-bank buying already under way in 2020–21. The 2022 freeze then acted as a regime-change signal

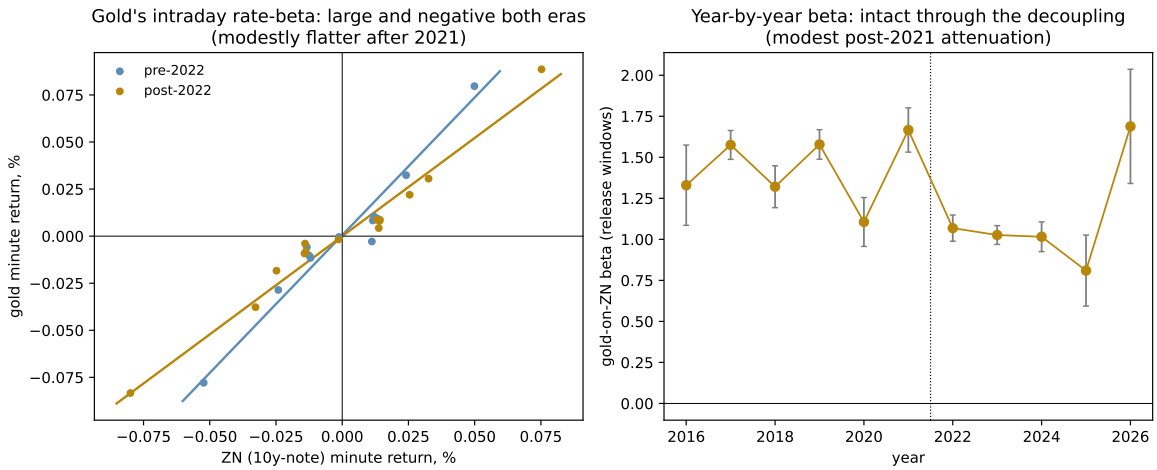


Figure 5: Gold's intraday beta to rate shocks, in ±60-minute windows around FOMC and payrolls releases (gold minute-return on ten-year-note-future minute-return, expressed as gold % per +1pp yield). Left: the relation is large and negative both before and after 2021, modestly flatter after. Right: year-by-year betas step down around 2022 but stay far from zero. The short-run mechanics are intact; the level is what broke.

(it made the seizure cost of dollar reserves salient to managers globally), accelerating a reallocation that had already begun (§6.4); it did not initiate it. A state-space cross-check agrees without imposing any split. Estimating $\ln \text{gold}_t = \beta\, r_t + \mu_t + \varepsilon_t$ by maximum likelihood with μ_t a random-walk level (Kalman-smoothed), the latent level μ_t stays within a few tens of percent through 2021 and only then rises, reaching about +270% by end-2025; it correlates 0.99 with the residual premium and carries economic content (correlation −0.88 with the dollar reserve share), so the premium is neither an artifact of the chosen break date nor of reading a residual as an object.

The break also shows up as out-of-sample failure. Estimating (4) only through 2019 and forecasting forward, the real-rate model fails: its end-2025 error is about 15 times the in-sample residual standard deviation of that pre-2019 fit (Figure 6), far outside the model's historical range, a sign that an omitted component has become first-order. The tests that follow ask whether reserve-demand reallocation is the leading interpretation of it.

Do the reserve variables carry genuine out-of-sample content, beyond labelling the residual after the fact? I compare expanding-window monthly forecasts of log gold, re-estimated each month and conditioning on realized regressors. The real-rate anchor's post-2021 RMSE is 0.57 log; adding the (exogenous) geopolitical-risk index cuts it to 0.53 (5%), and adding the seizure index to 0.51 (9%). A Clark–West test rejects the null of no incremental content (one-sided $p = 0.035$ for geopolitical risk, $p = 0.005$ adding the seizure index). The gain is modest in size but statistically significant, and it requires letting the relationship update: pre-2022 coefficients frozen and projected forward do *not* extrapolate (they forecast no better than the real-rate anchor), precisely because the gold–risk relationship itself re-rated after 2022. The premium is a level re-rating, not a stable relationship the anchor merely omitted.

5 Specificity: gold versus the metals and safe-asset complexes

A natural objection is that 2022–25 simply repriced all real assets: an inflation or debasement hedge would lift any hard commodity. If so, the other precious metals should have risen with gold. They did not. This

