

Tokenizing Real-World Assets

Lin William Cong, Simon Mayer, and Daniel Rabetti

Abstract

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TOKENIZING REAL-WORLD ASSETS*

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Abstract

Tokenization of real-world assets (RWAs)—the representation of off-chain assets on a digital ledger—has gained momentum across money market funds, government bonds, gold, and private credit. It bridges traditional finance and on-chain markets while continuing to rely on traditional infrastructure for custody, legal enforcement, and price discovery. Tokenization promises efficiency gains in issuance, trading, and settlement, and may facilitate secondary-market liquidity by making claims on otherwise illiquid assets more transferable. We distinguish three categories: tokenized liquid assets (e.g., gold and equities), money-like claims (e.g., stablecoins and tokenized deposits), and tokenized illiquid assets (e.g., loans and private credit). Tokenization of liquid assets integrates traditional markets with decentralized finance and reallocates liquidity across venues. Tokenization of illiquid assets, by contrast, facilitates secondary-market trading opportunities, but whether it creates meaningful liquidity depends on market design, investor participation, valuation quality, and asset opacity. This liquidity transformation inherits incentive problems familiar from banking and securitization, while introducing new economic and operational risks around custody, redemption design, and oracles. We argue that the trading speed of a tokenized claim should match the speed at which the underlying asset can be traded, valued, or redeemed—the speed-matching principle that organizes our policy framework. We propose a policy framework that ties regulatory requirements to the economic role tokens play and the speed and liquidity of their underlying markets rather than to the underlying technology, prioritizing clear legal foundations, credible redemption mechanisms, robust custody and audit standards, and oracle governance.

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1 Introduction

Tokenization refers to the representation of off-chain financial and real assets on distributed ledgers, enabling programmable transfer, settlement, and composability.¹ It builds on earlier blockchain developments—most notably Bitcoin’s introduction of decentralized value transfer—and extends blockchain-based settlement beyond native crypto assets to government bonds, commodities, loans, equities, and exchange-traded products. While Bitcoin itself proved ill-suited as a medium of exchange, fiat-backed stablecoins demonstrated how blockchain infrastructure could represent money-like instruments. Tokenization of real-world assets (RWAs) generalizes this idea to a broader set of financial assets and securities.

1.1 What Problems Does Tokenization Solve?

The central economic question surrounding RWA tokenization is not whether blockchain technology can represent traditional assets on-chain, but rather what economic problems tokenization is intended to solve and what frictions may undercut its potential in doing so.

Across asset classes, tokenization primarily serves two related objectives beyond record-keeping: (1) integrating assets into the on-chain ecosystem and enabling their programmability; and (2) enhancing the tradability and settlement of underlying assets, and potentially their liquidity. Programmability allows financial contracts to execute automatically, settlement to occur instantly or atomically, and reliance on intermediaries and counterparty risk to be reduced, making tokenized assets usable in on-chain and decentralized finance applications. Tokenization typically does not change the underlying asset’s fundamental features, such as its cash flows or risk profile. Its economic relevance comes instead from changing the asset’s trading venue, investor base, liquidity, settlement speed, and technical features such as programmability and composability.

¹[Park \(2025\)](#) discusses institutional differences between traditional and decentralized finance (DeFi).

Much of financial innovation has historically focused on overcoming barriers to access and trade. Exchange-traded funds provide a canonical example. The introduction of gold ETFs, most notably GLD, dramatically expanded participation in gold markets by converting a costly-to-store physical asset into a liquid, continuously traded financial claim accessible to both institutional and retail investors. Tokenization can be viewed as a technological extension of this logic. However, unlike earlier innovations, tokenization operates within a programmable, global, and continuously open market environment, and its economic consequences vary sharply across asset types.

First, for liquid assets, the primary motivation is integration rather than liquidity creation per se: bringing already liquid traditional financial assets on-chain to enable their use within the crypto-native or decentralized financial system. Whether tokenization additionally affects the liquidity, comovement, or informational efficiency of the underlying markets—as the literature on composite securities has documented for ETFs ([Ben-David, Franzoni, and Moussawi, 2018](#); [Glosten, Nallareddy, and Zou, 2021](#); [Cong, Huang, and Xu, 2024](#))—is an open empirical question that we return to in [Section 2.2](#) and the conclusion. Tokenized stocks, gold, or indices allow market participants to hedge risk, post collateral, and rebalance portfolios without exiting blockchain-based environments. For instance, a crypto investor may borrow stablecoins while posting tokenized shares as collateral, or use yield earned from staking volatile assets to hedge exposure by acquiring tokenized gold. A special case of this first objective—integration into the on-chain ecosystem and programmability—arises when the underlying asset is itself a payment instrument or money-like claim, such as bank deposits or money market mutual fund shares. Here, tokenization can improve interbank settlement, liquidity management, and the speed of transfers. Stablecoins are the canonical example, while tokenized money market fund shares may serve a similar role under appropriate regulation.

In this sense, tokenized liquid assets play a role analogous to stablecoins. Just as stablecoins provide a medium of exchange and a unit of account for on-chain transactions, tokenized liquid assets provide hedging instruments, high-quality collateral, and other mechanisms that

allow on-chain financial markets to function more completely, while also making traditional financial and real-world assets accessible to on-chain users.

Second, when tokenization is applied to assets that are illiquid and whose valuations adjust infrequently—such as private credit/equity, loan pools, or real estate—it seeks to solve a different problem: the absence of a liquid secondary market. In these cases, tokenization resembles securitization or *liquidity transformation*, creating claims that are, in principle, continuously tradable against illiquid underlying assets. Yet making such claims tradable does not, on its own, make either the claims or the underlying assets genuinely liquid. Tradability does not imply active trading, and information asymmetries about asset quality, together with other economic frictions, may prevent secondary-market liquidity from emerging.

Prices in tokenized secondary markets may be subject to fragility when investors cannot observe underlying asset quality, redemption capacity, or current NAV. Issuing claims against illiquid assets also raises additional difficulties: how and whether to facilitate redemption, how to maintain a credible link to the underlying assets, what valuation to rely on, and how to reconcile continuous tradability with the fact that illiquidity is, in some cases, intrinsic to the underlying economics.² This contrast — between liquid underliers, where continuous on-chain trading is largely unproblematic, and illiquid underliers, where continuous tradability can outrun the underlying’s adjustment speed — motivates what we later call the speed-matching principle (Section 1.3, Figure 2): the trading speed of a tokenized claim should match the speed at which the underlying can be traded, valued, or redeemed. We return to this organizing idea throughout the paper.

²For instance, the economics of private equity funds inherently require LP stakes to be illiquid: such stakes can only be transferred with GP consent, and GPs typically prefer a stable set of fund investors. Similarly, a key benefit of remaining private for a company is precisely the ability to maintain a small, concentrated shareholder base rather than a continuously changing one.

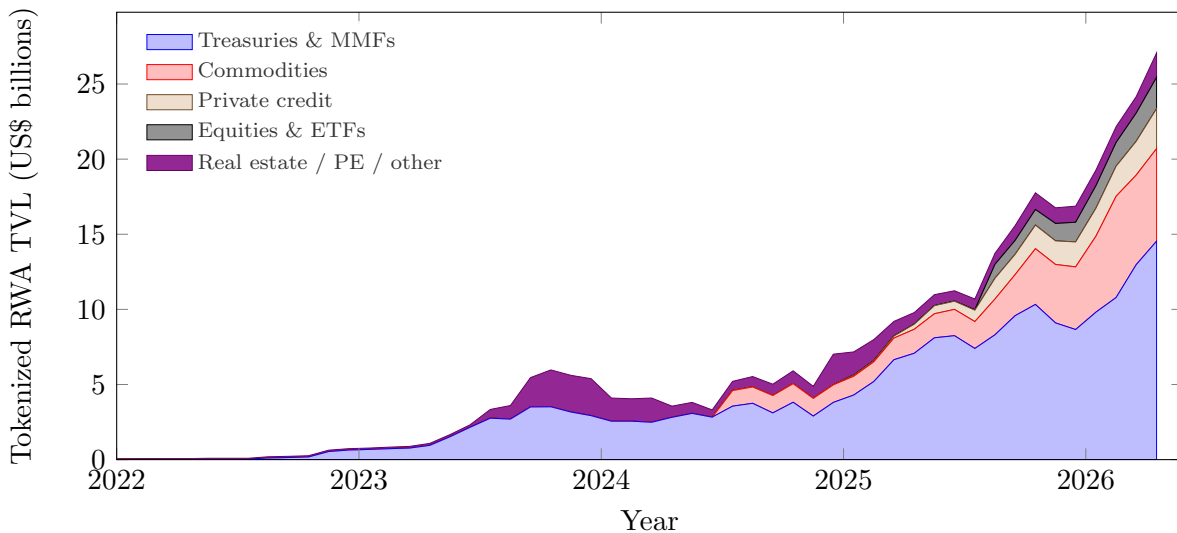


Figure 1: **Evolution of tokenized RWA total value locked by category, 2021–2026.** Monthly TVL aggregated across the top 50 DefiLlama-tracked RWA protocols, expressed in US\$ billions. Stablecoins are excluded throughout. Figure Technologies’ \$16.9 billion of HELOC tokens on the Provenance blockchain are not indexed by DefiLlama and therefore not shown; including them would roughly triple the private-credit category as of April 2026. Data source: DefiLlama, retrieved April 2026.

1.2 Where is Current Demand Coming from?

Demand for tokenized RWAs is not a single phenomenon. It comes from three distinct user segments, each with different tolerances for redemption frictions and off-chain custody risk and different preferences for trading speed and on-chain functionality: (1) on-chain financial infrastructure (DeFi protocols, exchanges, stablecoin issuers, crypto-native funds) that uses tokenized Treasuries, money market fund shares, and tokenized gold as composable collateral, reserves, and hedging instruments; (2) yield-seeking on-chain capital that flows toward whichever tokenized instrument — short-term Treasury tokens, money market fund shares, private-credit tokens, or HELOC-backed instruments — offers the best risk-adjusted on-chain yield; and (3) global retail investors who use tokenized equities, gold, and institutional fund shares to obtain exposure that would otherwise require access to U.S. or European brokerage channels, often through fractional, sub-\$100 trades. These three segments collectively account for the bulk of tokenized RWA value on public chains, with on-chain infrastructure currently

dominant (see Figure 1). We treat the supply-side market structure in Section 2 and return to demand composition in detail in Section 2.5.

1.3 How Does Speed Factor in?

Continuous, near-instant settlement and trading are among the most salient technological features of RWA tokenization. On the one hand, continuous trading extends price discovery into hours when traditional venues are closed: tokenized-equity prices incorporate weekend and overnight news and predict the direction of Monday’s opening in the underlying stocks (Cong, Landsman, Rabetti, Zhang, and Zhao, 2025), and tokenized-gold prices move one-for-one with spot gold around geopolitical and monetary-policy events, with Monday spot and futures markets typically converging to the token-implied level (Harvey, Chen, Rabetti, and Zhang, 2025). Programmable contracts also enable automated collateral rebalancing, faster margining, and near-atomic settlement. On the other hand, continuous trading can fragment liquidity over time and across venues (Blonien and Ober, 2024; Chen and Duffie, 2021; Agur and Copestake, 2025), and it can amplify fragility by removing the pauses—overnight windows, circuit breakers, discretionary intermediation—through which traditional systems absorb shocks. We later discuss these stress-transmission dynamics in detail.

The organizing implication, illustrated schematically in Figure 2, is what we term the *speed-matching* principle: the speed at which a token can be traded should generally match the speed at which the underlying can be traded or redeemed. For deep and liquid markets (Treasuries, gold, large-cap equities), 24/7 continuous trading is largely unproblematic, since arbitrage with off-chain markets disciplines prices even when redemption itself remains episodic. For markets whose fundamentals adjust on the timescale of weeks or months (private credit, real estate, private equity), the same continuous trading layer creates a temporal mismatch that can translate into liquidity and run risk. This principle recurs throughout the paper and underpins the policy framework in Section 4.

