

Silver After the Ceiling Break: Liquidity, GSR Compression, and the New Tape

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Once silver clears and *holds* above the Hunt-era nominal high (~\$50/oz), the market exits a 14-year range and enters true price discovery. In that regime, microstructure (stop runs, ETF flows, lease rates) fuses with macro liquidity. The practical linkage is simple: $\text{silver} \approx \text{gold} / \text{GSR}$. With gold already near \$3.46k/oz, any credible compression of the gold/silver ratio (GSR) from ~50 toward 30–25 maps to \$115–\$140 silver, with tail risk to ~\$170 in a squeeze. Whether that compression happens depends on balance-sheet policy and plumbing: M1 re-expansion via emergency backstops or QE, rapid Fed cuts that loosen real rates, stress in stablecoins that rotates flows from crypto pipes into “outside money,” heavy Treasury supply and how it is absorbed, and BRICS settlement narratives that anchor gold and let silver’s beta work later. This paper turns that scenario tree into a research and trading framework: what confirms a breakout, which dashboards lead (rates, reserves, RRP, TGA, ETF tonnage, COMEX stocks, stablecoin pegs), how to translate macro shocks into GSR targets, and what invalidates the thesis (failed acceptance back under \$50). The goal is an audit-friendly map from policy and liquidity to price bands, risk guards, and replication.

Keywords: silver breakout, gold/silver ratio, M1 liquidity, Fed rate cuts, quantitative easing, stablecoin risk, BRICS dedollarization, U.S. debt issuance, ETF flows, COMEX inventories, lease rates, real yields, dollar index, regime shift, risk management.

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1. Problem Statement and Claim

1.1 From ceiling to floor: why \$50 matters

Silver has spent ~14 years oscillating below the 2011 peak near \$49–50/oz. That level concentrated: (i) trapped longs from 2011, (ii) systematic shorts anchored to “the ceiling,” and (iii) risk systems calibrated to a long range. A **decisive** move *through and above* \$50 that **holds on weekly/monthly closes with rising volume** converts that ceiling into a **reference floor**.

Mechanically:

- Stops above \$50 convert short interest into **market buy orders** (short-covering burst).
- New mandates unlock (“no new ATH, no allocation” flips to “above ATH, allow risk”).
- Volatility regime shifts: option makers raise wings; miners’ beta expands > 1×.
- Narrative changes from “range-bound industrial metal” to “scarcity/monetary hedge,” attracting non-specialist capital.

We claim: once acceptance above \$50 is demonstrated (time + volume), the market enters **price discovery** where macro liquidity and the gold/silver ratio (GSR) dominate path and targets. In this regime, the most audit-friendly guidance is not a story, but a **mapping** from observable drivers (gold, GSR) to silver.

1.2 Core linkage: silver $\sim$ gold / GSR

Define:

- gold_usd_per_oz = current gold price in USD/oz
- $\text{GSR} = \text{gold/silver ratio} = \text{gold_usd_per_oz} / \text{silver_usd_per_oz}$
- $\text{silver_usd_per_oz} = \text{gold_usd_per_oz} / \text{GSR}$

This identity is the paper’s backbone: **given gold and an assumed/observed GSR, silver is pinned.**

With $\text{gold_usd_per_oz} \sim 3,462$:

- If $\text{GSR} = 50 \rightarrow \text{silver} \sim 3,462 / 50 \sim 69$
- If $\text{GSR} = 40 \rightarrow \text{silver} \sim 86.6$
- If $\text{GSR} = 35 \rightarrow \text{silver} \sim 98.9$
- If $\text{GSR} = 30 \rightarrow \text{silver} \sim 115.4$
- If $\text{GSR} = 25 \rightarrow \text{silver} \sim 138.5$

- If GSR = 20 → silver ~ = **173.1**

Range-expansion math from the last cycle is consistent:

2011 high (~49) – 2020 low (~12) = ~37; add to 49 → ~86 (first structural target).

GSR compression then supplies the **next bands** (30–25 → ~115–139), with a tail on disorderly squeezes (GSR ~20 → ~173).

Therefore, the claim is twofold:

- (i) **Threshold:** sustained acceptance above \$50 marks a regime change from range to discovery.
- (ii) **Driver: silver's path is gold divided by GSR;** liquidity shocks and policy responses move GSR, which sets the actionable target bands.

2. Data and Methods

2.1 Range-expansion math (2011 high to 2020 low)

Inputs.

- 2011 swing high (monthly): H_2011 ~ 49 USD/oz
- 2020 crash low (monthly): L_2020 ~ 12 USD/oz
- Range: $R = H_{2011} - L_{2020} = \sim 37$

Method. Use classical range-expansion once the prior all-time high is exceeded and *accepted*.

- Measured move 1: $T1 = H_{2011} + R \rightarrow \sim 49 + 37 = \sim 86$
- Fib 1.272: $T1.272 = H_{2011} + 1.272 * R \rightarrow \sim 49 + 47.1 = \sim 96$
- Fib 1.618: $T1.618 = H_{2011} + 1.618 * R \rightarrow \sim 49 + 59.9 = \sim 109$
- Symmetry check: midpoint $M = (H_{2011} + L_{2020})/2 \rightarrow \sim 30.5$ (used only as a control to detect failed breaks that round-trip to midrange).

Why this works. After ceiling removal, positioning and risk budgets frequently replicate the prior amplitude before new information dominates. We treat R as a structural “unit length” for the next leg, then hand off to GSR logic.

2.2 GSR mapping: targets for gold = \$3.46k

Identity.

$$\text{silver_usd_per_oz} = \text{gold_usd_per_oz} / \text{GSR}$$

Gold anchor.

$$\text{gold_usd_per_oz} = 3460 \text{ (rounded from spot } \sim 3.46\text{k)}$$

Target table (rounded to nearest \$0.1):

- GSR 55 $\rightarrow 3460/55 = \$62.9$
- GSR 50 $\rightarrow \$69.2$
- GSR 45 $\rightarrow \$76.9$
- GSR 40 $\rightarrow \$86.5$
- GSR 35 $\rightarrow \$98.9$
- GSR 33 $\rightarrow \$104.8$
- GSR 30 $\rightarrow \$115.3$
- GSR 28 $\rightarrow \$123.6$
- GSR 25 $\rightarrow \$138.4$
- GSR 22 $\rightarrow \$157.3$
- GSR 20 $\rightarrow \$173.0$

Interpretation.

- The **range-expansion zone** ($\sim 86\text{--}109$) corresponds to **GSR $\sim 40\text{--}32$** at gold 3.46k.
- **Policy-impulse compression** (QE/backstops, liquidity stress) that drives GSR $\sim 30\text{--}25$ maps to **\$115–\$139**.
- **Blow-off tail** with GSR ~ 20 implies **$\sim \$173$** (scenario, not baseline).

We will refresh this table mechanically as gold moves; the mapping is linear.

2.3 Acceptance criteria: weekly/monthly closes, volume/time

Goal. Distinguish a true regime change from a stop-run fakeout.

Rule set.

1. Level definition.

- Breakout level $B = 50$ (use 49–50 zone; we test both).
- Buffer band: $B_{\text{low}} = 49$, $B_{\text{high}} = 51$ (accounts for slippage and charting discrepancies).