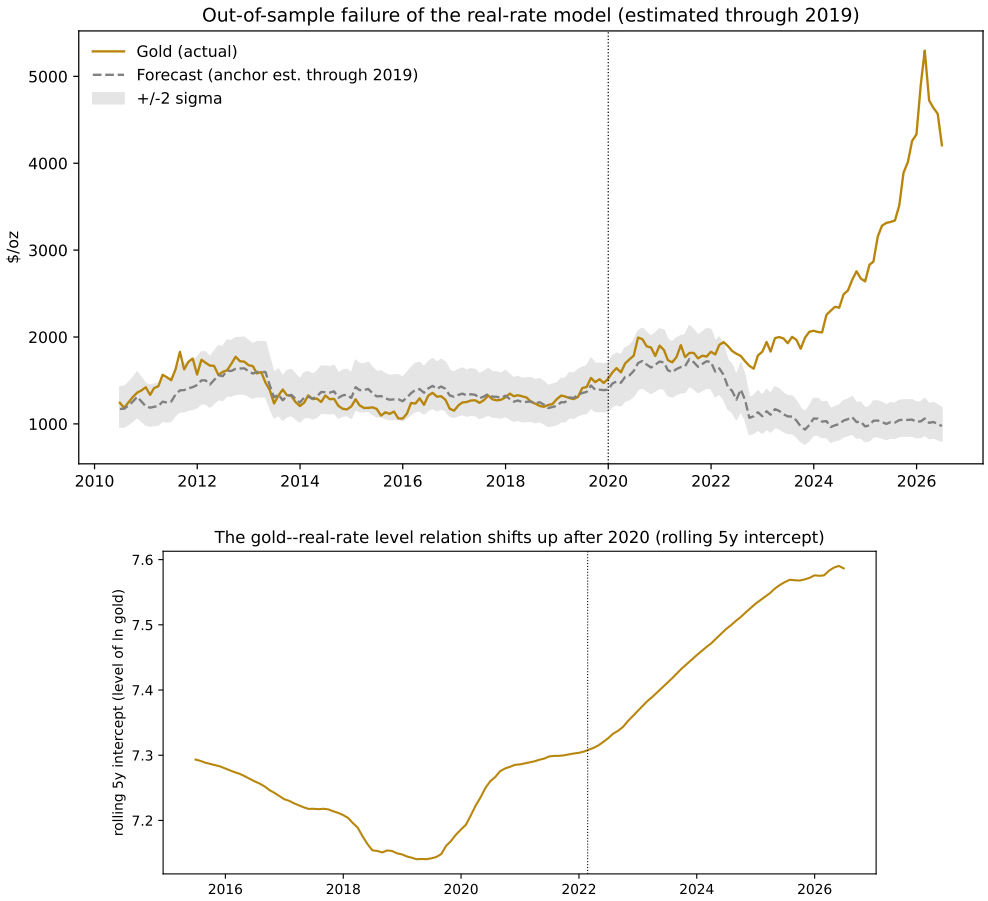


Figure 6: Top: out-of-sample failure of the real-rate model (anchor estimated through 2019; shaded band ±2 in-sample s.d.). Bottom: the rolling five-year intercept of (4) steps up after 2020, the level shift behind the premium.

comparison is a direct test of specificity, because silver, platinum and palladium share gold's "precious" and inflation-hedge characteristics but *not* its reserve-asset role.

Table 4 shows the phases. In 2022–24 (the central-bank phase) gold rose 44% while silver rose 25%, platinum fell 6%, palladium fell 52%, and copper fell 10%: the move was gold-specific, not metals-wide. Only in 2025 did the complex broaden, as silver (+122% that year) and platinum (+83%) caught up in the classic late-cycle fashion; palladium recovered +39% in 2025 but remained down 34% over the full window. The relative-price ratios show the shift clearly: platinum traded above the gold price and palladium near parity as recently as the 2010s, whereas gold now buys 2.5 platinum ounces and 3.3 palladium ounces.

I formalize the comparison two ways. First, I regress ln(gold) on the other four metals' log prices over the pre-2022 window ($R^2 = 0.88$) and project forward; the resulting gold-specific deviation from the complex (which nets out whatever moves all metals together) reaches +56% by end-2024 and is 0.93-correlated with gold's real-rate deviation from §4: the residual gold carries over bonds and over other metals move closely together, consistent with a common omitted force that is specific to gold. Second, a difference-in-differences on log prices with the metals complex as control and gold as treated tells the same story descriptively: the pre-2022 "gold × year" coefficients are jointly flat (parallel trends, $\max|t| = 0.4$), and gold's excess opens only after 2021, peaking at +53 log points in 2024. Inference here is intrinsically limited (there is a single treated asset among 5), so I do not rely on cluster-robust t-statistics, which over-reject with so few clusters. Two

Table 4: Gold versus the metals complex (Databento front-by-volume futures).

	Total return			Gold/metal ratio	
Metal	2022–24	2025	2022–26	end-2021	latest
Gold	+44%	+58%	+128%	–	–
Silver	+25%	+122%	+178%	78.4	64.3
Platinum	-6%	+83%	+73%	1.9	2.5
Palladium	-52%	+39%	-34%	1.0	3.3
Copper	-10%	+57%	+42%	–	–

Total returns by phase; gold/metal price ratios (precious metals only, same $/oz units). 2022–24 is the central-bank phase; 2025 the complex-wide broadening.

valid-but-weak alternatives bracket the evidence: randomizing which metal is treated, gold's 2022–24 excess is the *largest* of the five (the pooled 2022–24 excess: Gold +27, Silver +16 log points, the others negative; the +53 above is the single-year 2024 peak), but five assets cap the one-sided p at 0.20; and a wild cluster bootstrap with the null imposed gives $p = 0.303$, with the known caveat that the bootstrap under-rejects when only one cluster is treated. The reading is that the DiD *ranks* gold first but cannot, on five assets, certify significance. The specificity claim therefore rests on the continuous gold-versus-complex residual above (which is 0.93-correlated with the real-rate residual and estimated on the full daily cross-section rather than on five annual clusters) and on the phase returns, neither of which depends on cluster inference.

The remaining checks support the ranking. A placebo treatment in 2018 yields no gold excess (-1 log points). The gold-vs-complex correlation is stable to dropping any single control metal (0.86–0.93), so palladium's collapse is not driving it. And because silver, platinum and palladium carry their own industrial demand, I strip each metal's price of industrial production before re-running the comparison; gold's excess survives (+57% by end-2024). Throughout, the daily comovement *persists* (the gold–silver return beta is 0.43 before 2022 and 0.37 after, both with $t > 15$): as with real rates, the break is in the level, not the high-frequency relationship. Figure 7 shows the indexed complex and the DiD event study.

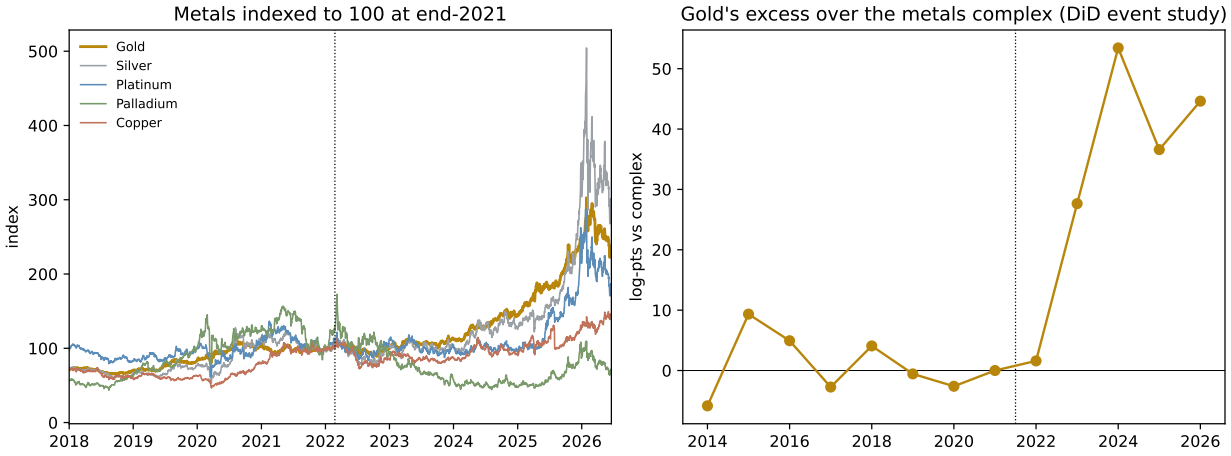


Figure 7: Left: the metals complex indexed to 100 at end-2021; gold pulls away first. Right: gold's excess over the metals complex by year (difference-in-differences event study); flat before 2022, opening after.