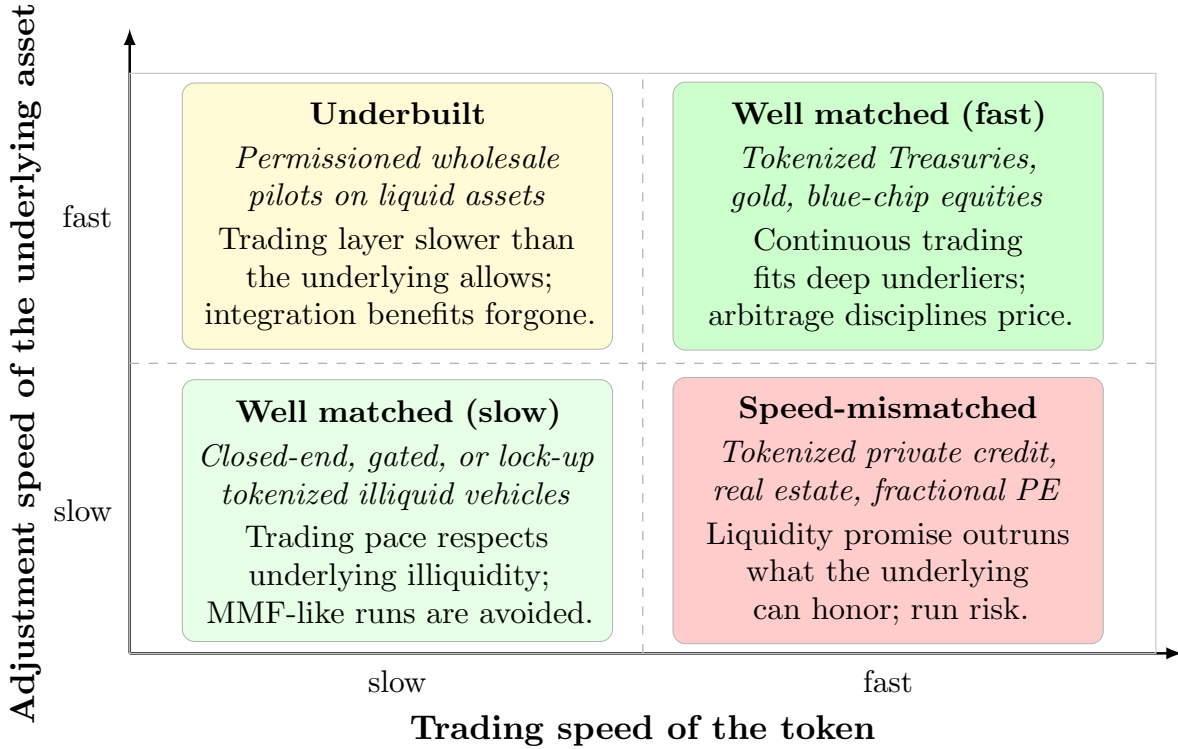


Figure 2: **The speed-matching principle.** Tokenized RWAs fall into four zones defined by the trading speed of the token (horizontal axis) and the adjustment speed of the underlying asset (vertical axis). Instruments in the two green quadrants are well matched: the token’s trading cadence respects the pace at which the underlying can actually honor redemptions. The red quadrant is where current tokenization faces the most acute fragility risk: continuously tradable, freely redeemable tokens on slow-moving underliers. The yellow quadrant represents an opposite inefficiency: permissioned or slow-settling designs fail to deliver the integration benefits that liquid underliers could support.

1.4 Other Challenges in Tokenization

Tokenization also introduces risks and challenges distinct from, and in some cases more acute than, those in traditional market infrastructures. Tokenized RWAs rely heavily on price and state oracles to connect on-chain contracts with off-chain realities, creating potential single points of failure through manipulation, outages, or delayed updates (Cong, Fox, Li, and Zhou, 2025). Despite on-chain transferability, tokenized assets depend on off-chain custody of underlying claims, introducing counterparty, operational, and legal risks tied to custodians, trustees, and special-purpose vehicles.

Blockchain scalability constraints raise further concerns: if RWAs were to achieve mainstream adoption, congestion, fee spikes, or validator concentration could impair settlement reliability precisely when liquidity demand is highest. Finally, tokenization’s global reach complicates supervision and enforcement, as fragmented compliance regimes and divergent legal definitions of ownership and finality challenge international regulatory coordination.

1.5 Roadmap and Contribution

In Section 2, we provide an overview of the RWA tokenization market excluding stablecoins. Tokenized activity has concentrated in private credit, money market funds, government bonds, and, more recently, equities and gold. Both large financial incumbents (e.g., BlackRock, Franklin Templeton) and specialized FinTechs (e.g., Figure Technologies, Ondo Finance) participate in these markets, typically combining blockchain settlement with traditional custody, legal structures, and off-chain asset management.³

Section 3 analyzes the core frictions that determine whether tokenized markets are robust or fragile, focusing on ownership and legal finality, custody and bankruptcy remoteness, redemption mechanisms, the speed-versus-coordination tradeoff, information disclosure and oracle design, and market structure. Section 4 develops regulatory recommendations that align oversight with the economic role tokens play in practice, as money-like instruments, collateral, or risk assets, rather than with the technology used to issue them, and translates the speed-matching principle into concrete design guidance.

Our contribution is to provide a policy-oriented synthesis of RWA tokenization, grounded in the three questions posed above: what problem tokenization solves for each asset class, where demand is coming from, and how the token’s trading speed interacts with the underlying’s adjustment speed. We explain why tokenization can enhance market functioning when it

³For assets such as stocks or gold, liquid traditional markets coexist with on-chain trading. For others, most notably private loans, tokenization effectively creates a digitally native form of securitization, allowing pooled claims to trade on-chain even when the underlying assets do not.

integrates liquid assets into on-chain financial systems, but can create fragility when it creates liquid claims on illiquid fundamentals. We also clarify why technology alone cannot overcome constraints related to liquidity, valuation, and credible commitment.

2 Background: The Tokenized Asset Market Today

Tokenized assets are digital tokens on blockchains that represent economic claims or ownership rights over real-world assets (RWAs). The underlying assets are typically held in custody by a trusted third party, while tokens are minted on a blockchain to represent specific claims. In most implementations, holding a token confers a contractual or beneficial claim on the underlying asset, its cash flows, or an issuing vehicle that holds the asset. Thus, a structural feature of tokenization is its role as a bridge among traditional finance (TradFi), centralized crypto-asset platforms (CeFi), and decentralized finance (DeFi). Most tokenized RWAs rely on off-chain custody, traditional legal enforcement, and regulated financial institutions to hold and service the underlying assets. This dependence creates a structural tension: the intermediaries whose infrastructure tokenization relies on are also those whose intermediation rents it promises to reduce ([Agur and Copestake, 2025](#)).

We use the term RWA broadly to refer to blockchain-based representations of off-chain assets, rights, or claims. This category includes tokenized financial instruments, such as stocks, bonds, money market fund shares, bank deposits, loans, and fund interests; money-like claims, such as stablecoins and tokenized deposits; and non-financial or partly financial assets, such as real estate, commodities, art, collectibles, and event tickets. The focus of this paper is primarily on tokenized financial instruments and financial claims, because these raise the most immediate questions for market structure, redemption, custody, investor protection, and financial stability.⁴ Non-financial tokenized assets raise related but distinct issues, often

⁴For a related asset-based approach to token classification, emphasizing that tokens should be classified by the nature of the asset, service, or function they represent rather than by the technology used to record them, see [Sidley Austin LLP, on behalf of Ava Labs, Inc. \(2025\)](#).

centered on property law, contract enforceability, consumer protection, intellectual property, or title registries rather than securities-market structure.

Most of the analysis concerns *representational tokenization*, where the token evidences a contractual or beneficial claim on an off-chain asset held by an issuer, custodian, trust, or SPV. This differs from native on-chain issuance, where the financial instrument itself is issued and maintained on a ledger. Tokenization can also be issuer-driven, intermediary-driven, or third-party driven. This distinction matters because tokenized equities or bonds created without issuer involvement may provide economic exposure without conferring shareholder-of-record status, voting rights, direct redemption rights, or issuer disclosures. Tokenized instruments should therefore disclose whether tokenization is issuer-sponsored, intermediary-sponsored, or third-party/synthetic, and whether token holders receive voting rights, corporate-action processing, issuer disclosures, redemption rights, and shareholder- or creditor-of-record status.

This section discusses the potential benefits of RWA tokenization, before proceeding to a detailed market overview. Section 3 then examines where these purported benefits may fail to materialize, alongside other policy challenges.

2.1 Potential Benefits of Tokenization

The benefits of tokenization center on two broad functions: (1) integrating off-chain assets into the on-chain ecosystem, thereby enabling programmability, composability, and new use cases in decentralized finance; and (2) enhancing the transferability of certain asset classes by creating tokenized claims on assets that are otherwise difficult to trade. In greater detail, commonly cited potential benefits include:

1. *Settlement and operational efficiency.* Tokenization can shorten settlement cycles, enable atomic delivery-versus-payment, and reduce some traditional intermediation costs around transfer agency, clearing, and record-keeping — though new intermediation layers around issuance, custody, oracle provision, and platform access may absorb part

of these savings. Continuous availability also extends off-hours price discovery for liquid assets and supports 24/7 settlement for money-like claims, with the caveat that the same speed amplifies stress when redemption facilities or underlying markets are unavailable.

2. *Transferability, access, and fractionalization.* Lower minimum investment sizes, reduced geographic barriers, and on-chain transferability can broaden participation and create secondary-market trading opportunities for otherwise illiquid claims such as private credit, real estate, and pooled loans. Transferability is not, however, equivalent to economically meaningful liquidity, which still requires depth, participation, price discovery, and incentives for liquidity provision.
3. *Programmability, embedded compliance, and composability.* Smart-contract code can embed eligibility checks, transfer restrictions, automated cash-flow distributions, voting rights, and collateral logic directly into the token. Tokens built to common standards can also be reused across protocols — a tokenized Treasury can serve simultaneously as collateral in a lending market, the settlement leg of a derivative, and a reserve asset for a stablecoin.
4. *Transparency and shared ledger infrastructure.* A common, auditable ledger can reduce reconciliation frictions across counterparties and improve the sharedness of information about ownership, flows, and collateral, with potential supervisory benefits. These gains depend on reliable transmission of off-chain information — custody, reserve backing, valuation, and corporate-action data — onto the ledger.
5. *Collateral, payment, and monetary functions.* Tokenized RWAs can serve as collateral within on-chain markets and, in the case of money-like claims, as payment or settlement assets. Stablecoins, tokenized deposits, tokenized money market fund shares, and tokenized Treasuries all respond to demand for on-chain dollar instruments, and proposals

such as PORTS suggest that public safe-asset design may evolve to support tokenized cash-management use cases (Duffie and Wilson, 2025).

These benefits are aspirational rather than guaranteed, and their relevance depends on implementation and asset class. For liquid assets, the primary benefit is integration into on-chain financial markets; for illiquid assets, the benefit is greater transferability, which is also where new fragilities inherent to liquidity transformation may arise. Some of these aforementioned benefits could in principle be achieved through non-tokenized mechanisms, while others—such as atomic settlement, composability, and DeFi integration—are more specific to blockchain-based systems.