2. Time criterion (closes).

- Minimum: **2 consecutive weekly closes** $\geq B_{\text{high}}$
- Strong: **1 monthly close** $\geq B_{\text{high}}$
- Failure signal: **any weekly close** $\leq B_{\text{low}}$ within 4 weeks of breakout *with rising open interest*.

3. Volume/participation.

- Futures: breakout week's total volume $\geq 1.5 \times$ 26-week average.
- ETFs (e.g., SLV/PSLV): net inflow over the breakout month $> 2\%$ of AUM.
- Options: 25 Δ call skew widens vs 25 Δ put by ≥ 5 vols on breakout week (proxy for demand).

4. Microstructure confirms.

- COMEX registered stocks: flat to down; no surge from exchange dilution.
- Lease rates: rise from baseline; brief backwardation not required but supportive.
- Miners: basket beta > 1.2 to spot over the breakout month.

5. Liquidity backdrop (context filter).

- At least one of: falling real 2y yield, rising bank reserves, ON/RRP drain, or TGA draw.
- If all are opposite (tightening), require **strong** criterion (monthly close + volume) before calling acceptance.

Decision rubric.

- If Time(min) + Volume + ≥ 1 Microstructure confirm → **Accepted** (activate targets: T1, T1.272, T1.618; then GSR bands).
- If price pokes above B_high but fails Time(min) or prints a weekly close $\leq$ B_low with rising OI → **Failed break** (expect retest 45–48 before re-attempt).

3. Liquidity Mechanics That Move GSR

3.1 M1, QE/backstops, and reserves (ON/RRP, TGA)

Mechanism. Expansionary plumbing compresses GSR by lifting the precious complex, with silver's beta > gold's.

- **M1** re-expansion and **QE/credit backstops** relax balance-sheet constraints, lower precautionary demand for cash, and rotate flows into “outside money.” Gold leads; silver accelerates later, compressing GSR.
- **ON/RRP drain → bank reserves up.** When money exits the Fed's reverse repo and shows up as bank reserves, term premia and funding stress ease; risk budgets grow; GSR tends to compress.
- **TGA draw.** Treasury spending injects net liquidity; often coincides with risk-on and a falling GSR.
- **Diagnostic set.** If reserves ↑ and ON/RRP ↓ while M1 stabilizes or rises, expect GSR drift lower; if the opposite, GSR sticks high or widens.

Tests.

- H1: $d(\text{GSR})/d(\text{reserves}) < 0$ after a 2–4 week lag.
- H2: QE announcements coincide with step-downs in the 60d moving average of GSR.

3.2 Fed cuts: slow vs rapid; real-yield transmission

Mechanism. The pace and the *real* stance matter.

- **Rapid cuts with credit support** compress GSR. They typically coincide with safety-seeking into gold first, then silver catches up and outruns.
- **Slow or “hawkish” cuts** can keep real yields elevated; gold grinds, silver lags; GSR stays high.

- **Real yield channel.** Lower real 2y/5y yields → higher present value for non-yielding assets; silver responds more in late cycle.

Signals to watch.

- 2y TIPS real yield; 5y5y breakevens; term premium proxies.
- Post-FOMC curve reaction: bull steepening with breakevens ↑ favors GSR compression.

Tests.

- H3: Weekly changes in 2y real yields are negatively correlated with next-month GSR changes.
- H4: “Cut + facility” events (rate cut paired with liquidity facility) compress GSR more than “cut only.”

3.3 U.S. debt supply and term premium

Mechanism. Heavy coupon supply without balance-sheet help can raise real yields and crowd out metals, widening GSR; balance-sheet absorption or buybacks invert that effect.

- **Refunding cadence.** Large belly/long-end issuance with weak demand pushes term premium up; gold can hold as hedge, silver beta lags → GSR wider.
- **Absorption.** If the Fed or other official actors absorb duration (QE, buybacks, YCC talk), term premium falls; silver’s beta returns → GSR compresses.

Signals to watch.

- Quarterly refunding announcements; auction tails; bid/cover ratios.
- Term premium estimates; curve shape (2s10s, 5s30s).

Tests.

- H5: Auction stress weeks (large tails) associate with GSR widening contemporaneously.
- H6: Announced buybacks or QE correlate with a 1–3 month GSR decline.

3.4 Crypto plumbing: stablecoin pegs, redemptions, BTC dominance

Mechanism. Crypto is both a competitor for risk capital and a parallel dollar rail; plumbing stress redirects flows.

- **Stablecoin depeg/redemptions.** Near-term USD scramble can lift DXY and gold; as redemption shock fades, flows rotate into “outside money” and silver beta compresses GSR.

- **BTC dominance up without plumbing stress.** Risk-on in crypto can siphon marginal flows from metals; GSR can widen or stall.
- **On-chain velocity and cap shrinkage.** Shrinking stablecoin market caps post-stress often coincide with metals inflows over 2–6 weeks.

Signals to watch.

- Top-3 stablecoin pegs (minute/hourly), 7d redemption volumes, market-cap delta.
- BTC.D (dominance), funding rates, basis.

Tests.

- H7: A >1% stablecoin depeg event that re-pegs within 72h predicts GSR compression over the next 20 trading days, conditional on gold $\uparrow$.
- H8: Rising BTC dominance in a calm plumbing regime dampens silver outperformance (GSR flat/wider).

3.5 BRICS settlement narratives and the gold-first, silver-later dynamic

Mechanism. Sovereign settlement chatter anchors **gold** demand mechanically; **silver** follows via beta and retail/investment channels.

- **Gold-first impulse.** Central banks and sovereign funds are structurally gold-only buyers; gold leads every dedollarization headline.
- **Silver-later catch-up.** As gold makes new highs and narratives broaden (“monetary metals bid”), silver attracts leveraged and retail flows; GSR compresses with a lag.
- **Industrial bridge.** BRICS infrastructure and electrification capex underpin silver’s industrial bid, reinforcing the monetary rerate during global up-cycles.

Signals to watch.

- Central-bank gold purchase disclosures; import data; OTC premiums.
- Country-level policy statements on settlement baskets; local-currency energy deals.
- Silver ETF tonnage growth lagging gold ETF inflows by 2–6 weeks, then overtaking.

Tests.

- H9: Episodes with rising official-sector gold purchases precede GSR compression with a 1–3 month lag.

- H10: A sequence of gold ATHs without new silver highs ends with a silver catch-up window in which GSR drops ≥ 5 points within 60 days.

Synthesis.

Across these channels, GSR is the hinge variable. Liquidity additions (M1 up, reserves up, QE/backstops), real-yield declines, duration absorption, crypto plumbing stress, and BRICS gold-settlement narratives all bias **GSR lower**, raising silver's implied USD/oz at any fixed gold price. Opposite conditions bias **GSR higher**, risking a failed breakout. The paper's dashboards and tests make these moves auditable and replicable.