Specificity holds against *safe* assets, not only metals, a direct falsification of a generic flight-to-safety

reading. If a broad flight to safety or a debasement hedge drove the move, the sovereign safe havens should have re-rated too. They did not. From end-2021 to end-2025 gold rose +137% in dollars, while the Swiss franc (the classic non-US safe haven) rose only +16%, the yen −26%, the euro +3%, and the long U.S. Treasury itself −28% (Figure 8; gold's +137% is to end-2025, the premium's reference date). The same gap holds in monthly panel data, not only in end-point returns: pooling the five assets with standard errors clustered by month, gold's post-2021 excess over the safe-asset complex is +1.5% per month (t = +2.3), a +126% cumulative gap. Nor is it carry: these are dollar returns, and crediting each haven with its own money-market yield over 2022–25 lifts the franc only to +18% and the euro to +13% in total return, still far below gold, which itself pays no coupon. Run through the same pre-2022 real-rate anchor, the Swiss franc's end-2025 deviation is +26% and the long Treasury's −9%, against gold's +346% on the same monthly anchor. The re-rating is specific to gold among safe assets, exactly as the no-counterparty mechanism predicts: the franc, the yen and the Treasury each have an issuer and an account that can be frozen; gold has neither. This is also why the global rise in δ shows up in gold rather than in a rival safe currency (§6.2).

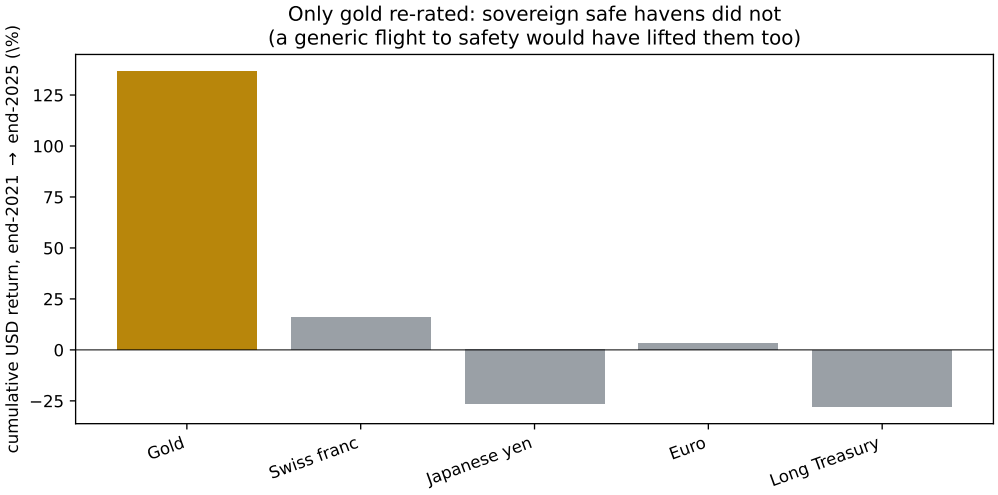


Figure 8: Only gold re-rated. Cumulative USD return, end-2021 to end-2025, for gold and the sovereign safe havens (Swiss franc, yen, euro) and the long U.S. Treasury. A generic flight to safety or debasement hedge would have lifted the sovereign assets too; only gold (the asset with no issuer to default and no account to freeze) shows the large re-rating.

One further alternative deserves a direct test: that the level reflects a shift in gold's *convenience yield* or lease rate (gold becoming scarce or expensive to borrow) rather than reserve demand. The futures curve rules it out. The front calendar spread implies an annualized cost-of-carry that averaged +1.24% before 2022 and +4.79% after; the curve stayed in contango in 100% of months throughout (never backwardation, which scarcity would produce), and the implied carry simply tracked the risk-free rate, with a slope of 0.96 on the three-month Treasury bill ($R^2 = 0.58$), as cost-of-carry contango should. Regressing the carry on the bill rate and projecting forward, the post-2021 residual is only +0.20%, well within its pre-2022 range (residual s.d. 0.6%; Figure 9). This speaks to the listed-futures curve; opaque OTC lease activity is not observed directly, but a scarcity-driven borrowing squeeze would raise lease rates and push the curve toward backwardation, the opposite of the stable, bill-tracking contango documented here. Gold did not become scarce or hard to borrow: the premium is a repricing of the spot *level*, not a convenience-yield phenomenon.

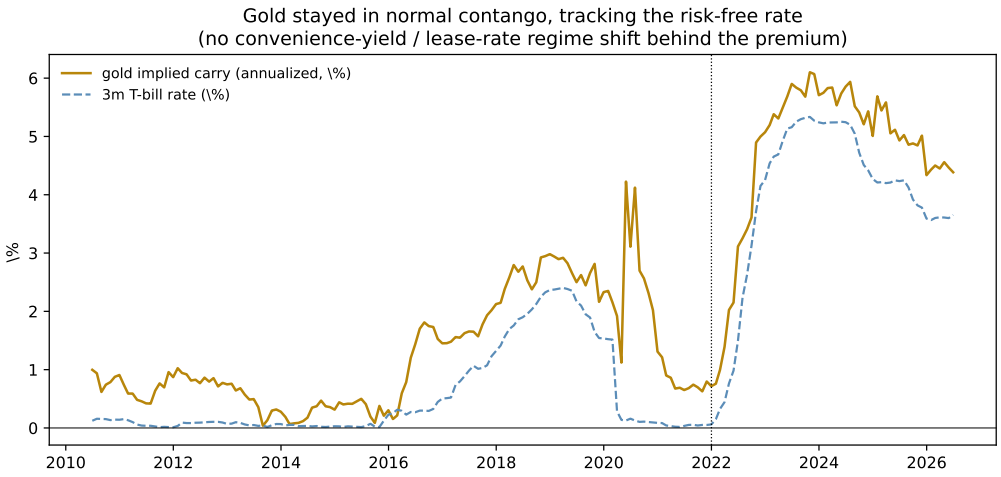


Figure 9: No convenience-yield regime shift. The annualized cost-of-carry implied by gold's front calendar spread stayed positive (contango) and tracked the three-month Treasury-bill rate throughout the premium's rise; gold never moved to backwardation, the signature of scarcity. The re-rating is in the spot level, not the curve.