It is equally important to be clear about what tokenization does not do. Representing an asset on a distributed ledger does not change its credit quality, solvency, fundamental valuation, or the creditworthiness of any counterparty in the chain of claims. A tokenized loan pool carries the same underwriting and default risk as the off-chain pool it represents; a tokenized fund interest is no more solvent than the fund itself; a tokenized deposit is only as safe as the issuing bank. On-chain representation can change how a claim trades, settles, and composes with other instruments, but it cannot manufacture liquidity where market depth is absent, recover value from a defaulting borrower, or substitute for the legal and operational backstops that protect investors in traditional markets. Many of the policy concerns analyzed in Section 3 arise precisely when these two layers — economic substance and trading technology — are conflated.

2.2 Tokenization versus ETFs and Other Composite Securities

The most natural reference point for tokenized RWAs is the existing literature on composite securities, particularly exchange-traded funds (ETFs) and depositary receipts. Like tokens, ETFs wrap underlying assets in a tradable instrument, rely on creation–redemption arbitrage to anchor prices to net asset value, and broaden access to assets that might otherwise be

costly or impossible for many investors to hold directly. A substantial literature documents that ETFs are not neutral conduits: they can affect the liquidity, informational efficiency, volatility, and comovement of the underlying markets they wrap (Ben-David et al., 2018; Glosten et al., 2021; Huang, O’Hara, and Zhong, 2021; Cong et al., 2024; Koont, Ma, Pástor, and Zeng, 2025). Any analysis of tokenization should therefore begin by asking which features of tokenized RWAs are genuinely new and which are already familiar from the composite-security literature.

We highlight six distinctions between tokenization and ETF-style composite securities. First, *composability*: ETF shares do not serve as smart-contract primitives that can be automatically pledged, liquidated, or rehypothecated using oracle-fed prices. Second, *arbitrage architecture*: ETF prices are disciplined by regulated authorized participants, whereas token mint–redeem arbitrage may be open to qualified holders, mediated by smart contracts, or rationed by issuer discretion. Third, *cross-asset trading*: tokenized securities can trade directly against stablecoins, non-security crypto assets, or other tokenized instruments in the same protocol, raising mixed-regime surveillance and disclosure questions. Fourth, *liquidity-transformation reach*: tokenization has expanded into private credit, real estate, and other assets that ETFs generally cannot wrap through daily in-kind creation and redemption. Fifth, *cross-chain fragmentation*: a single tokenized claim may exist on multiple chains that are not natively fungible. Sixth, *oracle dependency*: token NAVs, collateral values, and redemption eligibility often depend on oracle systems whose governance and fallback rules are themselves market-design choices.

These distinctions matter for both diagnosis and policy. The ETF literature shows that composite securities can affect underlying markets, so claims that liquid-asset tokenization is purely about integration should be treated as a baseline hypothesis rather than a settled conclusion. Whether tokenization alters the liquidity, comovement, volatility, or informational efficiency of the underlying markets remains an open empirical question. The corporate-bond ETF experience is especially relevant because even mature ETF markets actively manage

creation and redemption baskets to balance index tracking against liquidity transformation when the underlying bonds are illiquid (Koont et al., 2025).

2.3 Market Size and Infrastructure

As of April 2026, the distributed value of tokenized RWAs on public blockchains stands at roughly \$29 billion, excluding approximately \$300 billion in stablecoins.⁵ A further \$16.9 billion of private-credit tokens is outstanding on Figure Technologies' Provenance blockchain, which is not indexed by most public DeFi dashboards; including these tokens raises total tokenized RWA value to about \$46 billion, up from roughly \$2.9 billion in 2022 and about \$12 billion at the end of 2024. Growth accelerated sharply through 2025 and the first quarter of 2026, and long-term industry projections remain bullish, with estimates reaching \$18 trillion by 2033.⁶

This expansion is supported by a growing ecosystem of issuers, who often rely on regulated custodians to maintain one-to-one asset backing. Tokenized RWAs span both public and permissioned blockchains. Ethereum dominates the public segment with roughly \$16 billion in tokenized RWAs (about 54% of tracked value), followed by BNB Chain (\$3.8B, 13%), Solana (\$2.0B, 7%), Stellar (\$1.6B, 6%), and the Liquid Network (\$1.4B, 5%); Solana has also become a hub for high-speed tokenized stock trading, while zkSync Era hosts large private-credit pools. Permissioned networks such as Figure's Provenance blockchain and the Canton Network, backed by major banks and market infrastructures, support wholesale and interbank tokenization. Figure 1 shows how the category mix has evolved since 2021, with yield-bearing Treasuries and money-market instruments overtaking commodities as the largest segment through 2025, and Figure 3 illustrates how this value is concentrated across a small number of issuers and chains.

⁵<https://app.rwa.xyz/>

⁶<https://tinyurl.com/3wua4cuf>

Wholesale versus retail tokenization. A further distinction that policy should preserve rather than blur is between wholesale and retail tokenization. Wholesale initiatives, typically on permissioned networks operated by major banks and market infrastructures such as the Canton Network, Partior, or Finality, primarily serve bank treasuries, market-makers, and institutional asset managers; their core use cases are interbank settlement, collateral mobility, and repo automation. Retail-facing tokenization on public chains, by contrast, places ordinary investors in direct contact with smart-contract infrastructure, custodians they may not understand, and price gaps when traditional venues are closed.

The two segments raise different policy concerns: wholesale tokenization is primarily a financial-market-infrastructure question under the PFMI framework, while retail tokenization is primarily an investor-protection and market-integrity question under securities and consumer-protection law.

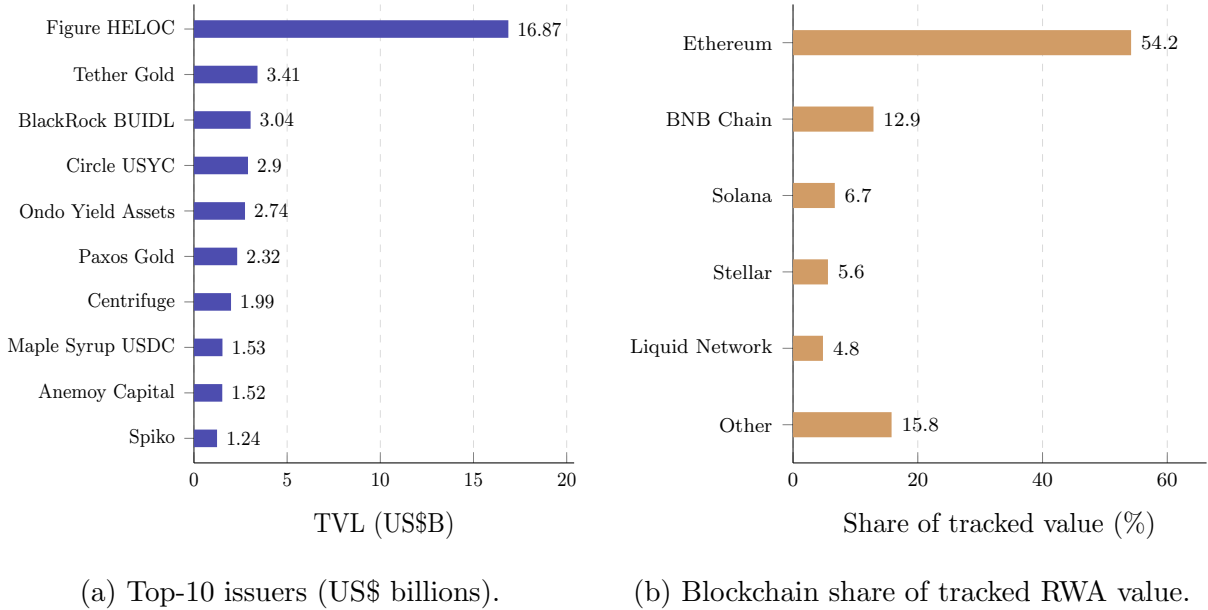


Figure 3: **Concentration of tokenized RWA value by issuer and by chain, April 2026.** Panel (a): the top ten tokenized-RWA issuers account for roughly 82% of total tracked value. Figure Technologies’ HELOC program alone represents about 37% of the total and runs on a permissioned chain (Provenance) that most DeFi-focused dashboards do not index. Panel (b): Ethereum hosts a clear majority of tokenized value on public chains, with the next four chains together adding another 30%. Data sources: DefiLlama and <https://app.rwa.xyz/>, retrieved April 2026.

2.4 RWA Classes and Their Tokenization

Tokenization should not be evaluated as a single phenomenon. As discussed in the Introduction and in Section 2.1, its economic effects and objectives differ sharply depending on the liquidity and specificity of the underlying asset.

Tokenizing liquid assets and money-like claims. When liquid assets are tokenized, tokenization primarily enables their integration into the on-chain ecosystem while facilitating programmability. Since the underlying assets are already liquid in traditional markets and can be traded without significant friction, the first-order effect of tokenization is not to create liquidity but to reallocate it across venues by facilitating on-chain trading of claims on the underlying. The ETF literature suggests, however, that composite securities can have non-trivial spillover effects on underlying markets through changes in liquidity, comovement, and information acquisition (Ben-David et al., 2018; Glosten et al., 2021; Cong et al., 2024); whether analogous effects arise from tokenization is an open empirical question (see Section 2.2). We review important “liquid” asset classes and their tokenization:

1. *Government bonds and money market instruments, a \$14.5 billion market by April 2026.* Tokenized Treasuries and money market funds expanded rapidly during 2023–2025 (Aquilina, Lewrick, Ravenna, and Schönleber, 2025; Aldasoro, Cornelli, Frost, Koo Wilkens, Lewrick, and Shreeti, 2025) and continued to accelerate into 2026. BlackRock’s BUIDL fund grew from \$650M in early 2025 to roughly \$3.0 billion across eight chains by April 2026, while Circle’s USYC (\$2.9B), Ondo’s yield-bearing tokens (\$2.7B), Anemoy Capital (\$1.5B), Spiko’s EU T-bill tokens (\$1.2B), and Ethena’s USDtb (\$0.9B) now anchor the segment alongside Franklin Templeton and a growing roster of Asian issuers.⁷ These instruments function as on-chain cash equivalents for

⁷Franklin Templeton’s on-chain money market fund launched on Stellar in 2023 and later expanded to Polygon; Goldman Sachs, BNY Mellon, and DBS have since launched or integrated similar products.

treasuries, exchanges, and DeFi protocols. MakerDAO, for example, holds substantial tokenized Treasury exposure as reserve assets.

Tokenized Treasury bills or money market fund shares derive their value from highly liquid underlying markets with frequent price discovery and established arbitrage mechanisms. In particular, a link to the traditional market is maintained through the ability to redeem the tokenized asset for the underlying, although such redemption may be limited in practice, as we also discuss later. Tokenized versions of these assets can circulate on-chain as cash-management tools or collateral in digital markets, but their stability ultimately rests on the ability to liquidate or redeem the underlying instruments in traditional markets. In this respect, tokenization resembles earlier innovations such as exchange-traded funds or depositary receipts: it layers a new trading and settlement technology on top of already liquid assets.

A related policy proposal is the creation of a Treasury instrument designed specifically for tokenized cash-management and settlement use cases. [Duffie and Wilson \(2025\)](#) propose Perpetual Overnight Rate Treasury Securities (PORTS), floating-rate Treasury notes issued and redeemable at par daily. Such an instrument would provide Treasury credit, overnight-rate exposure, and par liquidity in a form naturally suited to stablecoins, tokenized money market funds, and other tokenized dollar instruments. The proposal highlights that the tokenization of cash-equivalent assets may require not only private token wrappers around existing Treasuries, but also public-sector debt instruments designed for continuous, programmable settlement.

