

Chapter 3 at a Glance

- Tokenization—the representation of financial assets and liabilities on distributed programmable ledgers—has the potential to transform financial markets. By placing functions traditionally performed by separate intermediaries onto a distributed ledger, tokenization can reduce reconciliation needs, increase transparency, and enable greater automation.
- The tokenization ecosystem is subject to strong network effects: both benefits and risks increase when more assets, participants, and settlement instruments are brought onto the ledgers.
- The tokenized asset market remains small and fragmented. Future growth depends, among other factors, on how four key, interdependent constraints are addressed: legal certainty, regulatory clarity, interoperability, and availability of settlement assets.
- This chapter documents novel empirical evidence on some emerging benefits and risks. Analysis of tokenized equity markets shows evidence of 24/7 trading, fractional ownership, and preliminary indications that on-chain prices contain relevant information for traditional markets. However, mainly because of their small size, tokenized equity markets are so far less liquid, more volatile, and more fragmented than traditional ones. Given the incipient nature of the market, empirical findings should be interpreted with caution.
- Tokenization can elevate risks related to technology and infrastructure while creating new channels that amplify traditional vulnerabilities, including liquidity, interconnectedness, and leverage.
- For now, systemic risks remain limited. The key financial stability question is whether tokenized market infrastructure, legal foundations, liquidity arrangements, and risk controls are adequate if tokenization were to achieve broader adoption.

Policy Implications

- To enable efficient and safe market development, policymakers should adopt a technology-neutral approach that removes unnecessary constraints to tokenization while safeguarding financial stability.
- To remove unnecessary constraints to tokenization,
 - ensure that legislation provides legal certainty for tokenized assets;
 - provide regulatory clarity through the consistent implementation of the principle of “same activity, same risk, same regulatory outcome,” and create policy sandboxes to inform regulatory drafting;
 - promote interoperability across networks while safeguarding resilience; and
 - ensure that tokenized securities are settled in safe and widely accepted forms of money.
- To safeguard financial stability as tokenization scales,
 - intensify monitoring and mitigation of operational, governance, and infrastructure risks;
 - assess and manage the liquidity implications of atomic settlement, collateral reuse, and procyclical deleveraging;
 - design circuit breakers and liquidity safeguards for tokenized trading environments; and
 - strengthen monitoring of linkages between tokenized and traditional financial markets.

Introduction

Tokenization—the representation of assets and liabilities on distributed programmable ledgers—has the potential to transform financial markets. Traditionally, financial markets operate through multiple intermediaries and separate ledgers. Tokenization allows financial claims to be issued, transferred, serviced, and settled through shared digital infrastructure. As a result, tokenization can consolidate many steps along the asset life cycle, potentially reducing friction, improving transparency, and enabling greater automation.

Tokenization builds on the broader digitalization of finance. Digitalization makes financial assets and processes electronic. Tokenization offers further possibilities by allowing assets, payments, and contractual rules to interact on a shared data set through distributed ledgers. For example, broader digitalization allows programmability, whereas tokenization offers native programmability through smart contracts,¹ which can also lead to composability—the ability to combine and embed assets across protocols. By reducing the need for multiple intermediaries to operate their own separate ledgers, tokenization can improve automation and other financial processes. Potential benefits include lower transaction costs, faster settlement, new market designs, and more efficient market functioning, although not all these benefits are contingent on tokenized infrastructure (Adrian 2026; Cabedo and others 2026).

However, the potential benefits of tokenization depend critically on network effects, market design, and interoperability. Duffie (2020), for example, argues that integrated ledgers and common standards can dramatically improve the speed and efficiency of payments. Recent empirical studies provide early evidence that tokenized bonds may have lower issuance costs, tighter bid-ask spreads, and lower yields than comparable conventional bonds, suggesting tangible efficiency gains (Leung and others 2023; Aldasoro and others 2025; Born and others 2026).

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¹A smart contract is a self-executing computer program stored on a blockchain that automatically carries out predefined rules and actions when specified conditions are met. It enables parties to execute agreements without relying on a central intermediary.

At the same time, tokenization could build up financial vulnerabilities as it scales. Policymakers have warned that greater tokenization could amplify financial shocks by increasing interconnectedness, leverage, and liquidity risks (Carapella and others 2023; Bank of England 2024; FSB 2024; Born and others 2026). While these studies generally conclude that tokenization remains small and mostly experimental, posing limited systemic risk thus far, its future significance is less certain. The balance between potential benefits and risks depends on how tokenization will evolve, scale, and interact with the traditional financial markets (that is, TradFi).

