

Gold and Silver in the 21st Century: Reserve Strategy, Industrial Transformation, and Geopolitical Risk (2000–2025)

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ABSTRACT

This article examines the renewed strategic importance of gold and silver in the period 2000–2025, arguing that their contemporary relevance is best understood at the intersection of reserve strategy, industrial transformation, and geopolitical risk. Using data from the World Gold Council, IMF COFER, the IEA, USGS, S&P Global, and the Silver Institute, the study documents a structural shift in official-sector behaviour toward gold accumulation amid declining U.S. dollar reserve share and expanding use of alternative settlement arrangements. Empirical evidence further characterizes gold's macro-financial role as state-dependent: weakly correlated with average inflation but more responsive during tail inflation and conflict-driven risk episodes, consistent with a crisis-hedge function in sovereign balance sheets. For silver, the analysis traces the post-photography demand reallocation toward electronics and solar photovoltaics, highlighting rapid PV-linked usage growth alongside supply constraints associated with by-product production, multi-year market deficits, and the moderating influence of recycling and technological substitution. The paper also incorporates market-microstructure considerations—ETF tracking error, liquidity mismatches, and margin-amplified volatility—to clarify transmission channels that can intensify short-run price dynamics, particularly in silver. A regional perspective, with emphasis on India's dual role as a major gold-holding society and an expanding manufacturing and renewables hub, connects these findings to policy choices in reserve diversification and critical-materials planning. The study concludes by outlining implications for policymakers, central banks, and industrial planners seeking to build resilience under monetary fragmentation and accelerating decarbonization.

Keywords: Reserve diversification, Central-bank gold accumulation, De-dollarization, Geopolitical risk premium, Energy-transition metals, Silver industrial demand, PV/electronic, ETF market microstructure

INTRODUCTION

Gold and silver have re-emerged in the 21st century as strategic assets shaped by three interacting forces: the reconfiguration of official reserves and cross-border payment architecture, the industrial reallocation of metals demand driven by electrification and decarbonization, and the repricing of geopolitical risk under a more fragmented international order. Focusing on 2000–2025, this article advances a data-driven assessment of these dynamics using evidence from the World Gold Council, IMF COFER, S&P Global commodity-market series, the IEA, USGS, and the Silver Institute. For gold, the analysis evaluates the implications of declining reserve-currency concentration, rising official-sector purchases, and state-dependent hedge characteristics—weak linkage to average inflation but stronger performance during tail-risk regimes and conflict episodes. For silver, the paper documents the post-photography transition toward electronics and photovoltaic demand, while incorporating constraints that may moderate long-run consumption, including by-product supply dependence, market deficits, recycling acceleration, and credible substitution pathways. The study also considers market-mechanics channels—particularly ETF structure, liquidity mismatches, and margin-amplified volatility—that can transmit shocks into prices, with disproportionate effects in thinner markets such as silver. A regional perspective, with particular attention to India's dual position as a major gold-holding economy and an expanding manufacturing and renewables hub, links these findings to practical choices in reserve diversification and critical-materials planning. The paper concludes by outlining policy and strategic

recommendations for central banks, policymakers, and industrial planners seeking resilience amid monetary fragmentation and the energy transition.

The Rise and Fall of the Gold Standard:

Drawing on historical datasets from 1870–1971, this section assesses the Gold Standard’s advantages and its structural rigidity, particularly its tendency to constrain monetary expansion during periods of stress. Quantitative evidence—including the sharp contraction of the U.S. money supply in 1929–1933—illustrates how fixed convertibility limited policy responses and exacerbated the Great Depression. The discussion then traces the 1971 transition to fiat currency, which expanded the scope for counter-cyclical intervention while introducing new vulnerabilities such as inflation risk and currency debasement. This historical trade-off provides essential context for gold’s renewed relevance in contemporary **reserve management**.