2. *Commodities, a \$6 billion market as of April 2026, roughly double its late-2025 size.* Gold is the leading tokenized commodity. Tether Gold (XAUt, \$3.4B) and Paxos Gold (PAXG, \$2.3B) collectively represent close to \$6 billion in market value, with smaller issuers such as Matrixdock's XAUM adding to the segment, enabling continuous

trading and DeFi integration.⁸ Physical gold is costly to store and transfer, yet benefits from deep global markets and well-established price benchmarks. Empirical evidence in [Harvey et al. \(2025\)](#) shows that tokenized gold preserves core economic properties, including tight price alignment with spot gold and safe-haven behavior during geopolitical and market stress.

3. *Public stocks and equity ETFs, a roughly \$2 billion market, up from about \$0.4 billion in late 2025.* Tokenized equities remain small relative to underlying cash equity markets but have expanded roughly fivefold over six months.⁹ WisdomTree’s on-chain fund suite (\$0.9B), Ondo Global Markets (\$0.8B), and Backed Finance’s xStocks (\$0.4B) dominate issuance, adopting contrasting designs that trade either continuously or in sync with U.S. market hours. Empirical evidence in [Cong et al. \(2025\)](#) suggests that tokenized equities extend price discovery into off-hours while remaining closely integrated with underlying markets.

4. *Stablecoins and tokenized deposits.* Stablecoins, representing almost a \$300 billion market, are the largest form of tokenized RWAs but are typically treated separately.¹⁰ Related, tokenized deposits represent direct bank liabilities issued in programmable form. While they may improve interbank settlement and liquidity management, their architectures and regulatory treatment remain nascent as well.¹¹

Although banks engage in maturity and liquidity transformation, tokenized deposits do not introduce a new layer of liquidity transformation at the level of the token itself: the transformation remains contained within the regulated banking system.

⁸<https://coingecko.com/en/coins/pax-gold>

⁹See [Malinova and Park \(2023\)](#).

¹⁰See [Arner, Auer, and Frost \(2020\)](#); [Lipton, Sardon, Schär, and Schüpbach \(2020\)](#); [Catalini \(2021\)](#); [Gorton and Zhang \(2023\)](#); [Ma, Zeng, and Zhang \(2025\)](#); [Ante, Saggiu, and Fiedler \(2025\)](#); [Wen, Li, Lau, and Zhang \(2025\)](#); [Li and Mayer \(2025\)](#); [Cong \(2025\)](#).

¹¹See [BIS \(2022\)](#); [Aldasoro et al. \(2025\)](#); [Garratt and Shin \(2023\)](#); [EBA \(2024\)](#); [Chen \(2025\)](#); [BIS \(2025a,b\)](#).

Both stablecoins and tokenized deposits represent highly liquid, money-like claims and can be viewed as forms of tokenized money. Their value is typically anchored to a fixed target (e.g., a one-dollar peg), rather than to the market valuation of an underlying asset, distinguishing them from other tokenized RWAs. As a result, their primary economic role lies in payments, settlement, and cash management, rather than in providing exposure to underlying assets or facilitating risk transfer. This places them in a different category from most tokenized RWAs considered in this paper. Accordingly, we draw parallels where relevant but do not focus on them.

Tokenizing illiquid assets. Tokenization has also expanded into illiquid asset classes, such as private credit and loan pools, where the economic effects and objectives differ from those in the context of liquid assets. Individual loans—such as mortgages, consumer credit, or HELOCs—do not trade in liquid secondary markets. Tokenization in this context effectively creates a digitally native form of securitization or liquidity transformation, pooling loans and issuing transferable claims on their cash flows. Unlike tokenized Treasuries or gold, liquidity here is not anchored by a deep primary market for the underlying asset; instead, it may arise endogenously through secondary trading of the token itself. However, simply facilitating secondary trading of the tokens does not render the claims liquid per se, as information asymmetries and asset opaqueness can act as impediments for liquidity to arise.

Evidence from tokenized real-estate markets suggests that tokenization can create transferability without automatically creating economically meaningful liquidity. In one long-running RWA platform, AMMs, posted-offer P2P trading, and issuer buybacks coexist: AMMs handle many small immediacy-driven trades, P2P markets account for most dollar volume, and issuer buybacks serve as capped appraisal-based backstops. The lesson is not that tokenized RWAs cannot be liquid, but that liquidity depends on market design, investor participation, and incentives for liquidity provision ([Laschinger, Leonhard, Dorfleitner, and Schäfers, 2025](#)).

The most prominent RWA classes in this category are:

1. *Loans and private credit, a roughly \$20 billion market when Figure’s Provenance-based HELOC tokens are included.* Loans constitute the largest segment of tokenized RWAs. In this context, “private credit” typically refers to consumer loans, mortgages, or HELOCs rather than traditional middle-market corporate lending. Figure Technologies alone accounts for approximately \$16.9 billion of outstanding HELOC tokens on its Provenance blockchain,¹² while on public chains Centrifuge (\$2.0B) and Maple’s Syrup USDC (\$1.5B) lead, and Tradable on zkSync hosts close to \$1.9B in tokenized loans.¹³ Loans are often pooled, with tokens representing claims on diversified portfolios— analogous to securitization. Collateral typically remains off-chain and must be verified by issuers or third parties, raising disclosure and monitoring challenges.
2. *Alternative funds, real estate, and tokenized trading strategies, a combined \$1.5–2 billion market on public chains.* This class includes tokenized interests in private funds, real estate, and structured credit vehicles. Blockchain Capital’s tokenized fund on zkSync Era (\$0.8B), Securitize’s tokenized AAA CLO fund (\$0.1B), and Apollo’s on-chain diversified credit vehicle (\$0.1B) have emerged as early institutional entrants, while RealT continues to tokenize fractional U.S. residential property (\$0.15B). Institutions in Japan, Hong Kong, and Singapore have piloted tokenized real estate bonds. Legal and economic constraints remain significant in that space.¹⁴

2.5 Demand-side drivers

The market overview picture above, organized around what is being tokenized, is only half the story, focusing on the supply of tokenized assets. A parallel question, and the one that

¹²<https://tinyurl.com/34jhwcy2>

¹³<https://app.rwa.xyz/>

¹⁴For instance, opacity and information asymmetries in the underlying assets can impede trading, asset transfers may require issuer consent (e.g., GP approval for LP transfers of PE fund interests), or they may be restricted to accredited investors.

typically determines whether a given market will scale or stall, is who is buying tokenized RWAs and why, providing insights into the drivers of demand for tokenized assets.

After all, liquidity is not a technical attribute of a token. It is an equilibrium outcome jointly determined by investor demand, economic incentives, issuer support, redemption design, and arbitrage constraints. The composition of investor demand matters in particular: new users can improve risk-sharing and market liquidity if they bring uncorrelated demand and additional balance-sheet capacity, but they can also increase market fragility if their participation is correlated, levered, or poorly informed.

Drawing on the three demand segments introduced in Section 1, we next map the current market to the underlying economic motives behind tokenization.

On-chain infrastructure and treasury management. The largest share of current demand comes from on-chain financial infrastructure, protocols, and applications: DeFi lending protocols, automated market makers, centralized crypto exchanges, stablecoin issuers, and crypto-native funds. In these applications, participants often need a hedging instrument, collateral asset, or on-chain medium of exchange and store of value that can earn yield. Tokenized short-term Treasuries and money market funds closely fit this use case, which is why BlackRock’s BUIDL, Circle’s USYC, Ondo’s yield-bearing tokens, and similar products have grown faster than any other category. Tokenized gold plays a complementary role as a low-volatility hedge and an alternative reserve asset. For this segment, the attractive feature is not the creation of new liquidity but composability and use in on-chain financial markets.

Yield-seeking on-chain capital. A second pool of demand consists of crypto investors seeking yield through on-chain investment. This pool has grown rapidly as aggregate stablecoin supply has climbed above \$300 billion, much of which earns little or no yield at the wallet level. Demand in this segment is sensitive to yields and interest rates, and flows toward the on-chain instrument that offers the best risk-adjusted yield. Treasury tokens are relatively

more popular when T-bill rates are high. Tokenized private credit and HELOC-backed instruments capture a larger share when their yields become more attractive relative to that of treasury tokens.

Retail global access. A third pool of demand, smaller in dollars but large in user counts, comes from global retail investors who use tokenized equities, gold, and institutional funds to obtain exposure to assets that would otherwise require access to U.S. or European brokerage accounts. Empirical evidence on tokenized equities documents that more than three-quarters of transfers occur in sizes below \$100 (Cong et al., 2025), and similar micro-participation patterns appear in tokenized gold (Harvey et al., 2025).

3 Key Policy Issues and Challenges in Tokenization

Despite its promise, tokenization raises both *legal* and *regulatory* questions. Legal clarity concerns the nature of the tokenized right: who owns the token, whether control of the token transfers property rights or merely evidences a contractual claim, whether the token is a security or another legal instrument, and which body of private law governs transfers and settlement finality. Regulatory clarity comes next: once the legal character of the asset and associated rights is determined, policymakers must decide which regime applies, such as securities regulation, commodities regulation, banking law, payments law, tax law, or consumer protection.

This distinction matters because tokenization does not by itself determine the legal character of the asset. A tokenized share, bond, loan, concert ticket, or warehouse receipt may all be represented on a blockchain, but the applicable legal and regulatory treatment should depend on the rights and obligations the token represents, not merely on the technology used to record it (Sidley Austin LLP, on behalf of Ava Labs, Inc., 2025). This section examines the main legal, operational, economic, and regulatory frictions in RWA tokenization.

3.1 Ownership, Property Rights, Custody, and Legal Finality

A central challenge in RWA tokenization is the relationship between on-chain transfers and off-chain legal ownership. In most current designs, tokens represent contractual or beneficial claims on assets held by a custodian or special-purpose vehicle, rather than direct legal title to the underlying asset. As a result, transferring a token does not automatically constitute a legally final transfer of ownership under existing property or securities law.

A token holder may have control over the token, a contractual claim against an issuer, a beneficial interest in an asset-holding vehicle, or direct property rights in the underlying asset—but these are legally distinct. Control of a private key may establish practical control over the token record, yet it does not necessarily transfer legal title to the off-chain asset. In many current RWA structures, the token is best understood as evidence of a contractual or beneficial claim against an issuer, custodian, trust, or SPV rather than as the legally operative title record for the underlying. Recent private-law reforms, including the 2022 UCC Amendments and UNIDROIT Principles on Digital Assets and Private Law, provide useful frameworks for digital asset control and transfer, but they do not automatically determine whether a token transfer conveys rights in a separate off-chain asset ([Uniform Law Commission and American Law Institute, 2022](#); [UNIDROIT, 2023](#); [Moringiello and Odinet, 2022](#)).

This separation between economic exposure and legal title is not unique to tokenization. ETFs, mutual funds, and securitized products similarly interpose legal entities between investors and underlying assets. The difference lies in the clarity and enforceability of the ownership chain. Traditional financial instruments rely on well-defined registries, transfer agents, and statutory settlement finality. In tokenized markets, by contrast, the authoritative record of ownership is often ambiguous: the blockchain ledger records token transfers, while legal rights are determined by off-chain contracts and custodial records.

Custody. Most tokenized RWAs adopt a structure in which the underlying asset is held by a custodian or SPV, and tokens represent claims on that entity. Issuers mint tokens against

these assets, and investors hold tokens in self-custodied wallets or with digital custodians. Redemption is typically promised but, as discussed in Section 3.2, remains subject to legal, operational, and economic constraints as well as issuer discretion.

For example, a tokenized Apple share (AAPLx) represents a share held by a custodian rather than conferring direct shareholder-of-record status on the token holder. In tokenized loan structures, custody extends to ongoing servicing: issuers originate and service loans off-chain, verify collateral, and transmit cash flows to token holders through on-chain mechanisms.