6 The reserve-demand channel

6.1 Drivers and a horse race

If reserve de-dollarization drives the premium, two footprints should track it: reserve managers shifting *out of dollars* (a falling dollar reserve share) and *into gold* (rising official purchases). Both line up. The premium's correlation with the COFER dollar share is -0.85 and with cumulative official purchases is high. But both the premium and the dollar share are highly persistent, and, as a referee would rightly insist, a levels regression of one trending series on another risks spurious inference (Granger and Newbold, 1974). I confront this directly: ADF and KPSS tests put all the series in $I(1)$, and an Engle–Granger test (Engle and Granger, 1987) fails to reject the null of *no* cointegration between the premium and the dollar reserve share ($p = 0.59$). I therefore do *not* lean on their levels regression. The de-dollarization evidence rests on three things that do not depend on a common trend.

Before turning to them, one objection to the dollar-share evidence is worth settling, because addressing it strengthens the result. The COFER dollar share is a ratio, so when the dollar appreciates the dollar value of the non-dollar pile shrinks and the share rises *mechanically*, with no trade, so a referee might suspect the decline is just valuation (Arslanalp et al., 2023). Decomposing the change in the share into a valuation component (revaluing the non-dollar reserves by the broad dollar, quantities held fixed) and an active residual shows the opposite. The dollar *appreciated* over 2021–25, so valuation pushed the share *up* by 1.7 points; the share nonetheless fell 2.8 points, implying active reallocation of -4.5 points, larger than the headline decline (Figure 11). Over 2015–25 the active component is -5 to -9 points, depending on the currency basket used for the revaluation. Reserve managers were selling dollars, not merely marking them down.

(i) Central-bank purchase flows, with a horse race. Table 5 regresses the annual *change* in the premium on official net-purchase *flows* (tonnes per year, not a mechanically trending cumulative stock). The flow coefficient is positive and significant, and stable as I add changes in US debt-to-GDP, money growth, and inflation expectations: the fiscal/debasement and liquidity stories do not displace it. With only fourteen annual

observations I stress-test it: the coefficient is stable to leaving out any single year (it stays in [+0.36, +0.63] per thousand tonnes) and a wild bootstrap rejects no effect ($p = 0.006$). Lagged purchases also enter positively ($t = 2.0$), so buying tends to precede premium gains, which mitigates, though it does not eliminate, the reverse-causality concern that purchases merely chase the price. At quarterly frequency a recursive SVAR (geopolitical risk, IMF-reported official purchases, the premium; risk ordered first, quantities ahead of price) gives an exogenous geopolitical-risk shock a premium response of about 14% over eight quarters (90% band excluding zero) and roughly 60% of the forecast-error variance, while the *reported* quantity series explains almost none ($\approx 5\%$), as expected when the marginal buying is opaque (§6.3). This response is far smaller than the +341% level shift because it identifies off a single *transitory* risk innovation rather than the sustained ratchet of §3; a Granger test does not reject the null that risk fails to Granger-cause the premium ($p \approx 0.131$), and a local projection is sign-unstable in this short sample. I therefore read the quarterly time-series as lower-bound, suggestive evidence; the weight rests on the model, the cross-asset specificity, and the dollar-side mirror.

Table 5: Drivers of the gold premium: central-bank flows against rival explanations.

Dep.: Δ gold premium (annual)	(1)	(2)	(3)	(4)
CB net purchases (per 1,000 t/yr)	+0.54***	+0.53***	+0.59**	+0.58*
	(+3.1)	(+2.8)	(+2.0)	(+1.8)
Δ debt/GDP	No	Yes	Yes	Yes
Money growth	No	No	Yes	Yes
Inflation expectations	No	No	No	Yes
R^2	0.58	0.57	0.57	0.58
N	14	13	13	13

Annual changes in the gold premium π_t on World Gold Council central-bank net purchases and controls; HC1 t-statistics in parentheses. The real yield is *not* a regressor (it is netted out by the construction of π). $^*/^{**}/^{***}$: 10/5/1%.

(ii) Not a dollar artifact. Rebuilding the premium with gold priced in euros, yen and renminbi gives end-2025 premia of +362%, +557% and +369%, large in every numeraire. (The cross-numeraire differences partly reflect each currency's own move against the dollar and are not interpreted; the point is only that the premium is large and positive in every unit.) The premium is gold appreciating, not merely the dollar depreciating; the broad dollar enters the high-frequency regressions significantly, and the premium is what remains *after* that dollar variation is accounted for.

(iii) Not retail or ETF demand. Physically-backed gold ETFs were net *sellers* of 550 tonnes over 2021–24 while gold rose 44% (Figure 10). An investment- or retail-led rally would show the opposite; the pattern is more consistent with official-sector demand, and it is exactly the private crowding-out the model predicts (§3). A clean free measure of Chinese retail demand is hard to obtain, but it points the same way: the World Gold Council reports Chinese jewellery demand *falling* about a quarter in 2024 even as gold soared, the opposite of a domestic-retail-led rally.

(iv) Not generic anti-fiat demand. If the premium were a broad flight from fiat money rather than a reserve story, bitcoin (seizure-resistant and non-sovereign, but not a reserve asset) should share it. It does not. Bitcoin fell 64% in 2022, exactly as the reserve-freeze narrative peaked and gold's premium began to build, and fell again (by roughly 30% in 2026) as the premium reached its high; across the sample it co-moves

with equities (0.33 in daily returns, against 0.18 for gold), trading as a risk asset rather than a reserve hedge (Figure 12). No central bank holds material bitcoin reserves. These comparisons are more consistent with demand for gold as a reserve asset than with a generic shift toward all seizure-resistant assets.

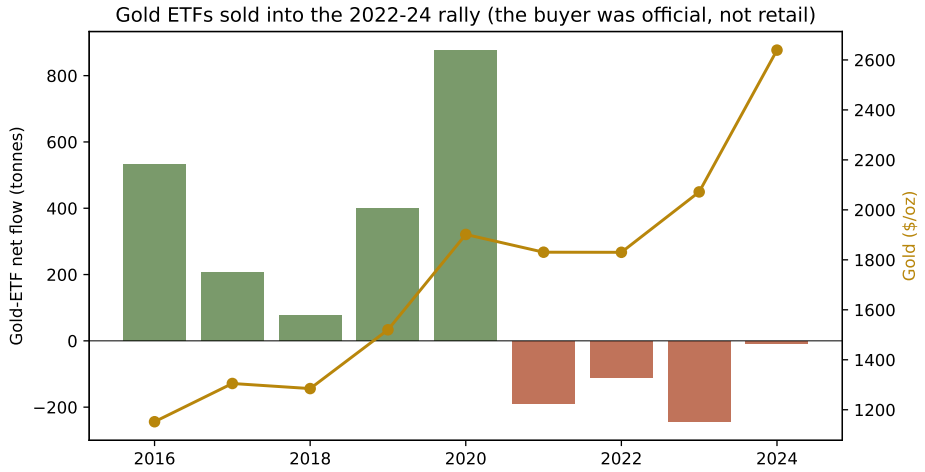


Figure 10: Gold ETFs sold into the 2022–24 rally: ETF net flows (bars) turned negative even as the price (line) rose, more consistent with official than retail demand.