Why Central Banks Are Buying Gold Again :

Central-bank gold purchases over 2010–2025, drawn from World Gold Council statistics and IMF COFER data, indicate a marked reorientation of reserve strategy toward bullion accumulation. Reported net purchases exceeded 3,220 tonnes during 2022–2024 and surpassed 860 tonnes in 2025 alone; China’s 15-month buying sequence, including an additional 40,000 troy ounces in January 2025, exemplifies the persistence of this shift. The pattern is commonly interpreted as a response by emerging-market reserve managers to heightened sanctions exposure, exchange-rate volatility, and counterparty risk, reinforcing gold’s perceived value as a politically neutral asset outside foreign jurisdiction in an increasingly fragmented geopolitical environment.

Silver’s New Identity in the Solar-Energy Revolution :

Drawing on IEA and Silver Institute datasets (2010–2025), this section measures the expansion of silver’s industrial demand—especially from photovoltaic manufacturing—while integrating material risks that are often underemphasized in conventional forecasts.

- Accelerated Recycling Technologies
- Potential Substitution Via Copper-Based Conductive Inks
- Policy-Driven Volatility In Solar Manufacturing And Renewable-Energy Deployment
- Supply Bottlenecks Due To Silver’s Predominantly By-Product Production Profile (Approximately 75%)

Taken together, these trends point to a favourable long-term demand outlook for silver, even as advances in recycling, material substitution, policy uncertainty, and by-product supply dynamics may temper the pace of consumption growth.

Gold vs. Inflation: A Century of Evidence :

Using U.S. data for 1979–2024, this section characterizes gold’s inflation linkage as state-dependent rather than constant. Across typical inflation outcomes, gold exhibits only a weak association with average inflation; however, when inflation moves into the upper tail of the distribution (above the 90th percentile), gold’s performance strengthens materially, consistent with a “super-hedge” profile under extreme price pressures. Over longer horizons, gold’s mean return (approximately 8% per year) exceeds the rise in U.S. consumer prices (about 3.9%), supporting its interpretation as a store of value more than a reliable short-run hedge against routine inflation fluctuations.

Silver’s Volatility: Blessing or Curse? :

Silver’s comparatively small market depth and its hybrid role as both an industrial input and a financial instrument contribute to substantially higher price variability than gold. UBS volatility figures document

episodes of acute turbulence, including daily moves of up to 26% and intraday drawdowns approaching 38%. Beyond these statistical characteristics, volatility is amplified by exposure to industrial slowdowns, liquidity dislocations associated with exchange-traded funds, speculative leverage cycles, and the longer-run possibility of demand dilution as alternative technologies substitute away from silver in key applications (for example, copper-based pastes or conductive inks for PV metallization, “thrifting” innovations that reduce silver loading per solar cell, and the use of carbon-based conductors in selected electronics applications). Viewed in this context, silver can serve as a high-beta tactical asset while remaining strategically important to several industrial supply chains.

Gold in Times of War :

Using post-1971 market data, this section evaluates gold’s behaviour under geopolitical stress by mapping conflict timelines to observable price responses. Historical episodes—including the Vietnam War, the Soviet–Afghan conflict, and the post-9/11 period—are used to illustrate how gold has frequently repriced upward when geopolitical risk rises in liberalized markets. The analysis is extended to recent shocks using S&P Global commodity-market series, with event windows around the Russia–Ukraine invasion (for example, the World Gold Council reports a 6% month-on-month gain in February 2022), the Israel–Hamas war (spot prices rose by roughly 9% in the weeks following 7 October 2023, as reported by Bloomberg), and the Iran–Israel escalation in April 2024 (gold advanced about 2.2% over that week amid heightened retaliation risk, according to CNBC). In addition to armed conflicts, the discussion considers supply-chain and security disruptions—such as Red Sea shipping attacks during 2023–2024—that can transmit geopolitical risk through energy and freight channels, reinforcing haven demand. Consistent with these event-study patterns, the World Gold Council documents that gold rose approximately 25.5% in 2024 and recorded 40 new all-time highs, underscoring the metal’s tendency to perform strongly when macro-financial uncertainty and geopolitical fragmentation coincide.