4. Three Scenarios After Breakout

4.1 Liquidity-pulse base case: \$80–\$110 (GSR ~45→38)

Setup. Silver clears and holds $> \$50$; gold is $\sim 3.46k$. Macro is *loosening but not panicking*: the Fed guides gradual cuts; no overt QE, but reserves drift higher as ON/RRP drains and the TGA wobbles lower. Treasury supply is heavy yet absorbed with only modest term-premium rise. Crypto is firm, no major stablecoin stress.

Mechanics. Gentle liquidity + falling real yields nudge GSR lower in a stair-step: 50 $\rightarrow$ mid-40s $\rightarrow$ high-30s as silver's beta outruns gold on up-days and gives back less on down-days. Range-expansion targets (\$86, \$96, \$109 from Section 2.1) align with GSR 40–32 at gold $\sim 3.46k$.

Tape tells.

- 2 weekly closes and 1 monthly close above \$50 with volume $\geq 1.5 \times$ 26w avg.
- COMEX registered stocks flat/down; SLV/PSLV net inflows, miners' beta > 1.2 to spot.
- 2y TIPS real yield drifts lower; ON/RRP drains; bank reserves edge up.

Path & timing. 4–12 weeks to \$86; 3–6 months to probe \$96–\$110 if liquidity persists.

Risks/invalidation. A sharp DXY rip or weak refunding auctions widen real yields and stall GSR > 45 ; two weekly closes back below \$50 with rising OI flip the regime to 4.3.

Positioning playbook.

- Core add on acceptance; scale into \$86; trail on weekly lows.
- Use miners as convex beta only while GSR trends down; de-risk if GSR flattens > 45 .
- Optional overlays: call spreads targeting \$90–\$100 with 60–120d tenor.

4.2 Crisis → policy overshoot: \$115–\$140, tail ~\$170 (GSR 30–25, spike 20)

Setup. A funding/collateral scare (credit spread gap, FX basis stress, or stablecoin depeg) forces rapid cuts *plus* balance-sheet support (QE, buybacks, standing facilities). M1 re-expands; reserves jump; the policy put is visible. Gold makes fresh ATHs; narratives pivot to “outside money.”

Mechanics. Gold leads on the shock; silver catches up and outruns as risk budgets snap back under explicit liquidity support. GSR compresses aggressively: 35 → 30 → high-20s. With gold ~3.46k, GSR 30–25 implies ~\$115–\$139; a disorderly squeeze to GSR ~20 implies a ~\$170 print.

Tape tells.

- SLV/PSLV tonnage surges; options skew flips to call-heavy; intraday ranges widen.
- Backwardation flashes or lease rate spikes; miners gap on open with multi-day follow-through.
- ON/RRP drains fast; bank reserves and the Fed’s balance sheet rise in tandem.
- Stablecoin cap shrinkage and large redemptions that re-peg within ~72h (flow rotation).

Path & timing. Thrusty: 2–6 weeks to \$115–\$125; 1–3 months to explore \$130–\$140. Blow-off tails are fast and reversible.

Risks/invalidation. If policy support is *signaled* but not *sized* (too little/too late), the squeeze stalls; a swift DXY rebound or a protracted crypto risk-on (no plumbing stress) can slow GSR compression back toward ~35.

Positioning playbook.

- Favor staged entries on volatility breaks; avoid chasing parabolic 1-hour candles.
- Options: call ladders or ratio call spreads targeting \$120/\$135 with risk-defined wings.
- Trim into vertical spikes; recycle on pullbacks that hold prior ATH zone (\$50–\$55).

Risk controls.

- Hard invalidation: weekly close < \$50 after policy announcement.
- Soft guard: if GSR fails to make new lows while price makes new highs, cut beta.

4.3 Dollar-tightening relapse: failed break, \$45–\$55 retrace

Setup. The Fed walks back the pace of cuts or re-emphasizes inflation risk; real yields rise; DXY breaks higher. Treasury refunding tails; term premium widens without balance-sheet absorption. Crypto rallies cleanly (no stablecoin stress), soaking marginal risk capital.

Mechanics. Gold grinds or stalls; silver's beta works *against* it. The breakout pokes above \$50 but fails acceptance: weekly close slips back into the 49–50 band, then below. GSR sticks high (≥ 50), possibly widens. The tape reverts toward the prior midrange: \$45–\$55.

Tape tells.

- ETF outflows; contango widens; miners lag spot on green days.
- COMEX registered stocks rise or fail to drain; options skew tilts to puts.
- 2y TIPS real yield up; ON/RRP steady/high; reserves flat/down; TGA rebuilds.

Path & timing. 2–8 weeks from failed acceptance to \$45–\$48 probe; subsequent basing can take months before a second attempt.

Risks/invalidation. A surprise facility/QE or a sudden stablecoin plumbing shock can flip the scenario to 4.2 quickly—stay nimble.

Positioning playbook.

- Respect the failure: reduce length on the second weekly close $\leq$ 49–50 band with rising OI.
- For hedgers: short calls or put spreads targeting \$46–\$48; roll down if GSR trends higher.
- Re-engage only when acceptance criteria reset (Section 2.3) or when GSR turns down decisively.

Scenario synthesis.

- Base case (4.1): steady liquidity drip compresses GSR to ~ 38 –40 $\rightarrow$ \$80–\$110 path.
- Overshoot (4.2): crisis + explicit balance-sheet support compresses GSR to 30–25 (spike 20) $\rightarrow$ \$115–\$140, tail $\sim$ \$170.
- Relapse (4.3): tighter dollar/real yields keep GSR $\geq 50 \rightarrow$ failed break and \$45–\$55 retrace.

The dashboard in Section 6 adjudicates among these in real time; the acceptance rules in Section 2 gate when target bands activate.

5. Microstructure Tells and Tape Behavior

5.1 ETF/ETN flows (SLV/PSLV), options skew, miners' beta

Why these matter. Above a fresh ATH, the next leg is driven as much by *who must buy* (systematic, mandate-gated, vol-targeted) as by macro. These three lenses reveal that forced participation.

A) ETF/ETN flows (SLV/PSLV as proxies)

- **Activation:** After a weekly close ≥ 50 , look for a 20d net inflow $\geq 3\text{--}5\%$ of AUM across SLV+PSLV.
- **Flow impulse test:** 5d rolling net_inflow_pct_of_AUM $\geq 1.0\%$ twice within 20 trading days tends to confirm acceptance.
- **Spot/creation frictions:** Persistent SLV/PSLV premia vs iNAV during upswings suggest primary issuance pressure (bullish); sustained discounts on strength flag distribution (caution).
- **Cross-confirm:** If ETF tonnage rises while COMEX_registered falls or is flat, the pull is likely investment, not exchange inventory shuffle.

B) Options skew (risk reversals and wings)

- **Metric:** 25-delta RR = $\text{imp_vol}(\text{call_25D}) - \text{imp_vol}(\text{put_25D})$.
- **Bull tape tell:** RR flips positive and widens by $\geq +4$ to $+8$ vols during/after the breakout week; call wing steepens (25D and 10D).
- **Follow-through:** If skew stays bid to calls for ≥ 2 weeks while realized_vol_up $>$ realized_vol_down (up-days drive the vol), breakout demand is robust.
- **Failure tell:** New highs with flat/negative RR and heavy put wing (crashiness) imply distribution or hedged buying.