These structures generate information asymmetries among issuers, custodians, and token holders, making it difficult for investors to verify the existence, quality, and segregation of underlying assets. They make robust audit and attestation practices central to maintaining the credibility of the link between tokens and underlying assets.

Legal recognition, settlement finality, and asset segregation. Legal disputes highlight the ambiguity of ownership in tokenized markets. If blockchain records conflict with traditional registries, the latter typically prevail. In most jurisdictions, blockchain ledgers are not yet recognized as the legally authoritative record of ownership.¹⁵

Two broad approaches exist: (i) *statutory recognition*, under which the token ledger is designated as the legal register of ownership; and (ii) *claim-based structuring*, in which tokens represent claims governed by existing securities law, with the blockchain serving as evidence rather than the source of legal rights.

Settlement finality raises a related issue. Public blockchains often provide probabilistic finality, creating uncertainty about when a transfer should be deemed legally final. Traditional market infrastructures rely on legislated moments of finality; analogous concepts may be required as large-value assets migrate on-chain.

¹⁵Exceptions include Delaware corporate law, Germany's eWpG, and Liechtenstein's TVTG; see <https://delcode.delaware.gov/title8/>, https://www.bmj.de/SharedDocs/Gesetzgebungsverfahren/DE/Elektronische_Wertpapiere, and <https://impulseregulierung.li>.

Underlying assets must also be bankruptcy-remote. Assets held in custody should be legally segregated so that token holders are protected if an issuer or custodian fails. Existing custodial safeguards in traditional finance provide a useful benchmark for such protections in tokenized markets.

Investor eligibility. Many RWAs—such as private equity interests—are legally restricted to accredited or institutional investors. Tokenization must therefore reconcile transferability with eligibility rules, requiring both legal clarity and technical enforcement mechanisms (e.g., whitelisting or ERC-1400-style restrictions). The investor-eligibility issue is most pressing for illiquid assets such as private equity.

3.2 Redemption Rights and Mechanics

RWA tokenization structures often rely on redemption to maintain the link between on-chain claims and off-chain underlying assets. In particular, on-chain tokens are typically minted against underlying assets held in custody off-chain, backing the tokens on a one-to-one basis. Redemption design is a central channel through which tokenization can either create or mitigate fragility. Many tokenized RWAs advertise redemption—either in kind or in cash—but in practice, redemption rights are often constrained by minimum sizes, timing restrictions, KYC requirements, or issuer discretion. For assets with deep and liquid traditional markets, these frictions may be largely irrelevant, as arbitrage can keep prices aligned. For illiquid assets, however, redemption promises interact directly with liquidity mismatch.

Tokenization: Combining ETF-like tradability with MMF-like redemption. Tokenization often combines the continuous tradability of ETFs with the redemption structure of mutual funds (e.g., money market mutual funds), without inheriting the institutional safeguards developed for either. ETF prices are anchored to NAV through arbitrage by authorized participants, who exploit deviations by creating or redeeming shares in kind

against the underlying asset or portfolio. Mutual funds—and, more broadly, vehicles that issue claims on asset portfolios—by contrast, offer redemption at (or near) par based on the NAV; their history illustrates how run dynamics can emerge when redemption demand overwhelms liquidity buffers (see, e.g., [Schmidt, Timmermann, and Wermers \(2016\)](#) in the context of money market mutual funds).

A defining feature of tokenization is that exit is possible through two distinct channels—redemption and secondary-market trading. Secondary-market sales are, in principle, continuously available, while redemption is rationed by minimum sizes, timing windows, verification requirements, or issuer discretion. Whether this feature is stabilizing or destabilizing depends critically on the liquidity of the underlying.

For tokenized claims on liquid assets such as Treasuries, gold, or equities, mint–redeem arbitrage plays a role analogous to that of authorized participants in ETF markets, and empirical evidence suggests that token prices remain tightly aligned with fundamentals. For tokenized claims on illiquid assets, however, this arbitrage channel breaks down: the underlying is not continuously priced or traded, hampering redemption and liquidation of the underlying. Adjustment is therefore transmitted directly into token prices, and holders can exit through secondary markets even when redemption is unavailable or delayed. This concern is closely related to evidence from corporate bond ETFs, where liquid ETF shares backed by less-liquid bonds require active creation and redemption basket management to balance index tracking against liquidity transformation ([Koont et al., 2025](#)).

Arbitrage architecture: APs versus open mint–redeem. The differences between ETF and tokenized arbitrage channels go beyond technology. ETF arbitrage relies on designated authorized participants that are contractually integrated with the issuer, have operational capacity, and operate under supervisory oversight. Token mint–redeem arbitrage may instead be open to qualified holders, mediated by smart contracts, or rationed by issuer discretion through minimum sizes, KYC requirements, or limited windows. Each design

involves a tradeoff: open mint–redeem can broaden arbitrage participation, smart-contract redemption can be fast and transparent, and issuer discretion can protect the underlying portfolio, but each may weaken price anchoring under stress. The credibility of token-to-underlying alignment therefore depends on the architecture of mint–redeem, not merely on its existence.

Practical limits to redemption. Absent clear legal and regulatory requirements, redemption terms are largely set by issuers and may change over time. Minimum redemption sizes, KYC requirements, limited redemption windows, off-chain account requirements, and issuer discretion can all prevent token holders from exercising redemption directly. Stablecoins provide a useful analogy: direct redemption is typically available only to large, verified counterparties, with most users relying instead on secondary markets (Ma et al., 2025; Li and Mayer, 2025). Tokenized RWAs often exhibit similar constraints.

These frictions are magnified by the on-chain/off-chain mismatch. Tokens may trade continuously, while redemption facilities and underlying markets operate on limited schedules. During off-hours or stress periods, token prices can deviate from fundamentals because redemption, underlying-market trading, and regulatory intervention are unavailable or delayed. These constraints are most severe when the underlying asset is illiquid or difficult to deliver directly, such as real estate, loan pools, private fund interests, or physical commodities.

Economic limits. For many RWAs, in-kind redemption is infeasible. Real estate, loan pools, and private equity interests cannot be meaningfully redeemed in kind, making cash settlement at NAV the only practical option. This introduces valuation and liquidity challenges. For tokenized shares of private firms, direct redemption may also fragment ownership and risk triggering registration thresholds under securities law.

Moreover, if redemption or buyback prices are based on stale appraisals rather than market-clearing values, redeeming investors may be paid more than the asset can be sold for.

The cost is then borne by the issuer, remaining investors, or the reserve/backstop facility. Tokenized illiquid funds should disclose valuation frequency, redemption pricing methodology, liquidity fees, gating rules, and how redemption losses are shared across remaining holders.

3.3 Incentives, Market Structure, and Systemic Risk

Tokenization reshapes incentives for issuers, intermediaries, and investors, with implications for market structure and systemic risk.

Origination and monitoring incentives. In the context of loan-pool tokenization, tokenization facilitates the rapid distribution of risk by pooling loans and issuing transferable claims on their cash flows. While this can broaden investor access, it can also weaken origination and monitoring incentives. When originators retain limited exposure to long-term credit risk, adverse selection and moral hazard may arise, echoing the problems associated with the originate-to-distribute model observed in earlier securitization waves ([Keys, Mukherjee, Seru, and Vig, 2010](#)).

Market fragmentation and concentration. Tokenization introduces new venues for trading exposure to underlying assets, often across multiple blockchains and platforms. Rather than unifying markets, this can fragment liquidity across venues. AMMs can discipline bilateral or posted-offer markets by offering an outside option for small, urgency-driven trades, but they can also fragment liquidity and reduce the scale needed for any single venue to sustain deep markets. As a result, the net effect of tokenization on liquidity remains ambiguous: while it may enhance tradability in principle, it can also fragment liquidity in practice. At the same time, it may concentrate operational and governance risks in a small set of custodians, issuers, oracle providers, and infrastructure platforms. Such concentration creates clearinghouse-like risks without clear regulatory oversight. These concerns connect to a broader literature on

fragmented trading venues and decentralized market design ([Malamud and Rostek, 2017](#); [Chen and Duffie, 2021](#); [Blonien and Ober, 2024](#); [Agur and Copestake, 2025](#)).

Cross-asset trading and regulatory boundaries. DeFi also creates a mixed-venue problem: assets subject to different legal and regulatory regimes can trade directly against one another as pairs. A tokenized security may trade against a stablecoin, a non-security crypto asset, or another tokenized financial instrument within the same protocol. This differs from traditional market structures, where asset classes are typically segmented across venues, intermediaries, and settlement systems. Cross-asset trading enhances composability but complicates oversight, because a single venue may combine securities, commodities, payment instruments, and non-security crypto assets in the same order flow. For tokenized RWAs, this raises questions about disclosure, surveillance, and regulatory responsibility ([U.S. Securities and Exchange Commission, Division of Trading and Markets, 2025](#)).

Speed, off-hours trading, and automated stress transmission. For liquid underlying assets, 24/7 token trading can extend price discovery beyond traditional market hours. Evidence from tokenized equities and tokenized gold suggests that token markets can incorporate overnight and weekend news while remaining anchored to the underlying once traditional markets reopen ([Cong et al., 2025](#); [Harvey et al., 2025](#)). But the same speed can amplify stress. When tokens trade continuously while underlying markets, redemption facilities, and supervisory processes are closed, adjustment pressure accumulates in token prices rather than through arbitrage or redemption.

This risk is heightened when tokenized assets are used as collateral in automated lending, margining, or liquidation systems. Continuous trading and smart-contract liquidation can reduce operational frictions in normal times, but they also remove discretionary buffers such as market closures, settlement delays, $T + 1$ windows, authorized-participant intermediation in ETFs, or circuit breakers. Under stress, thin on-chain liquidity, delayed oracles, and

congestion can interact with automated liquidation rules to produce fire-sale dynamics and rapid contagion.

Systemic implications. Tokenized RWAs are currently small relative to global financial markets, so their near-term systemic footprint is limited. At scale, however, tokenization could create new channels of shock transmission between traditional finance and on-chain markets. Tokenized Treasuries, money market fund shares, gold, or private-credit tokens may be used as collateral in DeFi lending, stablecoin reserves, margin systems, or automated trading strategies. A shock in the underlying asset, custodian, oracle, bridge, or redemption channel could therefore propagate through on-chain liquidation rules and feed back into traditional markets through forced sales, redemption pressure, or collateral revaluation.

The systemic concern is not that tokenization introduces an entirely new class of financial risk, but that it can compress the speed at which familiar risks materialize. Liquidity mismatch, run incentives, fire sales, collateral spirals, and operational failures can unfold faster when trading, settlement, and liquidation are automated and globally continuous. This makes the design of redemption gates, circuit breakers, oracle governance, collateral haircuts, and emergency suspension powers central to the regulation of tokenized RWAs.

Secondary-market mechanism design for illiquid assets. For tokenized illiquid assets, the choice of secondary-market mechanism is itself a regulatory object. AMMs provide immediacy but require sufficient turnover and compensated liquidity providers; posted-offer and P2P markets may concentrate larger trades but can suffer from thin or hidden buy-side depth; and issuer buybacks can stabilize prices while creating contingent balance-sheet exposure. Competition among these mechanisms may improve execution for some investors, especially small urgency-driven traders, but it can also fragment already-thin liquidity. Disclosure should therefore report execution quality, quoted depth, realized volume, LP

concentration, issuer-provided liquidity, and redemption utilization by venue (Laschinger et al., 2025).