Digital Gold vs. Physical Gold :

Bitcoin is typically characterized by higher beta and sharper drawdowns, reflecting its reliance on market microstructure, leverage, and network infrastructure, whereas gold exhibits lower realized volatility and a longer record of institutional adoption, including its continued role in central-bank reserves. Rather than treating the two assets as interchangeable “safe havens,” the discussion situates each within diversified hedging allocations, where their distinct risk channels and transmission mechanisms imply different portfolio functions.

In comparative terms, gold derives monetary characteristics from physical scarcity, deep and longstanding liquidity, and formal institutional integration—most notably its role on central-bank balance sheets—whereas Bitcoin’s investment case rests on digitally enforced supply rules and decentralised settlement, alongside materially higher operational and governance risks. Empirically, gold has tended to exhibit lower realised volatility and more stable correlation patterns with major asset classes, particularly during acute stress, while Bitcoin’s correlations have been more regime-dependent and have often converged with broader risk assets during periods of deleveraging. The two assets also diverge in their transmission channels: gold’s risk profile is shaped primarily by macro-financial conditions, real rates, and reserve-management demand within a mature regulatory perimeter, whereas Bitcoin remains more exposed to regulatory discontinuities, market-structure fragilities (including exchange and custody risks), and technology-linked factors such as network security and infrastructure reliability. These structural differences imply that gold is more plausibly treated as a strategic hedge and reserve asset, while Bitcoin is more appropriately viewed as a speculative, high-beta diversifier whose hedging efficacy is contingent on market regime and policy stance.

Industrial Silver: From Photography to Photovoltaics :

Silver’s industrial demand base has been reconfigured since the structural decline of photographic consumption, with growth increasingly anchored in electronics and energy-transition supply chains. The *World Silver Survey 2025* (Silver Institute/Metals Focus) reports that industrial demand rose 4% in 2024 to a record 680.5 million ounces, while total global silver demand reached about 1.16 billion ounces and the market registered a deficit of 148.9 million ounces, extending a multi-year pattern of structural tightness. Within industrial end-use, electronics

and electrical applications remain central (about 445 million ounces in 2023), and silver intensity in solar photovoltaics has expanded rapidly (estimated PV-related usage growth of roughly 12% CAGR), notwithstanding ongoing “thrifting” efforts to reduce loadings per cell. Beyond PV, recent datasets for 2024–2025 point to additional demand from electric-vehicle electrification (high-reliability contacts, power-electronics switching, and charging infrastructure), advanced semiconductor packaging and interconnects (including silver-filled conductive pastes and adhesives used in high-density assemblies), and medical and sanitation technologies that leverage silver’s antimicrobial properties (e.g., coated devices and wound-care materials). Emerging digital-infrastructure drivers—such as AI-enabled data-centre build-outs, 5G equipment, and high-speed transmission hardware—further broaden the industrial footprint, reinforcing silver’s status as a critical input across multiple frontier manufacturing domains.

Precious Metals in a De-Dollarizing World :

The international reserve landscape is increasingly characterized by diversification away from a single dominant currency. The U.S. dollar’s share of global reserves has fallen from approximately 71% in 2000 to about 58.4% in 2025, alongside renewed efforts to expand local-currency invoicing and to develop parallel settlement infrastructure within the BRICS ecosystem. Recent initiatives include the BRICS Cross-Border Payments Initiative (often discussed under the “BRICS Pay” umbrella), proposals for a BRICS-linked clearing and depository architecture (“BRICS Clear”), and interoperability discussions that would connect existing national platforms such as China’s CIPS, Russia’s SPFS, India’s UPI, and Brazil’s Pix for cross-border payments and messaging. In this setting, gold has gained prominence as a sanctions-resilient reserve asset that reduces reliance on foreign jurisdiction and counterparty access. Consistent with this shift, the IMF reports that gold represented 18.3% of total international reserves in 2024 (about 2.3 trillion SDR at market value), and notes that the market value of official gold holdings increased by roughly 15.4% in the first three months of 2025. Nevertheless, a more multipolar reserve system entails trade-offs, including fragmentation of global liquidity, greater operational and governance complexity in reserve management, and heightened sensitivity of gold-heavy portfolios to commodity-price cycles.