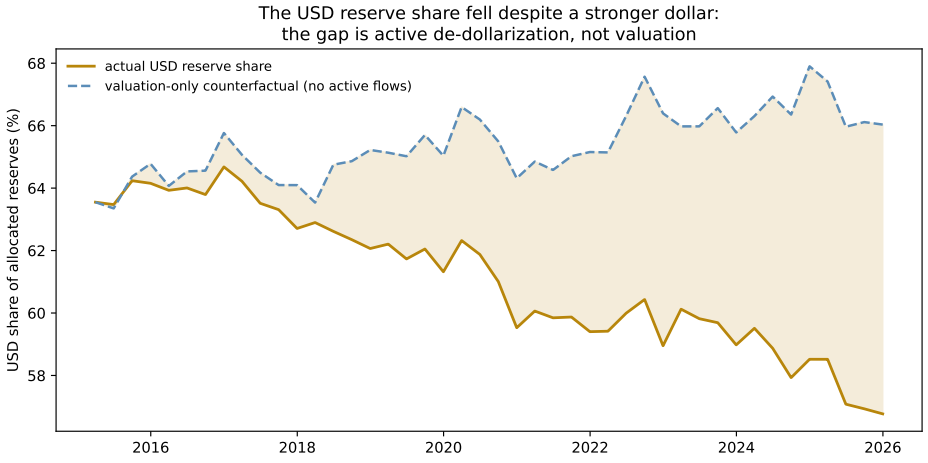


Figure 11: The dollar's reserve share fell despite a stronger dollar. The valuation-only counterfactual (dashed; non-dollar reserves revalued by the broad dollar, quantities fixed) drifts *up*; the actual share (solid) falls. The shaded gap is active reallocation out of dollars, not exchange-rate revaluation.

6.2 Seizability versus safety: the dollar-side mirror

The evidence so far is consistent with reserve de-dollarization but also with a generic flight to safety, and gold alone cannot separate the two. The way to separate them is to find an asset on which the two motives pull in *opposite* directions, and U.S. Treasuries are that asset. A generic safe-haven motive has reserve managers buying more Treasuries when risk rises; a seizure motive has them fleeing Treasuries, because Treasuries can be frozen. I measure the foreign-official segment directly, with the marketable Treasuries held in custody at the New York Fed for foreign official and international accounts. Its share of the Treasury market fell

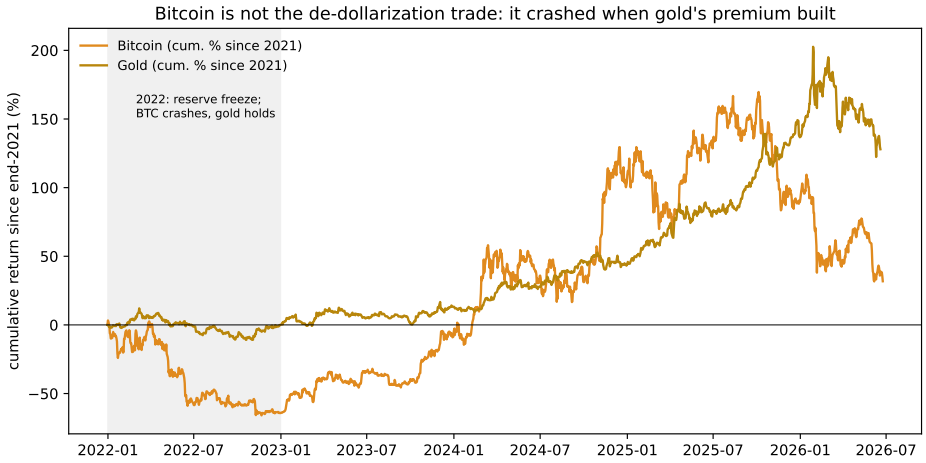


Figure 12: Bitcoin is not the de-dollarization trade. It crashed in 2022 as the reserve-freeze narrative peaked and gold's premium began to build, and fell again in 2025–26 as the premium reached its high, trading as a risk asset rather than a reserve hedge.

from about 18% in the early 2010s to 7% by 2025; more tellingly, its dollar level rose by about $0.9tn over 2010–21 and then *fell* by about $0.4tn over 2022–26. Foreign officials turned from accumulating Treasuries to shedding them in the most geopolitically fraught years since the Cold War, exactly when a safe-haven motive would have them buying.

This sign split distinguishes the two motives directly: generic safe-haven demand and reserve-seizure demand predict opposite responses for official Treasury holdings. I regress the monthly change in log official custody (2003–2026) on standardized measures of *financial* risk (the VIX), broad *geopolitical* risk (the GPR index), and a narrow *reserve-seizure* index built from the dated record of sovereign and central-bank asset freezes.[1] Geopolitical and seizure risk enter *negative* (-0.26, $t = -2.9$; and -0.16, $t = -1.8$), while financial risk enters *positive* ($+0.30$ per standard deviation, $t = +1.3$). The central result is the negative *geopolitical/seizure* loading: a generic safe-haven motive predicts that official Treasury demand *rises* with flight-to-safety risk, so a net demand that *falls* when geopolitical and seizure risk rise is the opposite of what a pure safe-haven motive predicts: in the foreign-official segment the seizure-avoidance motive dominates the safe-haven motive. That negative loading is robust: it holds under every financial-risk control (GPR -0.23 to -0.26, all $|t| > 2.5$) and, as the footnote notes, to the seizure index's half-life and weighting, and to dropping any single freeze event, including the 2022 Russia freeze, so it is not an artifact of that one episode. The financial-risk (safe-haven) leg, by contrast, is *sign-unstable* across proxies: significantly positive under the Chicago Fed financial-conditions index ($+0.59$/sd, $t = +8.3$), directional under the VIX ($t = +1.3$), and significantly negative under trailing equity realized volatility (-0.28/sd, $t = -2.9$). Because the safe-haven leg cannot be reliably signed I do not lean on it; the identification rests entirely on the robust negative geopolitical/seizure loading, which a generic safe-haven motive cannot produce. The gold premium is the other side of this rotation, co-moving -0.71 with the official Treasury share (Figure 13): a price and a quantity,