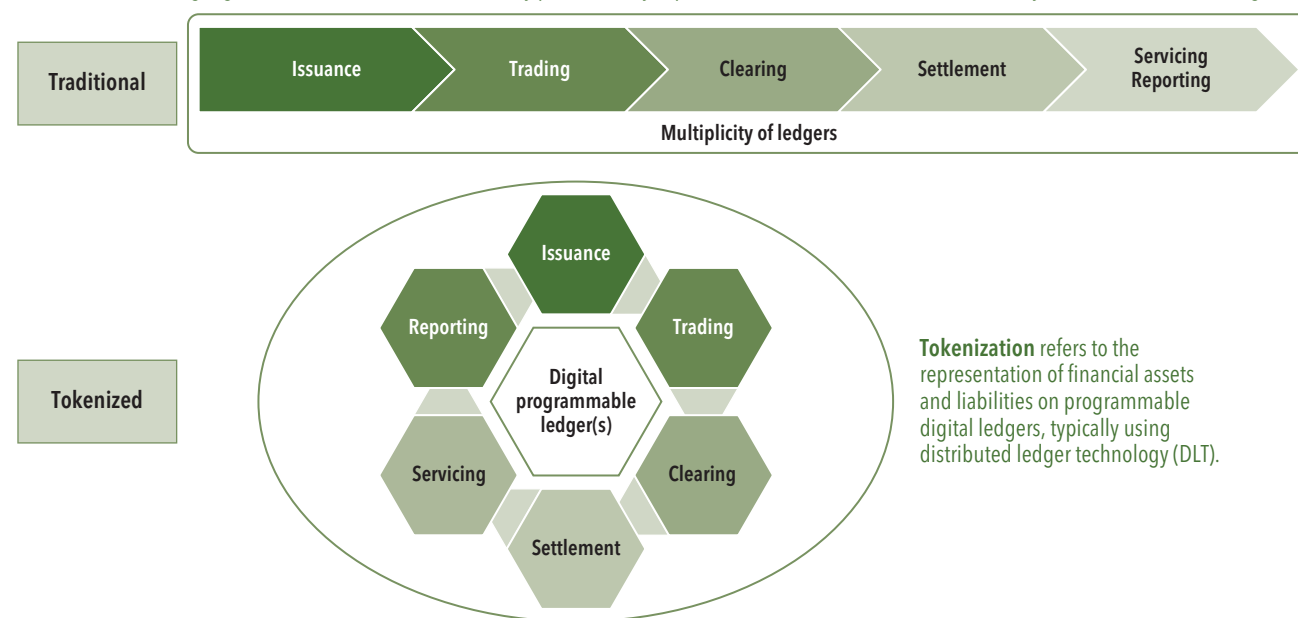
This chapter has two main objectives: (1) to discuss the potential benefits of tokenization and the constraints to its development and (2) to assess its implications for financial stability. The analysis covers both tokenized real-world assets (RWAs) and on-chain native assets² while excluding stablecoins, except when they are used for settlement. Rather than focusing on a specific asset class, the chapter examines the broader tokenization ecosystem, including tokenized bonds, money market funds, equities, repurchase agreements (repos), and related market infrastructure, building on a growing body of research.³ Given the still-limited size of tokenized markets, the chapter places less emphasis on current risks and more on how the features of tokenization could reshape financial markets as it scales, how vulnerabilities may evolve, and how policy frameworks can help prevent these risks from becoming embedded in the financial system.

²“On-chain native assets” here refers to real-world assets and liabilities (bonds, equities, money market funds, and so on) that have been created directly and only through distributed ledger technology (DLT). Protocol tokens and crypto assets such as Bitcoin and Ether are excluded from this definition. Acknowledging that real-world assets could be issued directly onto DLTs (“native issuance”) or otherwise immobilized and then represented onto DLT (“tokenized”), the terms are sometimes grouped simply as “tokenized assets.”

³Bains (2025), BIS-CPMI (2024), IMF (2024), Agur and others (2025), and Adrian and others (2026) review defining concepts of blockchains, tokenization, and changes to market functioning and architecture arrangements. FSB (2024) and Adrian (2026) explore emerging areas of financial stability vulnerabilities. IOSCO (2025) evaluates the implications for regulators, including market integrity and investor protection issues. Cabedo and others (2026) review the changing role for financial market infrastructures. Patel and others (2026) consider the role of settlement assets for tokenized capital markets and options for central bank policymakers.