ETFs and Market Mechanics :

This section examines the transmission channels through which precious-metals ETFs can introduce additional sources of market fragility. It outlines the mechanics of tracking error arising from fund fees, replication choices, and rebalancing frictions; explains how primary-market creation and redemption activity can generate premium/discount deviations relative to net asset value when authorized-participant activity is constrained; and discusses liquidity mismatches that arise when highly liquid ETF shares are ultimately backed by instruments whose effective liquidity deteriorates under stress (e.g., physical bars that require sourcing, transport, and vault capacity, or futures markets facing widening bid–ask spreads and delivery frictions). A salient illustration occurred in March 2020, when dislocations between physical bullion, futures pricing, and available refining/transport capacity contributed to atypical pricing gaps and short-lived premiums/discounts across gold-linked products—highlighting that “liquidity” at the ETF share level need not translate into immediate liquidity in the underlying market. The section further explains margin-driven volatility amplification: when volatility rises, higher initial/variation margin requirements and tighter collateral conditions can force leveraged participants and market-makers to reduce positions, generating procyclical selling, wider spreads, and feedback loops into ETF pricing. In thinner markets such as silver, large creations/redemptions and the hedging activity they induce (often via futures) can interact with margin calls to accelerate deleveraging, thereby translating flow shocks into outsized spot and intraday volatility.

Money Value Comparison :

Using inflation-adjusted benchmarks and currency-specific gold-price trajectories for 2000–2025, this section evaluates the extent to which gold’s appreciation mirrors the erosion of fiat purchasing power. Over this period, the U.S. dollar experienced an estimated decline of nearly 40% in real purchasing power, providing a reference point for interpreting gold’s long-run repricing in nominal terms. The cross-currency perspective is starker in high-inflation economies: measured in currencies such as the Turkish lira and Argentine peso, gold prices

increased by more than 1,000%, underscoring gold's role as a store of value when domestic monetary credibility weakens. The discussion also incorporates India's distinct demand and balance-sheet context, noting approximately 25,000 tonnes of privately held gold and its implications for household wealth preservation, current-account dynamics, and the transmission of global gold-price movements into domestic financial conditions. Gold's purchasing-power trend (2000–2025) can be summarized as a long-run repricing that is closely aligned with (and often exceeds) the cumulative erosion of fiat purchasing power, rather than a stable month-to-month inflation hedge. In inflation-adjusted terms, the framework in your draft shows that the U.S. dollar lost nearly 40% of its real purchasing power over this period, while gold tended to maintain (and in several regimes increase) its real value, particularly during episodes of macro stress, tail inflation, and risk-off repricing. Cross-currency comparisons strengthen this interpretation: in high-inflation or credibility-challenged monetary environments, gold's local-currency price rose far more sharply (often exceeding 1,000% in cases such as Turkey and Argentina), indicating that gold's purchasing-power preservation effect becomes most visible when domestic money experiences rapid debasement.

For **India**, gold's macroeconomic impact is amplified by its scale of household ownership—your section notes roughly **25,000 tonnes** of privately held gold—making it a major informal store of wealth alongside financial assets. This stock has several economy-wide implications:

- (i) it supports **household balance-sheet resilience** during inflationary or currency-pressure episodes by providing an asset that tends to reprice upward in rupee terms when domestic purchasing power weakens;
- (ii) (ii) it can influence the **current account and import bill**, because strong retail demand often translates into higher bullion imports when local prices rally or when households increase precautionary savings;
- (iii) It shapes **policy trade-offs** for monetary and financial authorities, who must manage the interaction between gold demand, domestic liquidity conditions, and exchange-rate stability. In short, gold in India functions not only as an investment commodity but also as a large, quasi-monetary household reserve with meaningful links to external balances and domestic financial conditions.

Regional Perspectives: Asia, Europe, the U.S., and India.

This section applies a comparative regional lens, combining consumption datasets, forward industrial-demand projections, and reserve-management considerations across Asia, Europe, and the United States. It then situates India as a distinctive case where cultural affinity for gold intersects with a growing role as an industrial and manufacturing hub with rising silver intensity in renewable-energy and electronics value chains. Taken together, the regional evidence supports policy-relevant discussion on how India can align renewable-energy planning with critical-materials constraints while also strengthening reserve diversification strategies amid a more fragmented global monetary environment.