[1] The index sums one pulse per freeze event, each weighted by the square root of the frozen reserves (USD bn) and decaying exponentially with a twelve-month half-life: Iran's central bank (2012), Russia/Crimea (2014), Venezuela (2019), Afghanistan's DAB (2021), the G7/EU freeze of Russian reserves and the SWIFT cut-off (2022), and the U.S. REPO Act and EU/G7 windfall-asset decisions (2024). The index is built only from these public freeze dates and frozen amounts; it uses no gold-price or premium data. The negative custody loading is sign-stable to the half-life (6–24 months: -0.09 to -0.24), to the weighting scheme (square-root, linear, log: -0.12 to -0.19), and to dropping any single freeze event (coefficient in $[-0.20, -0.13]$); its significance is marginal, with $|t|$ between 1.0 and 2.3.

one repricing of the safety of the dollar reserve system. The same seizure index also tracks the gold premium about as closely as broad GPR does (entered together they carry comparable, jointly significant loadings, GPR +0.19 and the seizure index +0.17 log points per standard deviation, each $t \approx 2.3$), further pointing to reserve-seizure salience specifically rather than generic uncertainty.

Two caveats qualify the reading. The financial-risk (safe-haven) leg is the proxy-dependent one discussed above, so the argument does not lean on it; and custody at the New York Fed is a proxy: a decline can reflect outright selling or moving custody beyond U.S. reach. Both, however, are seizure-avoidance, and the shift is not merely a change of vault: world official gold *holdings* rose over the same window (§6.3), so managers were adding the un-seizable asset, not only relocating the seizable one. The dollar-share decline is also secular, building from the mid-2010s rather than jumping in 2022, consistent with seizure risk as a slow ratchet that each freeze episode tightens (§6.4).

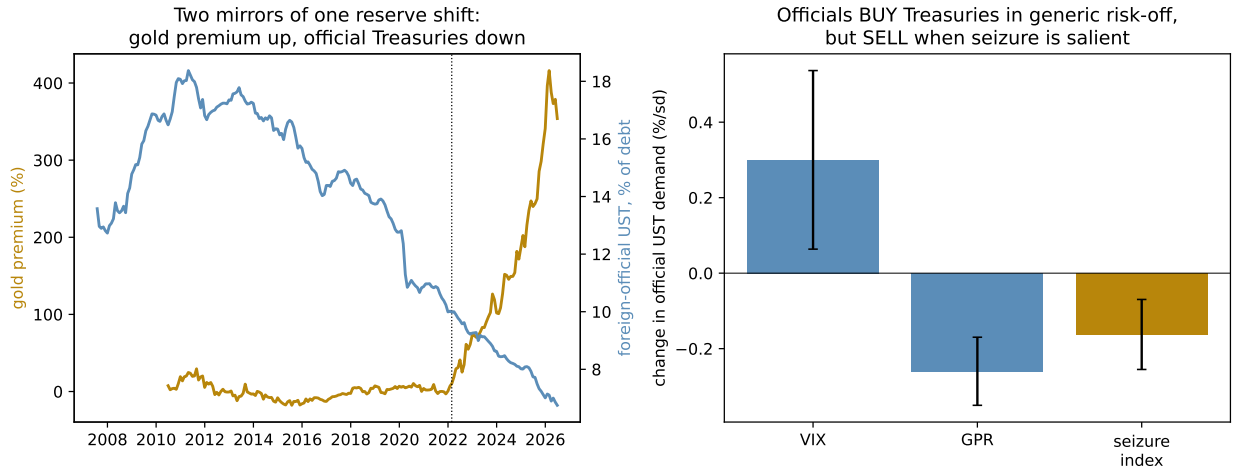


Figure 13: Left: the gold premium (left axis) and the foreign-official share of U.S. Treasuries (right axis) are mirror images: gold up, official Treasuries down. Right: the monthly change in foreign-official Treasury custody loads *negatively* on geopolitical and reserve-seizure risk (the robust sign that a generic safe haven cannot produce), while the financial-risk (VIX) leg is positive but proxy-dependent (see text; bars ±1 s.e.).

Where did the reserves go? If this were classic de-dollarization (a rotation into a rival reserve currency), some currency's share would have risen. None did. Over 2021–25 the dollar's allocated-FX share fell 2.6 points, but the renminbi's share, the obvious candidate, *fell* too (by 0.9 points), and no currency gained more than half a point (Figure 14). The reallocation went into gold, whose share of reserves rose sharply over the same window, from about 15% to 29% of allocated reserves plus gold. Part of that rise is valuation, since the gold price more than doubled, so it is not all active buying; but the compositional shift away from sovereign claims is the relevant fact, and it does not depend on the magnitude. Reserves left *sovereign* claims (every one of which is someone's liability and freezable) for the one reserve asset that is nobody's liability. The shift is sovereign-to-gold, not dollar-to-renminbi, which is why I read the premium as a flight to the non-sovereign asset, of which dollar diversification is the largest component, rather than as competition among currencies.