Figure 3.1. How Tokenization Reshapes the Asset Life Cycle*

Tokenization can bring together functions that are traditionally performed by separate intermediaries across the asset life cycle onto a distributed ledger.



Source: IMF staff compilation.

*Reporting is not tied to the sequence since it could happen along many stages.

Changes in Financial Market Infrastructures and Processes

Traditional financial markets, for example, for equities and bonds, operate through a network of specialized intermediaries, each maintaining a ledger and performing a distinct function along the asset life cycle. Trading, clearing, settlement, custody, servicing, and collateral management are typically conducted across separate institutions and recordkeeping systems (Figure 3.1). As a result, transactions often require information related to ownership or trades to move sequentially between multiple parties, and each step involves reconciling, verifying, and updating separate ledgers. Although this fragmented structure can create operational complexity, delays, and costs, it also reflects legal, regulatory, and risk-management arrangements that have evolved to support market integrity and financial stability (Cabedo and others 2026).

Traditional finance benefits from strong network effects through a few dominant central securities depositories, central clearing counterparties, Society for Worldwide Interbank Financial Telecommunication (SWIFT), major exchanges, and custodians. Tokenization attempts to recreate many of these functions

on distributed ledgers. In tokenized environments, financial assets are represented as digital tokens on distributed ledgers, which allow participants to interact through a common transaction environment governed by predefined rules. More activities can be executed directly on shared infrastructure, potentially reducing reconciliation needs, increasing transparency, and enabling greater automation (Box 3.1). This results in some integration or automation of traditional functions, which could potentially ease frictions, lower costs, and improve efficiency (Agur and others 2025). The system is subject to strong network effects: Benefits and risks increase when more assets, participants, and settlement instruments are brought into the platform and as markets converge on common standards and settlement arrangements rather than fragment into many isolated platforms.

Tokenization can affect each stage of the asset life cycle (Cabedo and others 2026).

- During issuance, assets and financial products are represented as tokens on a one-to-one or fractional basis. Assets and financial products could even be combined and represented as new products (for example, tokenized money market funds). Native

assets are created directly and only through distributed ledger technology (DLT), whereas existing financial assets could be represented on DLT in different ways.⁴

- During trading, programmable transfer rules can automate aspects of transaction execution, including eligibility criteria, transfer restrictions, and compliance requirements.
- Within clearing and settlement, smart contracts could automate certain clearing arrangements and may improve the coordination between securities and money for settlement, potentially facilitating delivery versus payment transactions with greater certainty and atomicity.
- Reporting functions could move to a real-time basis, potentially improving transparency of asset holdings and transactions and facilitating reconciliation of corporate actions.

Current Adoption in Financial Markets

The public market for tokenized RWAs, excluding repos, has grown rapidly, reaching about \$65 billion⁵ (Figure 3.2, panel 1). The overall market is even larger when factoring in the value of private tokenized markets, which include at least \$8 billion in tokenized bonds.⁶ The 30-day average daily volume of tokenized repos reached \$303 billion (Figure 3.2, panel 3). Tokenization markets are also segmented by investor type: tokenized equities are dominated by retail investors, whereas bonds, money market funds, and repos are predominantly institutional markets.

The prominence of tokenized repos reflects that collateral management and collateral mobility are among the most compelling early-use cases for tokenization.

⁴For example, existing assets may be immobilized in traditional accounts and held in custody off-chain while represented as a token onto DLT on a 1-1 or fractional basis. Legal rights can vary depending on the issuance mode. Garrido (2023) covers concepts of how legal rights can be attached to tokens.

Patel and others (2026) highlight the heterogeneity in issuance models for such nonnative tokens across asset classes, ranging from custodial models (which confer full legal rights to the underlying assets) to synthetic exposures (which concern only an asset's price). Regulatory guidance, such as from the US Securities and Exchange Commission (SEC), has sought to clarify how different issuance models may be reconciled with securities law (SEC 2026).

⁵As of July 2026. Private tokenized markets, repos, and stablecoins are not included in this figure.

⁶Private tokenized markets also include J.P. Morgan's Kinexys, Citi Token Services, HSBC Orion, Euroclear DLT, and others whose comprehensive data are limited.

By digitizing and automating collateral-related workflows, tokenized repo platforms can reduce operational frictions and improve the movement and deployment of collateral across transactions. Tokenized repo can also add greater flexibility and precision to the timing of the transaction, potentially supporting liquidity management. However, despite accounting for a large share of current tokenized market activity, tokenized repo volumes remain small relative to traditional repo markets, and transactions are still largely concentrated among affiliated entities (Duffie 2026; Patel and others, 2026; Box 3.2).