Policy implications differ materially across regions because reserve objectives are conditioned by currency status, external balances, and geopolitical exposure. In the United States, the priority is less “diversification” and more the preservation of safe-asset credibility—maintaining deep Treasury-market liquidity, anchoring inflation expectations, and safeguarding payments infrastructure, which together sustain the dollar's reserve role. In Europe, where reserves are typically managed under conservative liquidity and prudential constraints, the main implication is to strengthen stress testing for settlement fragmentation and collateral shocks, while treating gold primarily as a balance-sheet stabilizer rather than a tool of active statecraft. Across Asia, strategies are more heterogeneous: large surplus economies (notably China) emphasize payment resilience and incremental diversification—through local-currency settlement expansion and complementary messaging/clearing channels—whereas several emerging markets prioritize reducing sanction and counterparty exposure, which increases the appeal of unencumbered reserves such as gold. In the Middle East, hydrocarbon-linked revenue cycles and sovereign-wealth intermediation create incentives to balance near-term dollar liquidity needs with longer-horizon value preservation, implying a role for gold as a portfolio hedge against geopolitical and inflation regimes while maintaining ample liquid buffers for fiscal stabilization. For India, the policy agenda is dual: align renewable-energy and electronics industrial policy with silver-intensive supply chains, and integrate reserve

diversification with external-sector risk management in an environment of more complex cross-border settlement and liquidity conditions.

Policy & Strategic Recommendations :

- **Treat gold as a sovereign-risk buffer, not a routine inflation hedge.** Reserve frameworks should justify gold primarily for tail-risk protection (geopolitical shocks, sanctions exposure, confidence shocks), with position sizing driven by stress scenarios rather than average inflation correlation.
- **Build resilient, diversified reserves in a multipolar system.** As settlement fragmentation rises and USD reserve share declines, central banks should combine high-liquidity assets with sanctions-resilient components (e.g., gold) and adopt dynamic allocation rules (rebalance in low-volatility windows; avoid procyclical buying).
- **Integrate silver into decarbonization and industrial policy planning.** Renewable-energy roadmaps should explicitly model silver intensity in PV/electronics, incorporating supply bottlenecks from by-product production and assessing how policy-driven deployment cycles can destabilize demand and prices.
- **Mitigate technology and recycling risks through industrial strategy.** Policymakers and firms should monitor substitution pathways (e.g., copper-based PV metallization, thrifting) and accelerated recycling as structural “demand headwinds,” while investing in refining/recycling capacity and substitution-resistant applications.
- **Strengthen supply-chain security for critical metals.** National strategies should prioritize diversification of sourcing, strategic inventories where appropriate, and domestic/near-shore processing to reduce exposure to logistics disruptions and concentrated upstream capacity.
- **Regulate and supervise ETF-related transmission channels.** Market oversight should account for liquidity mismatch and margin-driven volatility amplification—especially in thinner markets like silver—by emphasizing transparency, stress testing of AP/market-maker capacity, and investor suitability guidance.
- **India-specific: align reserves and industrial objectives.** Given large private gold holdings and rising silver demand from renewables/electronics, India’s policy mix should coordinate external-balance management (imports/current account), domestic recycling/refining, and reserve diversification to reduce vulnerability to global price spikes.

Targeted Recommendations :

For Policymakers-

- Formulate national critical-metals security strategies that map exposure across mining, refining, logistics, and end-use manufacturing.
- Scale domestic refining and recycling capacity through fiscal incentives, standards, and permitting reforms to reduce import dependence.
- Embed silver supply-risk scenarios into renewable-energy policy design (particularly PV deployment targets), including contingency procurement and stock management.

For Central Banks-

- Adopt dynamic reserve-allocation frameworks that incorporate gold’s state-dependent crisis-hedge properties and rebalance using stress-scenario triggers.

- Reduce concentration risk by limiting overreliance on politically exposed reserve currencies and strengthening settlement and custody contingency plans.
- Accumulate or rebalance gold holdings preferentially during lower-volatility regimes to mitigate procyclical buying and execution costs.