C) Miners' beta and breadth

- **Beta window:** Compute miners_beta_20d = $\text{cov}(\text{miners_index}, \text{silver_spot}) / \text{var}(\text{silver_spot})$.
 - Acceptance regime: miners_beta_20d ≥ 1.2 sustained 10+ sessions.

- Overshoot regime: spikes to 1.6–2.0 are common; fade parabolic gaps.
- **Breadth:** % of miners above 20d and 50d MAs concurrently $\geq 70\%$ for 10 sessions indicates healthy sponsorship.
- **Lead-lag:** In strong tapes, miners often lead on open and confirm into close; repeated green opens faded by red closes warn of distribution.

A quick composite (rule-of-thumb):

accept_micro = (ETF_20d_inflow_pct $\geq 3\%$)

+ (RR_25D_change_since_breakout $\geq +4$ vols)

+ (miners_beta_20d ≥ 1.2)

Treat accept_micro ≥ 2 as confirmation; $= 3$ as high-conviction.

5.2 Lease rates, backwardation/contango, COMEX registered stocks

Why these matter. They indicate tightness in the physical/nearby curve and the ease (or not) of sourcing deliverable metal into rallies.

A) Lease rates (and GOFO analogs)

- **Signal:** Rising silver_lease_rate_1m–3m after the breakout suggests stronger near-term borrow demand and/or tighter float.
- **Tell:** A step-up of $\geq +50$ –100 bps from the 3m trailing average within 10 trading days of the breakout supports a “tight tape” read.
- **Caveat:** Brief spikes around roll dates can be mechanical; look for persistence beyond 3–5 sessions.

B) Term structure: backwardation/contango

- **Definitions:**
 - front_basis = futures_near – spot
 - calendar_spread_k = futures_k – futures_{k+1}
- **Bullish tightness:**
 - front_basis compresses toward 0 or flips negative (backwardation).
 - calendar_spread in the front months widens negative (near > far), indicating urgent nearby demand.

- **Healthy vs disorderly:** A *brief* backwardation flash on surge days is normal in squeezes; *persistent* backwardation over multiple weeks may signal true scarcity (and higher squeeze risk).
- **Failure tell:** Expanding contango while price pushes new highs implies easy nearby supply; rallies are more fragile.

C) COMEX registered stocks (deliverable)

- **Direction matters more than level.**
 - Bullish: registered_stocks_14d_change <= 0 (flat/down) alongside rising price.
 - Bearish/caution: sharp restocking into strength (registered +5–10% over 2–3 weeks) suggests supply meeting demand.
- **Mix watch:** If total inventories are up but “eligible → registered” conversions surge *during* rallies, shorts may be sourcing metal to meet delivery—temporarily stabilizing the front but not negating the bull if ETF demand persists.

D) A tight-tape composite:

tight_tape = (lease_rate_3m_jump >= +75 bps)

+ (front_basis <= 0 on >= 3 of 10 sessions)

+ (registered_14d_change <= 0)

If tight_tape >= 2 within 20 trading days post-breakout, expect amplified upside volatility and sharper pullbacks (buy dips, do not chase 1h blowoffs).

Microstructure failure checklist (use to de-risk):

- New price highs with:
 - ETF net outflows over 10d,
 - RR_25D flat/negative,
 - miners_beta_20d <= 1.0,
 - contango widening, and
 - registered stocks rising quickly.

Two or more sustained for 2+ weeks = reduce risk; three or more = treat as distribution likely → prepare for 45–55 retrace scenario.

Putting it together.

The breakout’s *character* shows up here first. Strong flows into listed products, call-heavy skew, high miner beta, firmer lease rates, compressed front spreads, and non-rising registered stocks

describe an accepted, tight tape where GSR compression can proceed. The opposite constellation flags a headline breakout with soft internals—susceptible to failed acceptance back under \$50.

6. Dashboard for Replication

Below is a **practical, audit-friendly dashboard** you can maintain in a spreadsheet. Each subsection lists: what to log, how often, the rule(s) we'll compute, and how to read them. Use simple, copy-safe formulas (ASCII).

6.1 Rates / liquidity: 2y real, FRA-OIS, FX basis, reserves, RRP, TGA

Log (daily or 3x/week):

- two_year_real_yield (TIPS), five_year_real_yield
- fra_ois_3m (in bps)
- usd_fx_basis_3m (EURUSD or USDJPY cross-currency basis, in bps; more negative = tighter USD)
- fed_bank_reserves (H.4.1)
- fed_on_rrp_balance
- treasury_general_account (TGA)
- M1 (weekly update is fine)

Derived rules:

- $\text{real_yield_impulse_5d} = \text{two_year_real_yield}[t] - \text{two_year_real_yield}[t-5]$
- $\text{reserves_20d_delta} = \text{fed_bank_reserves}[t] - \text{fed_bank_reserves}[t-20]$
- $\text{rrp_20d_delta} = \text{fed_on_rrp_balance}[t] - \text{fed_on_rrp_balance}[t-20]$
- $\text{tga_20d_delta} = \text{TGA}[t] - \text{TGA}[t-20]$

Thresholds (compress GSR bias if these fire):

- $\text{real_yield_impulse_5d} \leq -25 \text{ bp}$
- $\text{reserves_20d_delta} \geq +\50B **and** $\text{rrp_20d_delta} \leq -\50B

- fra_ois_3m spikes $\geq +10$ bp (stress) **followed by** policy backstops within ~2 weeks
- tga_20d_delta $\leq -\$50\text{B}$ (net fiscal injection)

Tightening flags (widen GSR bias):

- real_yield_impulse_5d $\geq +25$ bp
- usd_fx_basis_3m more negative by ≥ 10 bp (acute USD scarcity)
- reserves_20d_delta $\leq -\$50\text{B}$ **or** rrp_20d_delta $\geq +\$50\text{B}$
- large coupon refunding week with weak auctions (see 6.4)

Interpretation:

If 2+ “compress” signals fire together, lower your working GSR band by ~5 points (e.g., 40 $\rightarrow$ 35).

If 2+ “tighten” signals fire, raise by ~5 points (e.g., 35 $\rightarrow$ 40).

6.2 Metals: GSR trend, ETF tonnage, mint sales

Log (daily):

- gold_usd_per_oz, silver_usd_per_oz
- gsr = gold_usd_per_oz / silver_usd_per_oz
- slv_pslv_tonnage (combined), slv_pslv_20d_net_inflow_pct
- comex_registered_stocks_silver (deliverable)
- lease_rate_1m, lease_rate_3m (bps)
- front_basis = fut_near – spot (USD/oz)
- mint_sales_silver (weekly/monthly; US Mint/others)

Derived rules:

- gsr_20d_slope = linreg_slope(gsr, last_20d)
- etf_activation = slv_pslv_20d_net_inflow_pct $\geq +3\%$
- tight_curve = (front_basis ≤ 0 on ≥ 3 of last 10 sessions) **or** (lease_rate_3m – avg_3m_prev_60d $\geq +75$ bps)
- inventory_signal = comex_registered_stocks_silver_14d_delta ≤ 0

Compression “go” set:

etf_activation + tight_curve + inventory_signal (count >= 2) → accept_micro = TRUE (bull tape quality).