3.4 Oracles, Disclosure, and Coordination

Oracle risk and governance. Because underlying RWAs are held off-chain, tokenized markets depend on mechanisms that transmit off-chain information on-chain. Reserve backing, custody status, loan performance, corporate actions, and valuation inputs are not natively verifiable on-chain and must be conveyed through oracles, attestations, or issuer disclosures. When oracle inputs determine collateral values, NAV calculations, or redemption eligibility, transparency about data sources, update frequency, control rights, and fallback mechanisms is essential. DeFi history offers cautionary examples: the October 2022 Mango Markets exploit, in which a single attacker manipulated a thinly traded oracle price to extract roughly \$117 million in collateral, and the earlier bZx and Inverse Finance flash-loan attacks, all show how a single weak oracle input can translate into immediate, irreversible loss when collateral and liquidation logic are fully automated (Cong et al., 2025; Cong, Prasad, and Rabetti, 2026). For tokenized RWAs, where oracles transmit valuations of off-chain assets that cannot be quickly re-priced or re-traded once stale data has triggered an on-chain action, the analogous failure mode is harder to unwind.

Disclosure and coordination. Tokenization is often associated with greater transparency, but transparency is not unambiguously stabilizing. Real-time, machine-readable information can enhance monitoring, yet it can also compress the transition from private concern to common knowledge and accelerate coordinated exits during stress. Product-level disclosure is therefore especially important for asset-specific tokens, such as loans, real estate, and structured credit, where investors need information about underwriting standards, cash-flow structures, servicing arrangements, and valuation practices. At the trading level, tokenized venues should also disclose execution quality, volume quality, and surveillance controls,

because wash trading can distort liquidity and price signals in crypto markets (Cong, Li, Tang, and Yang, 2023; Aloosh and Li, 2024; Amiram, Lyandres, and Rabetti, 2025).

Cybersecurity, finality, and legal backstops. Private-key compromise, smart-contract vulnerabilities, oracle failures, and bridge exploits can lead to rapid and irreversible losses.¹⁶ Fast settlement reduces counterparty risk, but it also raises difficult questions when transfers result from theft, hacks, sanctions evasion, or smart-contract exploits. For representational tokenized RWAs, off-chain custody and legal enforcement may serve not only as sources of friction, but also as backstops: custodians, transfer agents, or courts may refuse to recognize transfers associated with illegal activity even if those transfers are technically final on-chain. Issuers should therefore disclose whether transfers can be frozen, reversed, or challenged, and how conflicts between on-chain finality and off-chain legal claims are resolved. Issuers should also disclose whether tokens include freeze, clawback, traceability, or taint-management features, because these mechanisms can improve legal enforceability but may reduce fungibility and DeFi composability.

Cross-chain and governance risk. Tokenized RWAs increasingly exist across multiple blockchains, fragmenting liquidity and complicating arbitrage. Identical assets issued on different chains are not natively fungible and often require bridges or cross-chain messaging systems, which introduce additional oracle-like dependencies and have historically been major attack vectors (Landsman, Lyandres, Maydew, Rabetti, and Zhang, 2025). Governance can create further risk when protocol control is concentrated or DAO voting can alter rules governing redemption, collateral, or disclosure (Appel and Grennan, 2023; Laternus, 2023; Fan, Shu, and Xie, 2024; Cong, Rabetti, Wang, and Yan, 2025; Fracassi, Khoja, and Schär, 2025; Han, Lee, and Li, 2025).

¹⁶Aggregate losses from DeFi security incidents exceed \$6.9 billion (<https://defillama.com/hacks>).

4 Policy Framework and Recommendations

4.1 Overview

The legal and regulatory treatment of tokenized RWAs remains unsettled, as these instruments blur boundaries between securities law, commodities regulation, and digital asset frameworks. In the United States, comprehensive guidance on on-chain securities trading remains limited, while Europe has adopted experimental approaches under the EU DLT Pilot Regime. Addressing the challenges identified in Section 3 therefore requires a coordinated framework that balances innovation with investor protection and financial stability. The experience with stablecoin regulation—most notably the GENIUS Act—illustrates how regulatory clarity can foster responsible growth.¹⁷

A distinguishing feature of RWA tokenization is its role as a bridge between the on-chain, crypto-native financial system and traditional financial institutions. Tokenized RWAs rely on blockchains for transferability, programmability, and composability, while depending on banks, custodians, transfer agents, and courts for asset backing, legal enforceability, and redemption. Policy must therefore address not only risks within each system, but also the frictions and feedback loops that arise at their interface.

Intermediaries versus infrastructure providers. Policy should also distinguish regulated intermediaries from infrastructure providers. Intermediaries include actors that issue tokens, custody underlying assets, maintain transfer records, operate trading venues, or control redemption; these actors create the core investor-protection, market-integrity, and financial-stability risks analyzed in this paper. By contrast, validators, node operators, RPC providers, and software developers may support distributed ledgers without custodying

¹⁷The Guiding and Establishing National Innovation for U.S. Stablecoins (GENIUS) Act, enacted in 2025, is the first comprehensive U.S. federal framework for payment stablecoins. It requires full one-for-one reserve backing in high-quality liquid assets, monthly reserve attestations, par redemption rights, and licensing of permitted issuers, while prohibiting interest payments to holders. Section 4.4 discusses its design choices and limits as a template for broader RWA tokenization.

customer assets, matching trades, or exercising discretion over redemption or settlement. Regulatory obligations should attach to activities that create legal, custodial, or market risk, rather than to the mere provision of passive technical infrastructure (Sidley Austin LLP, on behalf of Ava Labs, Inc., 2025).

We argue that tokenization does not warrant a one-size-fits-all regulatory approach. While certain technical standards should be common across asset classes, the overall policy framework should be tailored to the distinct economic functions that tokenized assets perform—requiring different designs for money-like instruments, liquid risk assets, and illiquid assets—while recognizing that tokenization operates as a bridge between traditional and on-chain financial systems. These functions also map onto the demand segments discussed in Section 2: on-chain infrastructure users, yield-seeking capital, and retail access demand.

We next develop this framework in five steps: we first present asset-specific policies organized around the speed-matching principle (Section 4.2); translate these into minimum design standards (Section 4.3); examine the GENIUS Act as a worked example of functional regulation (Section 4.4); outline some general technical standards that should apply across asset classes (Section 4.5); and compare international pilot regimes (Section 4.6).

4.2 Asset-Specific Policies and Matching Policies to Speed

We distinguish three categories of tokenized RWAs, each with distinct economic roles, dominant risks, and policy priorities. While the same tokenization technology underlies all three categories, their economic roles differ markedly, and so do the appropriate policy responses. The organizing principle that cuts across all three is what we term *speed-matching*: the trading speed of a tokenized instrument should be matched to the pace at which the underlying asset can be traded or redeemed in traditional markets. Regulatory frameworks that ignore this principle will either over-regulate liquid tokens and stifle their integrated use or under-regulate illiquid tokens, potentially leading to fragilities.

These categories also map onto the demand segments discussed in Section 2.5: on-chain infrastructure users, yield-seeking capital, and retail access demand.

Tokenized liquid assets. Tokenized Treasuries, equities, and commodities primarily integrate already liquid assets into on-chain markets. Their main policy objective is to preserve the link between the token and the underlying through robust custody, reserve disclosure, redemption-arbitrage mechanisms, oracle governance, and settlement finality. Because the underlying markets are deep, 24/7 trading is generally compatible with these assets, provided that off-hours pricing deviations, redemption constraints, collateral-use risks, and cross-chain issuance are disclosed.

The main demand for these tokens comes from on-chain infrastructure users, collateral users, and global retail investors seeking access or hedging instruments. Policy should therefore focus less on restricting trading speed and more on maintaining credible backing, practical redemption, reliable price feeds, and transparency about the arbitrage channels that keep token prices aligned with the underlying.

Tokenized money-like claims. Stablecoins and tokenized deposits function as payment, settlement, and cash-management instruments anchored to a fixed value. Their core risk is failure of par redemption under stress. Policy should therefore focus on high-quality liquid reserves, enforceable redemption rights, frequent attestations, issuer licensing, and AML/KYC compliance.

Tokenized illiquid assets. Tokenized private credit, private equity, and real estate create tradable claims on assets that are opaque, infrequently valued, and difficult to liquidate. Here, tokenization resembles liquidity transformation or digitally native securitization. Policy should not require these assets to mimic stablecoins or ETFs. The corporate-bond ETF experience illustrates why: even in a mature regulated market, liquid fund shares backed by less-liquid bonds require active basket design and liquidity management, rather than a simple

promise that tradability alone will eliminate liquidity mismatch (Koont et al., 2025). Instead, it should permit or require notice periods, gates, interval-fund or closed-end structures, valuation controls, liquidity fees, and clear cost allocation when redemptions occur at stale NAVs or appraised values. Regulation should not pressure such instruments into timely in-kind redemption when the underlying asset cannot be valued or transferred on comparable timescales; cash redemption, if offered, should occur on a schedule commensurate with the liquidity and valuation cycle of the underlying. Because this is the most challenging form of tokenization, early policy pilots should focus first on liquid and money-like assets and use those markets as laboratories for understanding custody, redemption, oracle, and settlement dynamics before extending similar frameworks to more complex illiquid assets.

Calibrating disclosure and oracles to trading speed. Disclosure and oracle requirements should also follow the speed-matching principle. Fast-trading tokens require a faster and more robust information infrastructure: tokens that trade continuously and are widely used as collateral should be subject to higher-frequency reserve attestations, real-time monitoring by oracles, and transparent circuit-breaker rules. Tokens that trade continuously but represent claims on slow-moving assets should be subject to enhanced NAV disclosure requirements, stress testing of redemption capacity, and clear rules on which off-chain valuation practices are permitted to drive on-chain prices.

The speed-matching problem is further complicated by the fragmentation of tokenized RWAs across chains with different settlement finalities and different bridging mechanisms. A token that settles in seconds on one chain but relies on an optimistic bridge with a seven-day challenge window on another is not, in practice, a single uniformly fast asset. Policy should recognize that cross-chain deployment can reintroduce the same temporal mismatches it was meant to eliminate and that the slowest leg of the settlement graph, not the fastest, often determines systemic behavior under stress.

Interoperability. Interoperability should be a policy objective, not merely a technical convenience. Without common standards for token representation, legal rights, redemption interfaces, oracle updates, and cross-chain transfer, tokenization may reproduce the proprietary silos and fragmented liquidity pools it promises to overcome. But interoperability must be defined legally as well as technically: a token that is bridgeable across chains is not necessarily identical across chains if custody, redemption, settlement finality, or oracle-update rules differ.

4.3 Minimum Design Standards by Asset Class

The principles above become actionable only when translated into concrete, testable requirements that vary by asset class. Table 1 proposes five baseline dimensions calibrated to each asset class’s liquidity, valuation profile, and economic function: legal claim and custody; redemption design; valuation and disclosure; secondary-market and interoperability design; and investor eligibility, KYC, and composability.

Three features of Table 1 are worth emphasizing. First, redemption design is where speed matching does the most work: same-day par redemption is reasonable for Treasury-backed tokens but not for HELOCs, private credit, real estate, or private funds. Second, oracle and disclosure requirements should scale with trading speed and collateral use, because stale or manipulated information becomes more dangerous when it can trigger automated liquidations. Third, eligibility restrictions are asset-class specific, but compliance design must preserve feasible protocol use; whitelisting that prevents tokens from entering legitimate liquidity pools, lending protocols, or collateral vaults can undermine the very composability that tokenization is meant to provide.

The additional disclosure requirements for secondary-market design, redemption pricing, investor eligibility, composability, and investor-base reporting are motivated in part by evidence from early tokenized real-estate markets, where liquidity outcomes vary sharply across AMMs, posted-offer P2P markets, and issuer buyback facilities (Laschinger et al.,

Table 1: **Proposed minimum design standards by tokenized-RWA asset class.** Illustrative baseline requirements calibrated to the underlying asset’s liquidity, valuation profile, and economic function. Thresholds are starting points for policy calibration, not firm prescriptions.