For Industrial Planners-

- Secure long-duration silver offtake arrangements and diversify suppliers to reduce exposure to by-product supply shocks.
- Prioritize process innovation that is substitution-resistant (e.g., designs that require high-conductivity inputs) while monitoring credible replacement pathways.
- Strengthen resilience across PV, electronics, and EV manufacturing supply chains through inventory buffers, dual sourcing, and contract terms that address delivery and price risk.

CONCLUSION

Taken together, the evidence presented in this study positions gold and silver as distinct yet interdependent strategic metals within an increasingly multipolar macro-financial order. Gold's enduring relevance stems less from routine inflation correlation than from its function as an instrument of sovereign-risk management: a liquid, jurisdictionally neutral reserve asset that tends to revalue when geopolitical tail risk, funding stress, or confidence in fiat regimes deteriorates. Silver, by contrast, is best understood through an industrial lens—its conductivity and material properties make it a critical input to electrification and decarbonization pathways—yet its outlook is bounded by non-trivial constraints, including the acceleration of recycling, the credible prospect of technological substitution, and supply-side fragilities linked to by-product production. For policymakers and industrial planners, these findings imply that resilience will increasingly be determined by the robustness of critical-materials supply chains, the pace of technology transition, and the governance of strategic stockpiles. For reserve managers, the central implication is not a wholesale shift toward any single asset, but the disciplined construction of balanced portfolios that preserve liquidity, mitigate sanction and counterparty exposure, and remain robust across adverse regimes. In a world where monetary credibility and geopolitical alignment are less assured, precious metals are likely to remain a measurable—rather than merely symbolic—component of economic security.

REFERENCES

1. Antonopoulos, A. M. (2017). *Mastering Bitcoin*. O'Reilly Media.
2. Bank for International Settlements. (2024). *Annual economic report 2024*.
3. Batten, J. A., Ciner, C., & Lucey, B. M. (2019). Gold: A safe haven or a hedge? *Finance Research Letters*, 30.
4. Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking & Finance*, 34.
5. Eichengreen, B. (1992). *Golden fetters: The gold standard and the Great Depression*. Oxford University Press.
6. Erb, C. B., & Harvey, C. R. (2013). The golden dilemma. *Financial Analysts Journal*, 69(4).
7. Fraunhofer Institute. (2024). *Silver use in high-efficiency PV cells*.
8. Friedman, M., & Schwartz, A. J. (1963). *A monetary history of the United States, 1867–1960*. Princeton University Press.
9. Ghosh, A., & Qureshi, M. (2022). *War and commodity markets* (IMF Working Paper).
10. International Energy Agency. (2023). *Critical minerals for clean energy*.
11. International Energy Agency. (2024). *World energy outlook 2024*.
12. International Monetary Fund. (2023). *Currency composition of official foreign exchange reserves (COFER)*.

13. International Renewable Energy Agency. (2024). Renewable power generation costs 2024.
14. Jacks, D. S. (2013). From boom to bust: A typology of real commodity prices in the long run (NBER Working Paper).
15. Markowitz, H. (1952). Portfolio selection. *Journal of Finance*, 7(1).
16. Mehta, S. (2014). Gold as household wealth in India. *South Asia Economic Journal*, 15(2).
17. Metals Focus. (2024). Silver market review 2024.
18. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies. Princeton University Press.
19. O'Connor, F., & Worthington, A. C. (2015). Silver's industrial demand and price volatility. *Resources Policy*, 45.
20. Reserve Bank of India. (2024). Annual report 2024.
21. S&P Global. (2024). Geopolitical risk and commodity markets 2024.
22. Silver Institute. (2024). World silver survey 2024.
23. Subramanian, A. (2022). The inevitable rise of a multipolar currency world. *Foreign Affairs*.
24. United States Geological Survey. (2024). Mineral commodity summaries: Gold & silver.
25. World Gold Council. (2024). Central bank gold reserves survey 2024.
26. World Bank. (2024). Commodity markets outlook 2024.