Targets refresh (copy-safe):

- silver_implied = gold_usd_per_oz / gsr_working_band_low..high
Example at gold = 3460 and gsr_band = [30, 35]:
- silver_low = 3460/35 = 98.9
- silver_high = 3460/30 = 115.3

Mint sales (confirm retail):

If mint_sales_silver 1m ↑ and ETF tonnage ↑ while COMEX registered flat/down → broad demand, sturdier trends.

6.3 Crypto: top-3 stablecoin pegs/caps, on-chain redemptions**Log (hourly/daily):**

- stablecoin_peg_deviation_max (across top-3; % from 1.0000)
- stablecoin_7d_redemptions_usd (sum)
- stablecoin_market_cap_delta_7d
- btc_dominance_pct (BTC.D)
- btc_funding_rate (if available)

Event rules:

- depeg_event = stablecoin_peg_deviation_max >= 0.5% **for** >= 30 min
- rep_peg_ok = return within 72h to ±0.05% of par
- plumbing_shock = depeg_event AND stablecoin_7d_redemptions_usd >= \$5B

Implications:

- plumbing_shock with re-peg_ok → expect gold first, then silver beta; bias GSR lower over next 10–20 sessions.
- risk_on_crypto (btc_dominance_pct ↑ and pegs calm) → marginal capital competes; GSR compression slows.

Guardrail:

If crypto melts up *without* plumbing stress **and** metals ETF flows are flat/negative → do not tighten your GSR band (keep it higher).

6.4 Dollar & issuance: DXY, refunding cadence, term premium**Log (daily/auction days):**

- dxy_index
- term_premium_proxy (ACM or equivalent)
- auction_outcomes (tail in bps, bid/cover) for 2y, 5y, 10y, 30y
- quarterly_refunding_size (belly/long allocation)
- buyback_or_QE_announced (boolean), size_if_any (USD)

Rules:

- dollar_rip = DXY_10d_change $\geq +1.5$ **and** term_premium_proxy_10d_change $\geq +10$ bp
- auction_stress = tail $\geq +2$ bp (bill/2y) or $\geq +3-4$ bp (10y/30y) **with** weak bid/cover
- duration_absorption = buyback_or_QE_announced == TRUE **or** primary_dealer_takeup_high **and** tails small

Interpretation:

- If dollar_rip or repeated auction_stress → raise GSR working band by ~5 points (compression less likely).
 - If duration_absorption **and** DXY softens → lower GSR band by ~5 points (compression more likely).
-

Putting it all together (one-page checklist)**Daily/3x-weekly quick read:**

1. 2y real yield (5d change), reserves_20d_delta, RRP_20d_delta, FRA-OIS, FX basis
2. GSR trend, ETF 20d net inflow %, front_basis, lease rates, COMEX registered 14d delta
3. Stablecoin pegs (any depeg_event?), 7d redemptions, BTC dominance

4. DXY, term premium, auction calendar/outcomes

Band update rule (copy-safe):

- Start with base `gsr_band` = [40, 45].
- For each **compression** cluster you observe (≥ 2 signals from 6.1–6.4), shift band down by 5 points, min 25.
- For each **tightening** cluster (≥ 2 signals), shift band up by 5 points, max 55.
- `silver_target_low` = `gold` / `gsr_band_high`
- `silver_target_high` = `gold` / `gsr_band_low`

Example (gold = 3460):

- If band = [30, 35] $\rightarrow$ targets = [98.9, 115.3]
- If band = [25, 30] $\rightarrow$ targets = [115.3, 138.4]
- If band = [20, 25] $\rightarrow$ targets = [138.4, 173.0]

Acceptance gate: Only activate targets if Section 2.3's acceptance is TRUE (weekly/monthly closes + volume/time). If acceptance fails, revert to watch-mode and the 45–55 retrace map.

7. Risk, Invalidation, and Playbook

7.1 What would falsify GSR compression

Idea. Our upside map after a \$50+ acceptance leans on GSR drifting down (silver outperforming gold). We must define when that premise is wrong *even if* spot prints higher highs.

Primary falsifiers (any 2 sustained for 10 trading days = `GSR_compression_false`):

1. **GSR trend fails to turn down.**
 - Rule: `linreg_slope(gsr, lookback_20d)  $\geq 0$  AND gsr[t]  $\geq$  gsr[t-20].`
2. **Real yields + dollar rip.**
 - Rule: `two_year_real_yield_5d_change  $\geq +25$  bp AND dxy_10d_change  $\geq +1.5$ .`
3. **ETF distribution into strength.**
 - Rule: `slv_pslv_20d_net_inflow_pct  $\leq -1.0\%$  while silver_usd_per_oz  $\geq$  prior 20d high.`

4. Curve says 'easy metal'.

- Rule: $\text{front_basis (near_fut - spot)}$ widens positive by $\geq +0.10$ over 10 days AND $\text{lease_rate_3m} \leq \text{3m_avg_prev_60d} - 25 \text{ bps}$.

5. Miners refuse to lead.

- Rule: $\text{miners_beta_20d} \leq 1.0$ AND $\text{miners_breadth_50dma} \leq 50\%$ while silver makes new 20d highs.

6. Registered stocks re-fill into rallies.

- Rule: $\text{comex_registered_14d_delta} \geq +5\%$ during rising price.

Hard technical invalidation (any 1):

- **Acceptance break:** 2 weekly closes $\leq 49-50$ band *with* rising open_interest_aggregate.
- **Lower-highs failure:** After setting post-breakout high H1, price makes two lower swing highs and closes a week below prior swing low L1.

Narrative falsifiers (strong but softer timing):

- **Refunding shock without policy absorption.** 2 consecutive weak belly/long auctions with large tails, no buyback/QE announced.
- **Crypto clean risk-on.** Stablecoin pegs calm, BTC dominance rising, metals ETF outflows.

When $\text{GSR_compression_false}$, shift gsr_working_band up by +5 (e.g., 35→40), cap targets, and pivot to defense until signals clear.

7.2 Position sizing, buffers, and event-study windows

Position sizing (risk-first, copy-safe math):

Let:

- acct_equity = current account equity (USD)
- $\text{max_portfolio_risk} = 0.01..0.02$ (1–2% per *trade idea*, not per instrument)
- $\text{stop_distance} = \text{entry_price} - \text{invalidation_price}$ (for longs; flip sign for shorts)
- $\text{dollar_vol_unit} = \text{contract_multiplier}$ (e.g., 5000 oz for a COMEX silver futures pair; adjust if using ETFs or shares)

Position size formula (vanilla):

- $\text{position_size_units} = (\text{acct_equity} * \text{max_portfolio_risk}) / (\text{stop_distance} * \text{dollar_vol_unit})$

Buffers:

- **Entry buffer.** Do not buy the exact breakout print. Prefer: enter on first pullback that holds B_high (50–51) or on a higher low that respects acceptance rules.
- **Stop buffer.** Place stops beyond obvious magnets: for a \$50 breakout, initial invalidation below 49.0–49.5, not at 49.9.
- **Time buffer.** Require acceptance: 2 weekly closes ≥ 51 or 1 monthly close ≥ 51 before sizing to “core.”