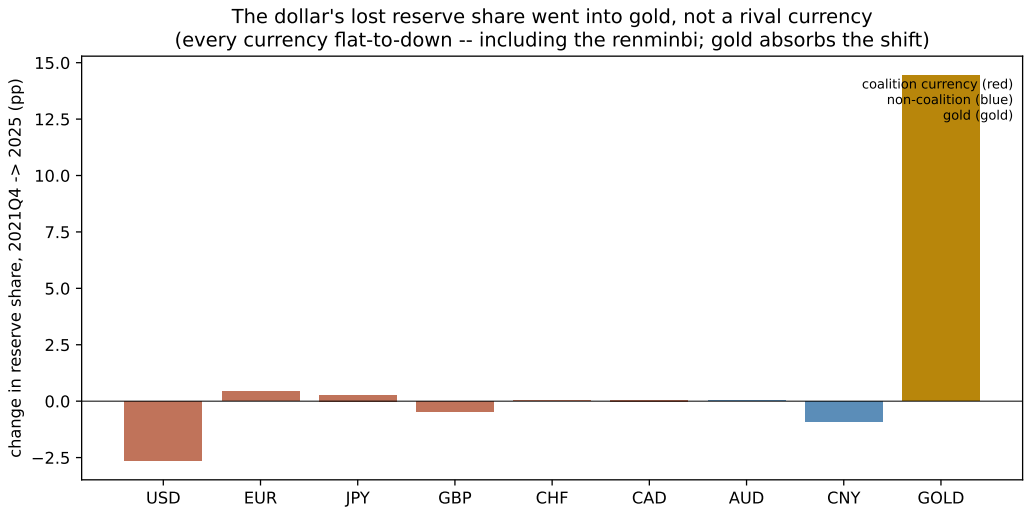


Figure 14: Change in reserve share, 2021Q4–2025. Every currency is flat-to-down (including the renminbi, the obvious de-dollarization candidate) while gold absorbs the shift. The dollar's lost share went to a non-sovereign asset, not to a rival currency. (Gold's share is value-based and partly reflects the higher gold price; freeze-coalition currencies in red, others in blue.)

6.3 Cross-country evidence and the opacity of official buyers

Why not identify the channel from cross-country variation in who bought gold? I try, and the answer is instructive. In a country panel of IMF-reported official gold (2016–2025), a difference-in-differences interacting the post-2022 indicator with each country's pre-war geopolitical distance from the US (Bailey et al., 2017) is statistically insignificant (−0.09, $t = -0.8$; permutation $p = 0.16$): among *reporting* countries, accumulation is broad-based across emerging markets and does not concentrate among US-opposed states. I do not read this null as positive evidence for either interpretation: the test is uninformative here, because the countries most likely to act on seizure fear are precisely those that report least. It establishes only that a clean cross-sectional design is unavailable, which is why the channel is read from prices.

That caveat is the deeper point: a cross-country test cannot settle the question because official buying is opaque. Table 6 compares the change in the IMF-reported world gold stock with the World Gold Council's estimated official purchases. Before 2022 they roughly agree; after, a large gap opens (2,302 tonnes cumulatively over 2022–24) because the principal buyers do not report transparently: China discloses in occasional lumps, Russia stopped reporting in 2022, and over-the-counter purchases escape the IMF template (Arslanalp et al., 2023). This opacity is why the paper reads official demand off the *price*: when quantities are hidden, the marginal official bid still clears in the market, and the premium is a price-based measure of demand that the quantity data miss.

A behavioral signature points the same way and does not depend on the opaque holdings data: *where* central banks keep their gold. Since the mid-2010s a wave of repatriation has moved bullion out of Western vaults into domestic custody: Germany (674 t from New York and Paris, 2013–2017), the Netherlands (122 t, 2014), Austria, Hungary, Poland (100 t from London in 2019, with more announced in 2024), Turkey, and India (over 100 t returned from the Bank of England in 2024). The stated motive is to hold gold where it cannot be frozen. Repatriation clusters after 2014 and again after 2022, the same ratchet as the premium and the dollar-side flight, revealed in the one choice that is unambiguously about seizability rather than

Table 6: The opacity gap: IMF-reported world gold change vs. WGC estimated official purchases.

Year	IMF reported (t)	WGC purchases (t)	Hidden gap (t)
2019	496	605	109
2020	248	255	7
2021	346	463	117
2022	252	1,082	830
2023	363	1,037	674
2024	247	1,045	798

Reported change is the sum of year-on-year changes in IMF IRFCL country gold holdings; WGC purchases include estimated and over-the-counter buying. The post-2022 gap is the under-reported official demand.

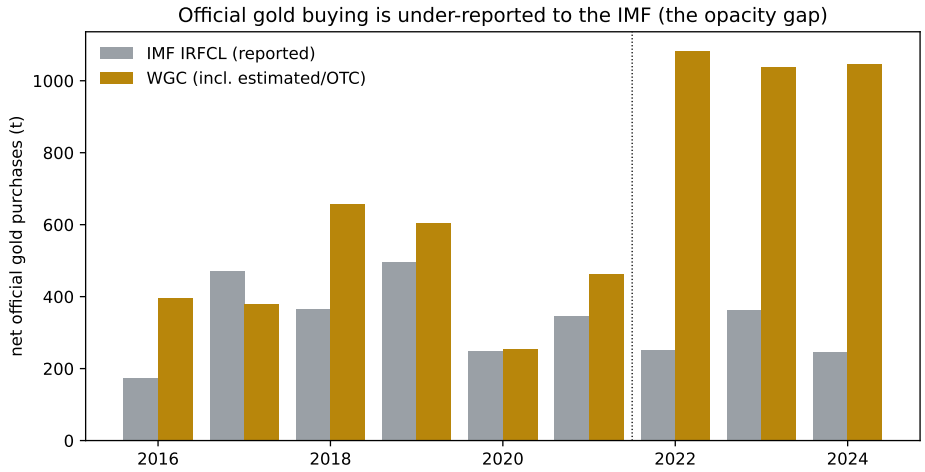


Figure 15: Official gold buying is increasingly under-reported to the IMF: the gap between WGC estimated purchases and the IMF-reported world stock change widens sharply after 2021.

diversification.

6.4 The 2022 reserve freeze as catalyst

The obvious trigger for a jump in perceived seizure risk δ is the immobilization of roughly $300bn of Russian reserves on 26 February 2022, the first reserve weaponization at that scale. I test the event directly, and the evidence fits a slow reserve-reallocation mechanism rather than a repricing. The immediate reaction was muted: the one-week cumulative abnormal return (from a pre-event market model) is +1.4% with $t = 0.9$ (insignificant), and intraday gold spiked on the invasion and round-tripped. The freeze is not the start of the decoupling either, since the premium's trend break predates it (§4). What the freeze marks is the durable change: geopolitical risk spiked nearly sixfold, official buying jumped to its record 1055 t/yr pace and stayed there, and over the following year, as real yields surged and dragged the whole metals complex down, gold fell the *least* at every horizon, the relative resilience of a steady reserve bid. Consistent with §6.3, the freeze plausibly raised δ for *all* dollar-holders at once (it demonstrated that reserves can be frozen), which is why the response shows up as an aggregate level shift and is not concentrated in the most-opposed countries. The freeze did not reprice gold in a day; it coincides with a multi-year change in who accumulates it. The later seizure milestones tell the same story at higher frequency: around the 2024 REPO Act and the G7's decision to

lend against frozen-asset windfalls, intraday gold shows no sharp, gold-specific move (the industrial metals move similarly), consistent with gradual reallocation rather than event-day repricing (these headlines were also well telegraphed).