Dimension	Tokenized Treasuries & MMFs	Tokenized commodities & equities	Tokenized private credit	Tokenized RE / PE / alts
Legal claim, issuer licensing, custody, and backing	Full backing by eligible short-term government securities or regulated MMF shares; qualified custodian or regulated sponsor; bankruptcy-remote segregation	Full backing by underlying asset or equivalent exposure; qualified custodian, transfer agent, or securities intermediary; corporate-action rights disclosed	Claim on identified loan pool or credit vehicle; servicer, collateral, waterfall, and asset-segregation structure disclosed	Claim on fund, SPV, property, or alternative asset clearly specified; title, transfer restrictions, GP/issuer consent rights, and bankruptcy remoteness disclosed
Redemption architecture and pricing	Same-day or next-day redemption for qualified holders; secondary market for others; par/NAV pricing, fees, cutoffs, and settlement windows disclosed; purpose-built par-redeemable Treasury instruments, if available	In-kind or cash T+1 redemption tied to underlying market hours; off-hours treatment and redemption constraints disclosed	Minimum notice period; gates permitted; no same-day par redemption; NAV methodology, liquidity fees, swing pricing, and loss allocation disclosed	Closed-end, interval-fund, or auction-based design preferred; no open-ended redemption at stale appraised value without gates, discounts, or loss-allocation safeguards
Valuation, oracle, and disclosure	Daily NAV; frequent reserve attestations; ≥ 2 independent price oracles if used as collateral; short staleness tolerance	Observable market-price oracle; off-hours tolerance explicit; corporate actions, reserve audits, and redemption denials disclosed	Loan-tape, delinquency, prepayment, collateral, and servicer reports; independent audit; NAV oracle updated at least monthly	Independent appraisal or fund valuation; valuation frequency disclosed; stress scenarios, appraisal uncertainty, and stale-price controls reported
Secondary-market and interoperability design	Authorized-participant or market-maker arrangements disclosed; venue-level volume, spreads, collateral use, and cross-chain issuance reported	Venue-level volume, spreads, off-hours deviations, arbitrage arrangements, and cross-chain fungibility reported	Trading venue, AMM depth, posted-offer depth, issuer support, LP concentration, redemption utilization, and execution quality disclosed	Transfer restrictions, posted-offer depth, buyback caps, issuer support, LP concentration, execution quality, and cross-platform transferability disclosed
Investor eligibility, KYC, and composability	Open to retail in qualifying jurisdictions; KYC obligations and protocol use disclosed	Open to retail in qualifying jurisdictions subject to securities, commodities, or fund rules; protocol use disclosed	Accredited/institutional or pooled retail with enhanced disclosure; eligible smart-contract and collateral use specified	Accredited/institutional only unless otherwise permitted; transfer approvals, eligible smart-contract use, and whitelisting procedures specified

2025). Investor-base reporting should include holder concentration, large-holder flows, eligible-investor status, wallet activity, geographic participation, and the share of repeat participants.

4.4 Lessons from the GENIUS Act

The GENIUS Act is the closest real-world precedent for the kind of functional, economic-role-based regulation this paper advocates, and its design choices merit close examination because they illustrate both how much regulatory clarity can accomplish and where it runs into tension with decentralization.

By imposing full one-for-one reserve backing in high-quality liquid assets, monthly attested reserve disclosure, clear par-redemption rights for qualifying holders, and a licensing regime for issuers, the Act provides a template for stabilizing the payment stablecoin sector and reducing uncertainty about the legal status of compliant issuers. Related work examines the interaction between stablecoins, bank deposits, and financial stability under alternative regulatory frameworks, emphasizing that outcomes depend critically on reserve composition, redemption design, and prevailing market conditions rather than on tokenization per se (Li and Mayer, 2025; Cong, 2025).

The GENIUS Act clarifies the quality of permissible reserves, but it does not by itself create a reserve asset optimized for tokenized finance. Duffie and Wilson’s PORTS proposal illustrates a complementary public-sector design: a Treasury security issued and redeemable at par daily, paying an overnight floating rate, and potentially usable as transparent, high-quality collateral for stablecoins and other tokenized dollar instruments (Duffie and Wilson, 2025). This suggests that stablecoin and tokenized-RWA regulation should consider not only issuer requirements, but also the design of the safe assets that back tokenized cash-like claims.

Two features of the Act, however, do not extend naturally to broader RWA tokenization. First, the Act’s prohibition on paying interest to holders reflects a conscious policy decision to distinguish stablecoins from bank deposits and money market funds, but tokenized RWAs

are often explicitly yield-bearing instruments whose economic rationale depends on passing through underlying returns. Replicating this restriction across tokenized Treasuries or MMFs would eliminate their primary use case. Second, the Act effectively excludes fully decentralized designs by requiring licensed, U.S.-regulated issuers, which implicitly assumes that regulated custody of reserves is always feasible. For illiquid-asset tokens whose underlying cannot be held in segregated custody by a single regulated issuer (for example, pooled HELOCs or fractional real estate), the Act’s template is simply the wrong shape.

Overall, the GENIUS Act is a strong template for money-like and liquid-asset tokenization, but it cannot be ported wholesale to tokenized private credit or real estate. For those asset classes, the policy analog is closer to the historical regulation of closed-end funds and interval funds than to stablecoins: redemption capacity must be aligned with the speed at which the underlying can be valued and sold, not with the speed at which the token can change hands.

4.5 Cross-Cutting Technical Principles for Tokenization

Several technical principles apply across asset classes, even though their calibration should differ by asset liquidity and redemption design. Tokenized markets require common standards for token metadata, legal rights, custody attestations, transfer restrictions, oracle inputs, and transaction reporting. These standards should support interoperability, supervision, and investor protection without imposing the same trading or redemption model on all assets.

Wholesale and retail segmentation. The wholesale–retail distinction should operate as a design principle rather than a descriptive aside. Wholesale tokenization on permissioned networks primarily raises financial-market-infrastructure questions, including settlement finality, operational resilience, governance, and access. Retail tokenization on public chains primarily raises investor-protection, suitability, disclosure, custody, and venue-integrity concerns. Identical underliers may therefore warrant different redemption, oracle, and

disclosure calibrations depending on whether the token is held by regulated institutions on a permissioned ledger or by retail wallets on a public chain.

Technical and data standardization. Tokens representing similar rights should use common metadata and reporting formats for ownership rights, custody, valuation, redemption, transfer restrictions, and corporate actions. Standardization can improve comparability, supervisory oversight, and interoperability across wallets, custodians, trading venues, and protocols.

Identity, KYC, and transfer restrictions. Investor-eligibility rules must be enforceable without making legitimate protocol use impossible. Policy should clarify whether KYC obligations fall on issuers, exchanges, custodians, wallet providers, or third-party identity services, and whether eligible smart contracts may hold or transfer restricted tokens.

Tax and transaction reporting. Tokenized markets require standardized records for basis tracking, income reporting, wash-sale rules, and cross-border tax compliance. Without consistent transaction reporting, tokenization may increase rather than reduce compliance frictions.

Oracle and fallback design. Because tokenized RWAs depend on off-chain information, issuers should disclose oracle data sources, update frequency, governance, fallback procedures, and responsibility for erroneous or delayed data. Single-source or weakly governed oracle dependencies should be avoided for tokens used as collateral or money-like instruments.

4.6 International Coordination and Pilot Regimes

Given the global nature of blockchain-based assets, international coordination is essential. A flexible, test-and-learn approach, supported by pilot regimes, can help regulators adapt

existing rules while preserving market integrity. Pilot regimes should therefore require comparable data reporting across jurisdictions, including holder composition, venue-level liquidity, redemption use, oracle-update frequency, and cross-chain issuance.

Pilot regimes. Jurisdictions have adopted experimental frameworks to observe tokenized markets in practice, including the United Kingdom’s Digital Securities Sandbox, Singapore’s Project Guardian, the EU’s DLT Pilot Regime, and Switzerland’s DLT Act. These initiatives could be expanded to additional asset classes, providing evidence for future rulemaking. Table 2 compares the main pilot regimes along the dimensions most relevant to tokenized RWAs: which asset classes are eligible, whether retail participation is permitted, the extent of regulatory waivers, and the degree to which legal ownership on-chain is recognized domestically.

Three patterns stand out. First, retail access is the dimension where jurisdictions differ most, with Switzerland the most permissive and the UK the most restrictive. Second, only Switzerland has moved beyond pilot status to recognize tokenized securities as a distinct legal category, which may explain why Swiss issuers have been disproportionately active in tokenized-bond issuance. Third, all four regimes leave the design of redemption largely to issuers, meaning the speed-matching problem identified in Section 4.2 is not directly addressed by any of the pilots; this is precisely the gap that Section 4.3 proposes to fill.

Global principles. Cross-border coordination through IOSCO, the FSB, and the BIS is critical. Shared taxonomies, aligned supervisory expectations, and enforcement cooperation would support consistent development. Global principles for tokenization, analogous to the PFMI framework, could establish baseline expectations for governance, disclosure, custody, and operational resilience.

Pilot regimes should not only test legal and operational feasibility; they should also generate evidence on the economic mechanisms that determine whether tokenized RWA markets deepen

Table 2: **Comparison of major international pilot regimes for tokenized securities.** All regimes are experimental and time-limited; details evolve. Entries reflect the authors’ reading of publicly available regulatory documents as of early 2026.

	UK DSS	EU DLT Pilot	Singapore Project Guardian	Switzerland DLT Act
Eligible assets	Equities, bonds, money market instruments, funds	Equities and bonds below size caps; MMF shares	Tokenized bonds, funds, FX, deposits; selective private markets	Any security, including tokenized shares of Swiss AG
Retail access	Restricted; most issuances institutional	Size caps on retail	Institutional; limited retail pilots	Permitted, subject to prospectus rules
Legal recognition on-chain	Modified under sandbox; reverts after pilot	Operates under existing EU securities law with narrow waivers	Existing securities on-chain as evidentiary record	DLT securities are a recognized legal class
Redemption / settlement	Intraday or T+0 permitted under waivers	Settlement up to EUR 6 bn per DLT MTF / SS	Bespoke per project; often T+0 atomic	Standard securities settlement, with DLT as transfer mechanism
Supervisor	FCA & Bank of England	ESMA + national competent authorities	MAS	FINMA

or remain fragile, including investor composition, liquidity-provider incentives, redemption design, and venue competition. We return to these open questions in the conclusion.

5 Conclusion

Tokenization extends traditional assets and contractual claims onto programmable ledgers. Its promise is not that blockchain representation changes the underlying asset’s cash flows, credit quality, or legal enforceability, but that it can change trading venues, settlement speed, investor access, composability, and the interface between on-chain and off-chain spaces.

The central policy lesson is that tokenization should be regulated according to economic function rather than technology. Tokenized liquid assets primarily integrate existing markets with on-chain finance; money-like claims require enforceable par redemption and high-quality liquid backing; and tokenized illiquid assets involve liquidity transformation, valuation uncertainty, and redemption-risk allocation. These categories call for different rules.

Here, speed is the organizing design principle. Continuous trading is valuable when the underlying market can support it, but hazardous when the token’s liquidity promise outruns the underlying asset’s ability to trade, be valued, or honor redemptions. A workable policy framework should therefore pair legal clarity, credible custody and redemption, disclosure, oracle governance, and interoperability with asset-specific speed matching.

Several empirical questions should guide future research and pilot regimes. Does tokenization bring genuinely new investors, or merely migrate existing investors to a new venue? Do AMMs and other on-chain venues improve competition for order flow, or fragment already-thin liquidity? What limits arbitrage between tokenized claims and their underlying assets when redemption is rationed, markets are closed, or custody, KYC, bridge, and oracle frictions bind? Who bears losses when appraisal- or NAV-based redemption prices exceed market-clearing values? Finally, does tokenization affect the liquidity, volatility, comovement, or informational efficiency of underlying markets, as the ETF literature has documented for other composite securities? These questions are central because the benefits of tokenization depend not only on technical transferability, but also on investor composition, liquidity-provider incentives, redemption design, and venue competition.