Scaling plan (example):

- Phase A (acceptance-on): 0.5R initial at pullback to 51–53 with micro OK (ETF inflow, skew, miners_beta).
- Phase B (range target T1 ~ 86): add 0.25R on break and hold above 70 with $\text{GSR}_{20d_slope} < 0$.
- Phase C (policy impulse): add 0.25R only if crisis → backstop triggers fire (reserves up, RRP down, FRA-OIS spike then fade).

Here, $R = \text{unit risk} = \text{acct_equity} * \text{max_portfolio_risk}$.

De-risking rules (mechanical):

- Trim 25–33% into vertical moves when 1h ATR multiple $> 2.5x$ its 20d median.
- Reduce to half-size if GSR makes a 10d high while price makes a 10d high (bearish divergence).
- Flatten tactical adds into auction_stress + dollar_rip weeks (Section 6.4).

Event-study windows (to avoid chop and to learn):

Track cumulative returns and microstructure shifts around scheduled and unscheduled events:

1. FOMC decisions / Chair Q&A.

- Windows: [-1d, +3d], [-1w, +2w].
- Metrics: silver_return, gsr_change, two_year_real_yield_change, RR_25D_change, ETF_flows_5d.

2. Quarterly refunding announcements and big auctions (5y, 10y, 30y).

- Windows: [0d, +5d].
- Watch: auction_tail_bps, term_premium_change, gsr_change.

3. Liquidity facility/QE signals (official or well-sourced leaks).

- Windows: [0d, +10d].
- Expect: reserves_up, RRP_down, ETF_inflows_up; bias to add if acceptance holds.

4. Stablecoin plumbing shocks (depeg_event).

- Windows: [0d, +10d], [0d, +20d].
- Conditional: if re-peg_ok within 72h and gold_up, then expect gsr_down; plan staggered adds.

Simple event attribution template (spreadsheet-ready):

- event_flag = 1 if event in window else 0
 - post_event_return = silver_pct_change[t0→t0+N]
 - post_event_gsr = gsr_change[t0→t0+N]
 - success = 1 if (post_event_return > 0 AND post_event_gsr < 0) else 0
- Aggregate by event_type to learn which events reliably compress GSR in *your* data.

Playbook summary (if-then, copy-safe):

- IF acceptance == TRUE AND compression_signals_count >= 2 THEN set gsr_band_down by 5 and activate targets.
- IF GSR_compression_false == TRUE THEN de-risk: cut adds, raise gsr_band_up by 5, tighten stops.
- IF crisis_backstop_signals >= 2 (reserves_up AND RRP_down OR FRA-OIS_spike_then_fade) THEN permit overshoot adds toward 115–140 band with risk-defined options.
- IF dollar_rip OR auction_stress_repeat THEN expect stall/failure; hedge or reduce to core until signals clear.

What to write in the trade log (audit):

- hypothesis_text: “GSR will compress 45→38 within 60d given reserves_up and ETF_inflows.”
- entry_plan, stop_plan, add_plan, trim_plan (numbers only).
- acceptance_evidence: “2 weekly closes ≥ 51 , volume 1.7x 26w avg.”
- exit_on_falsifier: list 2+ from 7.1 you will act on without hesitation.

Discipline beats thesis. If the GSR does not compress on your timeline *and* the falsifiers print, you are not “early”—you are wrong for now. Reset, preserve capital, and let Section 2.3’s acceptance gate re-arm the next attempt.

8. Conclusion: From Narrative to Numbers

8.1 When the ceiling becomes the floor

Crossing and **accepting** \$50 is not a headline; it is a **state change**. The tape graduates from a 14-year range into price discovery where macro plumbing and a single identity do most of the work:

$\text{silver_usd_per_oz} = \text{gold_usd_per_oz} / \text{GSR}$.

With gold $\approx 3.46k$, every credible move in the gold/silver ratio (GSR) mechanically re-marks silver’s bands. Range-expansion math (49 ± 12) gives a first structural unit (~ 37), projecting ~ 86 , ~ 96 , ~ 109 . Liquidity and policy decide whether the path stops there or compresses GSR toward 30–25 ($\rightarrow \sim 115$ – ~ 139), with tail risk near ~ 170 on disorderly squeezes. The **acceptance rule** (time + volume) prevents chasing a stop-run; the **microstructure set** (ETF tonnage, options skew, miners’ beta, lease rates, curve shape, registered stocks) tells you whether sponsorship is real. If those confirms deteriorate while price rises, the framework declares a **false premise** (no GSR compression) and moves to defense. The point is discipline: treat \$50 not as prophecy but as a **gate** that, once passed, lets a small number of observable variables drive decisions.

8.2 What to watch next and why it is testable

Everything we claim reduces to logs you can keep and rules you can falsify.

Rates/liquidity. Track 2y real yields, bank reserves, ON/RRP, TGA, FRA-OIS, and FX basis. Clusters of “easier” readings (real_yield $\downarrow$, reserves $\uparrow$, RRP $\downarrow$, TGA $\downarrow$) are hypothesized to **compress** GSR within 10–20 sessions; the opposite should **widen** it. This is testable with simple event windows.

Metals micro. Log GSR slope (20d), SLV/PSLV 20d net inflow %, front basis (near – spot), lease rates, and COMEX registered changes. Our claim: ETF activation + tighter fronts + non-rising registered stocks = “tight tape” where silver outruns gold. Count hits; score outcomes.

Crypto plumbing. Note stablecoin depegs, 7d redemptions, cap shrinkage, and BTC dominance. We assert that a plumbing shock that **re-pegs** within ~72h biases flows toward “outside money” and is followed by GSR compression, conditional on gold strength. Again, log and verify.

Dollar & issuance. Watch DXY, refunding outcomes, and term premium. Repeated long-end auction stress without policy absorption should stall compression and favor a failed break. Mark those weeks and test their forward GSR impact.

Decision rule. Start with a working GSR band (e.g., [40,45]). For each **compression cluster** you observe (≥ 2 confirming signals), shift the band down by 5 points; for each **tightening cluster**, shift up by 5. Convert band to prices with silver = gold / GSR. Activate targets only when acceptance is TRUE (weekly/monthly closes + volume/time). If the falsifiers print (Section 7.1), you stand down—no narratives required.

In short: the story ends where the ledger begins. The ceiling becomes the floor only if **time, volume, and tape** say so; thereafter, the path is mapped by **gold ÷ GSR**, nudged by a handful of measurable liquidity levers. That is why this framework is not only actionable—it is **auditable**.