The market is expanding fast, albeit from a small base (Figure 3.2, panels 1 and 2). Tokenized fixed income, spanning corporate credit, asset-backed credit, and money market fund holdings, accounts for the bulk of tokenized assets outside repos, at about \$48 billion. Within this category, tokenized credit accounted for \$30.4 billion, with asset-backed credit accounting for the largest share, followed by smaller corporate and diversified credit segments. Tokenized money market funds, at about \$17.5 billion, are held primarily as yield-bearing, cash-like collateral and are generally created and redeemed with the issuer rather than traded. Tokenized equity markets remain limited, with an estimated market size of \$2.3 billion.⁷ Issuance is highly concentrated: two platforms, Ondo Finance and Backed Finance, together account for more than 70 percent of tokenized equity value, with products aimed at investors that reside outside the United States.⁸

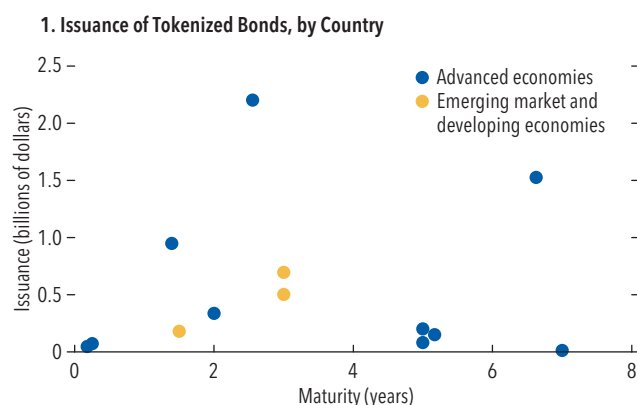
At present, tokenization activity is also concentrated geographically. Most value originates from issuers in the United States, followed by issuers with undisclosed domiciles and a long tail of smaller financial centers, including Liechtenstein and the British Virgin Islands (Figure 3.2, panel 4). The large share of issuers with

⁷Tokenized equities take one of three forms, distinguished by the rights they convey. Native tokens are issued directly on-chain as the share itself, with holders retaining full economic and governance rights (for example, Figure and Exodus). Custodial tokens represent a beneficial claim on a share held in custody, with dividends and corporate actions passing through to the holder. Synthetic or special purpose vehicle-based tokens represent a claim on a structured vehicle that holds the underlying shares, giving economic exposure without direct legal ownership. The two largest issuers, Ondo Finance and xStocks (the latter issued by Backed Finance), use synthetic models.

⁸Ondo Finance and Backed Finance (xStocks) are among the largest tokenization platforms globally and major issuers of tokenized real-world assets (RWAs), particularly US Treasuries, stocks, and exchange-traded funds.

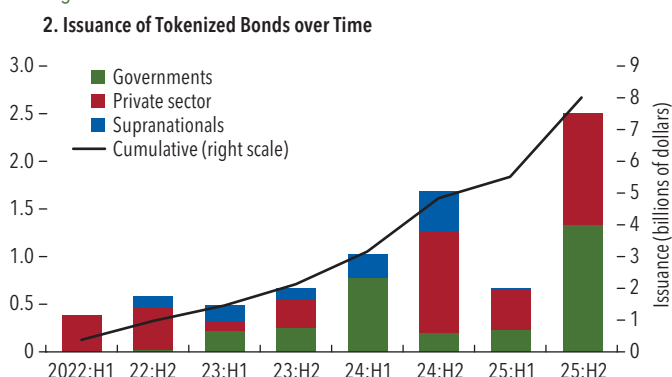
Figure 3.3. Tokenization of Debt Securities

Tokenized bond issuance spans advanced economies and emerging markets but remains concentrated at shorter maturities.



Sources: De Luna Martinez and Zhang (forthcoming); and IMF staff calculations.

Issuance has scaled since 2022, with governments and the private sector driving the trend.



Sources: De Luna Martinez and Zhang (forthcoming); and IMF staff calculations.

issuance has scaled steadily to about \$8 billion, driven primarily by government and private sector issuers (Figure 3.3, panel 2). So far, however, the number of issuers and the range of maturities remain limited (Box 3.3).