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A Appendix

A.1 Empirical Insights: Tokenized Equities

Cong et al. (2025) offers the first comprehensive empirical analysis of tokenized stock markets. Although still small in scale (approximately \$420 million market capitalization by late 2025), the market has expanded more than fourteenfold within the year and now comprises hundreds of tokens tracking major U.S. equities. Two issuers dominate direct equity tokenization — Backed Finance (xStocks) and Ondo Finance (while WisdomTree leads in tokenized fund products), creating a natural contrast in market architecture between decentralized 24/7 trading and a quasi-24/5 design synchronized with U.S. market hours.

Pricing and benchmark alignment. Tokenized equities closely mirror the underlying stock prices during regular trading hours, with deviations primarily occurring when traditional exchanges are closed. Overnights and weekends are the periods of largest divergence, albeit usually modest in magnitude. Importantly, token markets often impound public news during these off-hours, anticipating the direction of the next opening of the underlying stock. Weekend trading frequently distributes what would otherwise be a concentrated Monday gap into smaller adjustments across Saturday and Sunday. These patterns suggest that tokenized markets extend intertemporal price discovery beyond conventional trading windows while maintaining a tight link to fundamentals.

Fractional ownership and micro-participation. A defining characteristic of tokenized equities is granular fractionalization: over three-quarters of all transfers occur in trade sizes below \$100. This micro-trading is enabled by blockchain settlement and attracts a global retail user base that may lack access to U.S. brokerage channels.¹⁸ Despite the extremely small size of many transactions, the study finds no evidence of persistent mispricing or drift attributable to micro-order flow. Instead, arbitrageurs and automated liquidity providers rapidly correct price gaps across venues, indicating that fractionalization broadens participation without undermining pricing efficiency. Tokenization, therefore, opens U.S. equities to global retail investors while maintaining market integrity.

Market design, liquidity, and participant composition. Backed and Ondo adopt contrasting design philosophies that shape liquidity and return dynamics. Backed’s tokens trade continuously across multiple blockchains, attracting widespread retail participation and large volumes of micro-trades. Ondo’s tokens, in contrast, enforce minting and redemption only during U.S. market hours, limiting liquidity during weekends and anchoring prices more tightly to the underlying stock on weekdays. These differing architectures yield distinct liquidity profiles: Backed shows greater off-hour price variation and higher weekend participation, while Ondo exhibits deeper liquidity during periods of overlap with the underlying market. Overall, liquidity is sufficient to support active trading in popular tokens such as TSLA, AAPL, and NVDA, while liquidity for long-tail tokens remains thin.

Arbitrage dynamics and linkage to fundamentals. Token prices remain tightly tethered to underlying stock fundamentals through mint–redeem arbitrage. Deviations between token

¹⁸Related evidence on blockchain-based market microstructure and arbitrage appears in Makarov and Schoar (2020); Biais, Bisiere, Bouvard, Casamata, and Menkveld (2023).

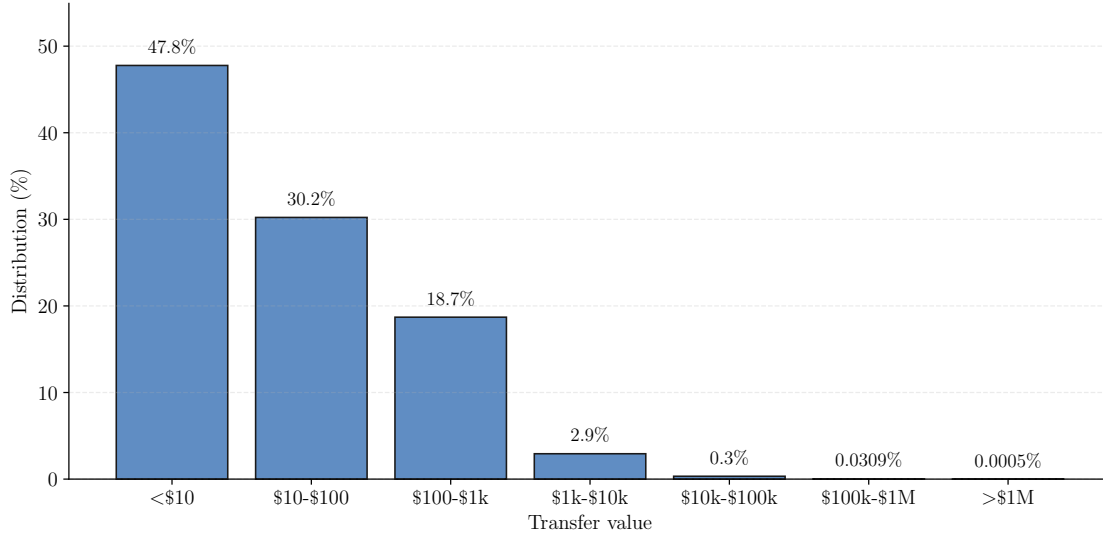


Figure 4: **Distribution of TSLAx transfer values (3-month aggregate)**. The histogram reports the distribution of TSLAx transactions by transfer value. courtesy: [Cong et al. \(2025\)](#).

prices and stock prices are typically small and short-lived. Larger divergences arise mainly during hours when redemption is unavailable or underlying equity markets are closed. These deviations usually converge once arbitrage channels reopen. The market behaves similarly to cross-listed securities or ADRs, where off-hours informational shocks can temporarily move prices but are corrected once the primary venue opens. Persistent mispricing is rare, underscoring strong cross-market integration despite decentralized trading.

Off-hour dynamics: reversals and predictability. The study documents distinct information-processing patterns across off-hour segments. During weekday nights, token returns often exhibit short-horizon reversals consistent with thin liquidity or transient order imbalances. In contrast, weekend token returns tend to be directionally informative: when material news arrives during traditional market closures, the tokenized market often leads the underlying stock’s Monday opening. Weekend token gains are associated with higher Monday stock returns on average, suggesting that tokens serve as a conduit for early price discovery when the main venue is inactive.

Overall, these findings show that tokenized equities function as a small but informative laboratory for continuous, fractional, globally accessible trading. Token prices stay closely aligned with underlying stocks, with off-hour trading incorporating news earlier and smoothing return timing across nights and weekends. Fractional micro-trading broadens participation without persistent mispricing, and arbitrage keeps markets integrated. Thinner liquidity during non-overlapping hours does introduce volatility and short-run reversals, but overall, tokenized equities complement traditional venues by extending price discovery beyond standard trading hours and enabling global, easily accessible participation.

A.2 Empirical Insights: Tokenized Gold

[Harvey et al. \(2025\)](#) provides the first comprehensive empirical analysis of tokenized gold markets from 2020 to 2025, with a focus on the two dominant instruments: PAX Gold (PAXG)

and Tether Gold (XAUt). These tokens represent fully backed claims on vaulted LBMA-standard bars and trade continuously on centralized and decentralized crypto exchanges. Leveraging on-chain transaction data, high-frequency order-book snapshots, and traditional benchmarks (spot, GLD, COMEX futures), the study offers several insights into how a classic safe-haven asset behaves when ported into a 24/7 blockchain-based microstructure.

Pricing and benchmark alignment. Tokenized gold tracks traditional gold prices extremely closely. Across the full sample, PAXG’s daily returns exhibit correlations of 0.99 with spot gold and 0.87 with GLD, with deviations typically below 0.1% during overlapping market hours. Temporary divergences emerge only when traditional markets are closed. Weekend and overnight trading allows token prices to incorporate news in real time, for example, geopolitical shocks or monetary policy leaks, with Monday spot and futures markets subsequently converging to token-implied levels. These patterns parallel early findings in tokenized equity markets and suggest that token venues provide meaningful off-hours price discovery without undermining parity with physical gold.

Liquidity, market depth, and temporal patterns. Liquidity in tokenized gold is thinner than in GLD or COMEX futures but has grown steadily. Weekday turnover concentrates during London–New York hours and Asian trading windows, with markedly lower (yet nontrivial) activity on weekends. Exchange order books typically display narrow bid-ask spreads (0.01–0.05% during peak hours), while on-chain AMM pools offer supplemental, though shallower, liquidity. Turnover as a share of market capitalization (2–5%) remains below that of GLD (5–10%), reflecting a combination of long-term holding behavior and high concentration in large custodian and exchange wallets. Importantly, tokenized gold fills an institutional gap by enabling continuous trading availability, with elevated weekend activity during stress episodes such as the Russia-Ukraine invasion and the FTX collapse.

Microstructure and user composition. The on-chain microstructure exhibits a bimodal distribution of trade sizes. Over half of PAXG transfers are micro-lots under \$200 (often automated or retail-driven), yet occasional large-block movements exceeding \$1 million, and in rare cases \$50 million, also account for a share of volume. Automated arbitrageurs and routing bots enforce cross-venue price alignment, particularly between decentralized pools and centralized exchanges. Transaction cost frictions arise from Ethereum gas fees (typically \$8–10 per transfer but highly volatile), making small transfers disproportionately expensive. Still, fractionalization enables participation from users who would otherwise be excluded from traditional gold markets, highlighting a clear segmentation between micro-retail and institutional-scale usage.

Behavior during macroeconomic, geopolitical, and crypto-specific shocks. Tokenized gold performs as a safe-haven asset in both traditional macro shocks and crypto-native crises. During CPI releases, FOMC communications, and geopolitical escalations, PAXG moves one-for-one with physical gold. Crucially, because token markets operate continuously, anticipatory repricing often occurs on weekends (e.g., during the Middle East conflict in October 2023). During crypto-market turmoil, including the Terra collapse and the FTX failure, tokenized gold experienced record on-chain volumes and small but positive abnormal returns as crypto investors sought refuge in asset-backed tokens. These effects dissipated quickly, and no persistent premium or discount emerged, underscoring confidence in issuer solvency and redemption structures.

Correlation structure and portfolio properties. Consistent with physical gold, tokenized gold exhibits low correlation with equities (0.15), weak correlation with Bitcoin (0.15, which fluctuates toward zero over time), negative correlation with the U.S. dollar index, and positive correlation with inflation expectations. The correlation structure indicates that tokenization does not alter gold’s macro-embedded behavior: tokenized gold preserves gold’s role as a diversifier and hedge within multi-asset portfolios.

Volatility, efficiency, and arbitrage frictions. Volatility in tokenized gold mirrors that of gold almost exactly. The study finds minimal token-specific noise even during periods of blockchain congestion. Arbitrage frictions, including redemption minimums (400 oz), KYC gating, and time-zone processing delays, can generate transitory deviations up to 1–2%, but these gaps close rapidly through cross-market trading and futures hedging. Illiquidity metrics show improvement over time as market depth deepens.

The evidence demonstrates that tokenized gold seems to successfully transport some of the economic properties of physical gold, most notably its role as a perceived safe-haven asset in times of crisis, into a 24/7 digital trading environment. Across macroeconomic shocks, geopolitical escalations, and periods of acute crypto-market distress, tokenized gold behaves as investors expect gold to: it attracts flows during uncertainty, maintains tight pricing alignment with physical benchmarks, and exhibits the same low, stable correlations that make gold a hedge and diversifier in traditional portfolios. Continuous trading further enhances these safe-haven characteristics by allowing risk-averse investors to rebalance during weekends and off-hours, when news risk is often highest and conventional gold markets are closed. In short, tokenization does not dilute gold’s safe-haven identity; rather, it extends and operationalizes it by offering global, fractional, always-on access to an asset whose fundamental appeal lies in its resilience during periods of instability.