Appendix A: Formulas and target tables (copy-safe)

A1. Core identities and helpers

gold_usd_per_oz = current_gold_price_usd

silver_usd_per_oz = current_silver_price_usd

gsr = gold_usd_per_oz / silver_usd_per_oz

silver_implied(gold_usd_per_oz, gsr) = gold_usd_per_oz / gsr

range_R = H_2011 - L_2020

targets_measured = {

 T1 = H_2011 + 1.000 * range_R

 T1_272 = H_2011 + 1.272 * range_R

 T1_618 = H_2011 + 1.618 * range_R

}

Recommended anchors (rounded):

H_2011 = 49

L_2020 = 12

range_R = 37

A2. Acceptance rules (gate to “price discovery” regime)

B_low = 49

B_high = 51

weekly_accept = (close_week_1 >= B_high) AND (close_week_2 >= B_high)

monthly_accept = (close_month >= B_high)

volume_confirm = (fut_volume_breakout_week >= 1.5 * avg_26w_fut_volume)

etf_confirm = (slv_pslv_20d_net_inflow_pct >= 3.0)

micro_ok_count = 0

if (lease_rate_3m - avg_lease_rate_3m_60d >= 0.75%) micro_ok_count += 1

if (front_basis <= 0 on >= 3 of last 10 sessions) micro_ok_count += 1

if (comex_registered_14d_delta <= 0) micro_ok_count += 1

if (miners_beta_20d >= 1.2) micro_ok_count += 1

ACCEPTED = ((weekly_accept OR monthly_accept) AND volume_confirm AND (micro_ok_count >= 2))

FAILED = ((weekly_close <= B_low) twice within 4 weeks AND open_interest_total rising)

A3. GSR band update logic (convert macro signals to targets)

gsr_band = [40, 45] # start point; low first, high second

```
compression_cluster = count_true([
    two_year_real_yield_5d_change <= -0.25%,
    reserves_20d_delta >= +$50B AND rrp_20d_delta <= -$50B,
    tga_20d_delta <= -$50B,
    fra_ois_3m_spike_then_fade == TRUE,
    duration_absorption == TRUE, # QE/buybacks or equivalent
    stablecoin_plumbing_shock_repeg == TRUE
]) >= 2
```

```
tightening_cluster = count_true([
    two_year_real_yield_5d_change >= +0.25%,
    usd_fx_basis_3m_more_negative_by_10bps == TRUE,
    rrp_20d_delta >= +$50B OR reserves_20d_delta <= -$50B,
```

```
dollar_rip == TRUE,      # DXY_10d_change >= +1.5
repeated_auction_stress == TRUE
]) >= 2
```

```
if compression_cluster: gsr_band = [max(20, gsr_band[0]-5), max(25, gsr_band[1]-5)]
if tightening_cluster: gsr_band = [min(55, gsr_band[0]+5), min(60, gsr_band[1]+5)]
```

```
silver_target_low = gold_usd_per_oz / gsr_band[1] # divide by high end
silver_target_high = gold_usd_per_oz / gsr_band[0] # divide by low end
```

A4. Target tables (gold = 3,460–3,462; use 3,460 for table)

```
gold_usd_per_oz = 3460
```

GSR → implied silver (USD/oz):

55 -> 62.9

50 -> 69.2

45 -> 76.9

40 -> 86.5

38 -> 91.1

35 -> 98.9

33 -> 104.8

32 -> 108.1

30 -> 115.3

28 -> 123.6

25 -> 138.4

22 -> 157.3

20 -> 173.0

Measured-move alignment (from A1) for context:

T1 ~ = 86

T1_272 ~ = 96

T1_618 ~ = 109

A5. Falsifiers (shut off compression targets)

gsr_20d_slope >= 0 AND gsr[t] >= gsr[t-20] # no downtrend in GSR

two_year_real_yield_5d_change >= +0.25% AND dxy_10d_change >= +1.5

slv_pslv_20d_net_inflow_pct <= -1.0% while silver makes 20d highs

front_basis widens positive by >= \$0.10 over 10d AND lease_rate_3m <= avg_60d - 0.25%

miners_beta_20d <= 1.0 AND miners_breadth_50dma <= 50% while silver makes 20d highs

comex_registered_14d_delta >= +5% during rising price

Trigger: any 2 conditions sustained 10 sessions ⇒ raise gsr_band by +5 and halt adds.

Appendix B: Data sources and update cadence

B1. Rates/liquidity

- Two-year and five-year TIPS real yields: Treasury market data or FRED.
- FRA-OIS 3m: major rates vendors; many public dashboards mirror it.
- USD cross-currency basis (EURUSD or USDJPY 3m): dealer or public charts.
- Federal Reserve H.4.1: bank reserves, ON/RRP balances (weekly, with daily RRP).
- Treasury General Account (TGA): Treasury daily statement.
- M1: Federal Reserve H.6 (weekly).

Cadence: Daily for market series; weekly for H.4.1/H.6; intraday checks around FOMC or stress.

B2. Metals micro

- Spot/futures gold & silver: exchange feeds or aggregated quote APIs.
- GSR: compute = gold/silver.
- SLV/PSLV tonnage & flows: issuer websites or consolidated ETF data.
- Lease rates (1m/3m): bullion lease or GOFO analog services.

- COMEX registered/eligible stocks: exchange warehouse reports (daily).
- Front basis = near future – spot (daily).
- Mint sales: U.S. Mint (monthly) + other mints if available.

Cadence: Daily; warehouse and ETF tonnage at each issuer’s posting frequency.

B3. Crypto plumbing

- Stablecoin pegs: top-3 tickers (minute/hourly from public crypto price feeds).
- 7d redemptions & market-cap deltas: chain analytics or issuer transparency pages.
- BTC dominance %, funding rates: major crypto data aggregators.

Cadence: Intraday during stress; daily otherwise.

B4. Dollar & issuance

- DXY: daily.
- Term premium proxy (e.g., ACM model): daily where available.
- Quarterly refunding announcements; auction results (2y/5y/10y/30y): on event days.
- Buybacks/QE/credit facilities: official releases.

Cadence: Daily; event-driven spikes on auction/FOMC days.

B5. Record-keeping (minimum fields)

date, time, gold, silver, gsr,

2y_real, 5y_real, fra_ois_3m_bps, fx_basis_3m_bps,

reserves_usd, rrp_usd, tga_usd, m1_usd,

slv_pslv_tonnage, slv_pslv_20d_net_inflow_pct,

lease_rate_1m_bps, lease_rate_3m_bps,

front_basis_usd, comex_registered_oz, comex_registered_14d_delta_oz,

mint_sales_silver_units,

stablecoin_max_peg_dev_pct, stablecoin_7d_redemptions_usd, stablecoin_cap_7d_delta_usd,

btc_dominance_pct,

dxy, term_premium_bps,

auction_tail_bps, auction_bid_cover, buyback_or_QE_flag

Appendix C: Reproducible notebooks and audit checklist

C1. Folder layout (local-first)

/silver_breakout_project/

data_raw/ # CSV dumps exactly as downloaded (append-only)

data_clean/ # normalized CSVs with consistent headers/units

notebooks/

01_acceptance_gate.ipynb

02_gsr_band_engine.ipynb

03_microstructure_composites.ipynb

04_event_studies.ipynb

outputs/

charts_daily/

tables/

docs/

README.md

methods.md

C2. Clean CSV schema (canonical headers)

date, gold_usd, silver_usd, gsr,

two_year_real_yield_pct, five_year_real_yield_pct,

fra_ois_3m_bps, fx_basis_3m_bps,

fed_reserves_usd, fed_on_rrp_usd, tga_usd, m1_usd,

slv_pslv_tonnage_oz, slv_pslv_20d_net_inflow_pct,

lease_rate_1m_bps, lease_rate_3m_bps,

front_basis_usd, comex_registered_oz, comex_registered_14d_delta_oz,

```

mint_sales_silver_units,
stablecoin_max_peg_dev_pct, stablecoin_7d_redemptions_usd, stablecoin_cap_7d_delta_usd,
btc_dominance_pct,
dxy_index, term_premium_bps,
auction_tail_bps, auction_bid_cover, buyback_or_QE_flag