7 Discussion and conclusion

The results revise the workhorse model of gold valuation. Real rates still price gold at the margin (the high-frequency beta is intact and gold error-corrected to the real-rate level before 2022), but the long-run anchor stopped binding, and a new, slow-moving level of demand sits on top that real rates, the dollar, inflation expectations, money growth and volatility do not capture. The evidence ties that demand to gold's reserve role: it coincides with the secular decline in the dollar's reserve share and with record official purchases, it is specific to the one metal central banks hold, it is large in every currency, it rose while retail and ETF demand fell, and it builds as reserve safety became salient. A reserve manager facing seizure risk generates this pattern; the model rationalizes its sign and specificity, and a stock-equilibrium calibration bounds the magnitude (the official flow is an order too small to be the premium, so the bulk is a re-rating of the existing stock's safety value rather than a flow-driven scarcity), even if the level is not structurally identified to a point.

Three caveats bound the claims, and I have tried to meet rather than paper over them. First, the identification is not experimental. The evidence I rely on most is the cross-asset specificity and the model's mapping to the data; the reserve-share and purchase regressions are associational, which is why I demote the (non-cointegrated) levels regression and rely on flows, lags and the cross-asset test. Reverse causality (purchases chasing price) is mitigated by the lag structure but not eliminated. Second, COFER dollar-share movements blend active reallocation with valuation effects; stripping the valuation channel leaves the decline intact as active reallocation, but the share remains corroborating context and I keep the primary weight on quantities and prices. Third, the premium is by construction whatever the real-rate model omits; the contribution is to show that this omission has a coherent reserve-safety interpretation, an associational footprint in aggregate reserve behavior, a mechanism, and a bounded magnitude: that it is robust to enriching the anchor and to removing extrapolation, and that it is specific to gold. What I cannot do, given the opacity of official buyers, is decompose the premium country by country; that the data hide the buyers is itself the point.

Gold has decoupled from its traditional real-rate anchor at the level while remaining tethered to it at high frequency, and the gap, more than fourfold by 2025, is consistent with a de-dollarization premium. It coincides with the dollar's falling reserve share and record central-bank buying, it is specific to the one precious metal that serves as a reserve asset, it survives a horse race against fiscal, monetary and retail explanations, and a reserve-portfolio model with seizure risk reproduces its sign pattern and gold-specificity. Models that price gold off real rates alone now miss an important component; reserve demand is the leading candidate for the missing anchor. It is worth being explicit about how far each claim reaches: the level-versus-mechanics split is established; the gold-specific reserve-safety repricing is strongly supported (it holds against the metals complex and the sovereign safe havens alike, and the futures curve rules out a convenience-yield account); the finer decomposition (reserve-seizure salience versus a broader flight to safety, and dollar diversification versus general reserve caution) is where the evidence is suggestive rather than decisive.

Does the market expect the re-rating to last? Gold-mining equities offer a market-based read, since a

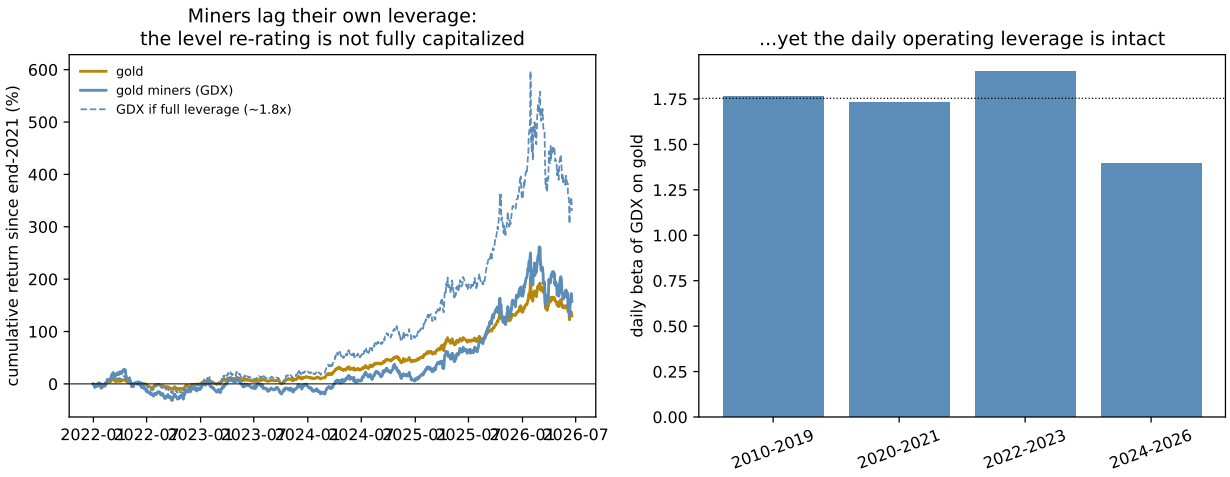


Figure 16: Left: since end-2021 gold-mining equities (GDX) rose only modestly more than gold, far short of the dashed counterfactual in which they track gold at their historical ~1.8× operating leverage; the higher gold level is not fully capitalized. Right: yet the daily operating leverage itself is intact across 2022. As with real rates and the metals complex, the high-frequency mechanics hold while the level is what moves.

miner is a levered claim valued on the gold price investors expect to persist. Their high-frequency operating leverage to gold is intact (the daily beta of mining-equity returns on gold returns sits in the 1.4–1.9 range throughout), yet since end-2021 they have risen only about 1.1 times as much as gold, far below that leverage. The equity market reacts to gold day to day but has not capitalized the higher level at full leverage, discounting a meaningful part of the spot re-rating as not-yet-permanent. This is the level-versus-mechanics split once more, now in a third market, and it has two implications. It is a market vote that part of the premium may not prove permanent (though 2021–23 mining-cost inflation also compressed margins, so this overstates the discount); and, because an investment-led rally would have bid the leveraged equity play up at *full* leverage, the lag is further evidence that the marginal buyer is the official sector accumulating physical metal, not the investment community.

Whether the premium persists depends on whether reserve diversification continues, and on whether the seizure-risk assessment that triggered it proves durable. Here the beliefs are likely asymmetric: a demonstrated willingness to freeze reserves is hard to un-demonstrate, so even returning the frozen assets need not restore the prior anchor. The premium may prove stickier than the episode that set it off.

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