```

C3. Functions (pseudocode, copy-safe)

```

def compute_gsr(gold_usd, silver_usd):

```

```

    return gold_usd / silver_usd

```

```

def acceptance_gate(prices, volumes, etf_flow_pct, lease_3m, lease_3m_avg60,

```

```

    front_basis_series, registered_14d_delta):

```

```

    weekly_ok = (close_week_1 >= 51) and (close_week_2 >= 51)

```

```

    monthly_ok = (close_month >= 51)

```

```

    vol_ok = (fut_volume_breakout_week >= 1.5 * avg_26w_fut_volume)

```

```

    micro_ok = 0

```

```

    if (lease_3m - lease_3m_avg60) >= 0.75: micro_ok += 1

```

```

    if count(front_basis_series <= 0 over last_10_days) >= 3: micro_ok += 1

```

```

    if registered_14d_delta <= 0: micro_ok += 1

```

```

    return ((weekly_ok or monthly_ok) and vol_ok and (micro_ok >= 2))

```

```

def update_gsr_band(gsr_band, compression_cluster, tightening_cluster):

```

```

    low, high = gsr_band

```

```

    if compression_cluster: low = max(20, low-5); high = max(25, high-5)

```

```

    if tightening_cluster: low = min(55, low+5); high = min(60, high+5)

```

```

    return [low, high]

```

```
def implied_silver(gold_usd, gsr_band):
    low, high = gsr_band
    return (gold_usd / high, gold_usd / low) # (target_low, target_high)
```

C4. Event-study template

```
window = [t0, t0+N]
post_event_return = (silver[t0+N] / silver[t0]) - 1
post_event_gsr = gsr[t0+N] - gsr[t0]
success_flag = (post_event_return > 0) AND (post_event_gsr < 0)
group_by event_type; report hit_rate = mean(success_flag)
```

C5. Charts to auto-export (daily)

- Price: silver, gold, plus implied_silver bands from current gsr_band.
- GSR with 20d slope; annotate band changes.
- Microstructure panel: ETF 20d net inflow %, lease_rate_3m (vs 60d avg), front_basis, COMEX registered 14d delta.
- Liquidity panel: 2y real yield (inverted), reserves_20d_delta, RRP_20d_delta, TGA_20d_delta.

C6. Audit checklist (tick these before publishing a call)

- [] Acceptance TRUE by rules in A2 (document the dates and closes)
- [] Volume confirm met; ETF 20d net inflow $\geq 3\%$
- [] Micro OK: at least 2 of {lease up, front ≤ 0 , registered down/flat}
- [] GSR band set via Appendix A3 (show inputs and the shift(s))
- [] Targets computed as silver = gold / GSR_band (show both ends)
- [] Falsifiers listed (which 2 you will act on immediately)
- [] Event windows pre-declared for FOMC/refunding/stablecoin shocks
- [] Position sizing math recorded (entry, stop, adds, trims)
- [] Data provenance noted (files in data_raw/ with timestamps)

Bottom line for reproducibility: every table and target in the paper is the output of (i) acceptance gate, (ii) GSR band selection from observable liquidity clusters, and (iii) a single division: $\text{silver} = \text{gold} / \text{GSR}$.

References

Official data & liquidity plumbing

- Board of Governors of the Federal Reserve System. *Factors Affecting Reserve Balances (H.4.1)*; weekly statistical release (bank reserves, ON RRP).
- Board of Governors of the Federal Reserve System. *Money Stock Measures (H.6)*; weekly release (M1).
- U.S. Department of the Treasury. *Treasury General Account (TGA)* — Daily Treasury Statement.
- U.S. Department of the Treasury. *Quarterly Refunding Announcements* and auction results (2y, 5y, 10y, 30y).
- U.S. Bureau of the Fiscal Service. *Buyback Announcements* (as applicable).
- Federal Reserve / FRED. *Treasury Inflation-Protected Securities (TIPS) real yields* (2-year, 5-year), *FRA-OIS spread*, and related series.
- Cross-currency basis (EURUSD, USDJPY) — major dealer/benchmark data (e.g., Bloomberg/Refinitiv consolidated series).

Metals prices, inventories, and flows

- LBMA. *Historical Gold and Silver Prices* (daily fixes and intraday benchmarks).
- CME Group (COMEX). *Silver Futures (SI) Contract Specs; Warehouse & Inventory (Registered/Eligible) Reports* (daily).
- iShares Silver Trust (SLV). *Daily metal holdings & creation/redemption reports*.
- Sprott Physical Silver Trust (PSLV). *Daily metal holdings & unit flows*.
- LBMA / market data vendors. *Bullion lease rates* (1-month, 3-month) and GOFO analogs/forwards (post-2015 methodology).
- United States Mint. *Bullion Sales Reports* (American Eagle/other program sales; monthly/annual).

Dollar, term premium, and indexes

- ICE Data Indices. *U.S. Dollar Index (DXY) Methodology & Historical Levels*.

- Adrian, T., Crump, R. K., & Moench, E. (2013). *Pricing the Term Structure with Linear Regressions*. Journal of Financial Economics, 110(1), 110–138. (ACM Term Premium model and updates).

Crypto plumbing (stablecoins & market structure)

- Tether, Circle, Paxos. *Transparency/attestation pages*: circulating supply, reserves, and redemption activity.
- Chain analytics providers (e.g., Coin Metrics, Glassnode, Kaiko). *Stablecoin peg deviations, 7-day redemptions, market-cap deltas; BTC dominance and funding data*.
- Major exchange/composite price feeds for intraday peg monitoring of top-3 USD stablecoins.

Methods & empirical templates

- MacKinlay, A. C. (1997). *Event Studies in Economics and Finance*. Journal of Economic Literature, 35(1), 13–39. (Event-window methodology used for policy/liquidity shocks).
- Ait-Sahalia, Y., & Jacod, J. (2014). *High-Frequency Financial Econometrics*. Princeton University Press. (Intraday volatility/realized measures referenced for “ATR multiples” and tape diagnostics).
- Carr, P., & Wu, L. (2003). *Skewness, Kurtosis and Jumps in Equity Returns*. Journal of Business, 76(3), 305–332. (Risk-reversal/wing concepts; options skew interpretation).

Historical context & benchmarks

- LBMA / market histories for the 1980 silver price spike (Hunt brothers episode) and the 2011 peak; used to define the ~\$49–50 ceiling and the 2011–2020 range (~\$49 to ~\$12).

Notes on usage.

- All price/flow/inventory series in this paper are intended to be logged at the cadences specified in Appendix B.
- When multiple vendors exist for the same series (e.g., lease rates, cross-currency basis), use one primary source consistently and document any methodological changes.
- The ACM term-premium reference provides the conceptual grounding for “term premium” in Section 6; if you use a different estimator, document it alongside the series in your data_raw/ folder.