As in traditional finance, where concentration is largely institutionalized through regulated financial market infrastructures (FMIs) such as central securities depositories, central counterparties, payment systems, and foreign exchange settlement systems, tokenized market infrastructure is organized around leading chains, platforms, custodians, oracles, and bridges. Most activity occurs on a handful of key blockchain networks and platforms (Figure 3.4, panels 1 and 2) and relies on off-chain data such as prices, corporate actions, and collateral information, with data provision by a single provider. At the same time, this concentration coexists with fragmentation across a long tail of secondary providers as activity is spread across dozens of smaller networks and platforms that remain weakly interoperable at most.

Key Constraints to the Growth of Tokenized Markets

The growth of asset tokenization is currently constrained by four key, interdependent factors: legal certainty, regulatory clarity, interoperability, and safe, sound, and scalable settlement (Figure 3.5).

Legal certainty is a prerequisite for scale, as market participants need confidence that tokenized assets

confer enforceable rights and obligations. The legal framework must establish clear rights over both the token and the underlying asset it represents, define the legal relationship between the two, and clarify whether transfers recorded on distributed ledgers constitute legally effective transfers of ownership and settlement finality—and at what point. The framework must also address the legal recognition and enforceability of smart contracts, distributed records, and ledger entries as well as the responsibilities of custodians and other service providers. Additional risks arise in cases of insolvency, enforcement, fraud, and cyber incidents (see Online Annex 3.3, which provides examples of specific operational and infrastructure risks). In cross-border transactions, differences in property laws and conflict-of-law rules may create uncertainty over ownership, jurisdiction, and the enforceability of claims. Without legal certainty across these dimensions, adoption, especially by institutional investors, is likely to remain limited.

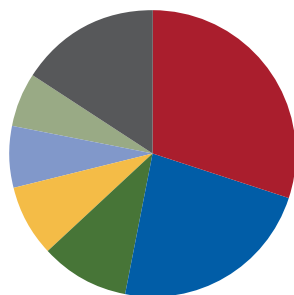
Regulatory uncertainty remains a key market concern, especially for institutional adoption. Global standard-setters apply the principle of “same activity, same risk, same regulatory outcome,” using a technology-neutral, look-through approach that maps existing securities, banking, and payments rules onto tokenized products. Frictions with existing regulation arise mainly at the back end of the asset life cycle—clearing, settlement, and reporting—and around DLT-specific features, where existing frameworks are less readily applicable (see the policy recommendations section on

Figure 3.4. Layers of Concentration in Tokenized Market Infrastructure

Tokenized assets are concentrated across a handful of leading blockchain networks ...

1. Tokenized Value, by Blockchain Network
(Share of total)

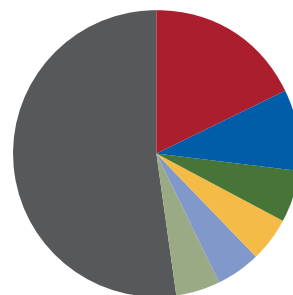
■ Ethereum ■ Avalanche ■ BNB Chain ■ XRP Ledger
■ Solana ■ Stellar ■ Other



... while platforms, which include issuers, managers, and protocol operators, are similarly concentrated.

2. Tokenized Value, by Blockchain Platform
(Share of total)

■ Bridgetower ■ Securitize ■ Ondo ■ Circle
■ Justoken ■ Tether Holdings ■ Other



Sources: RWA.xyz; and IMF staff calculations.

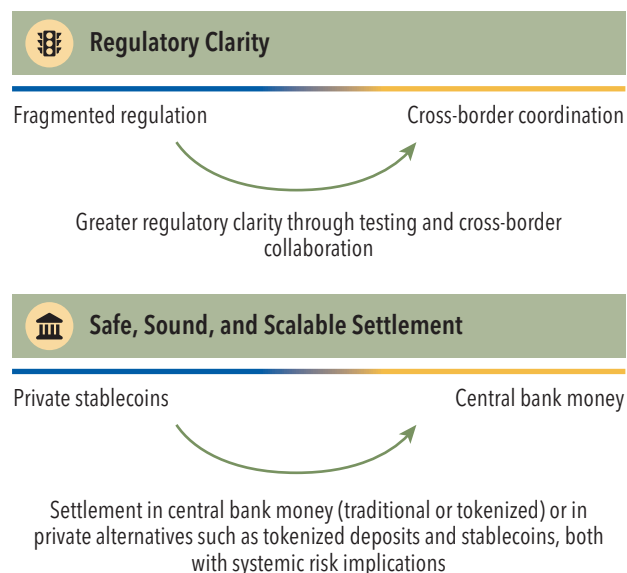
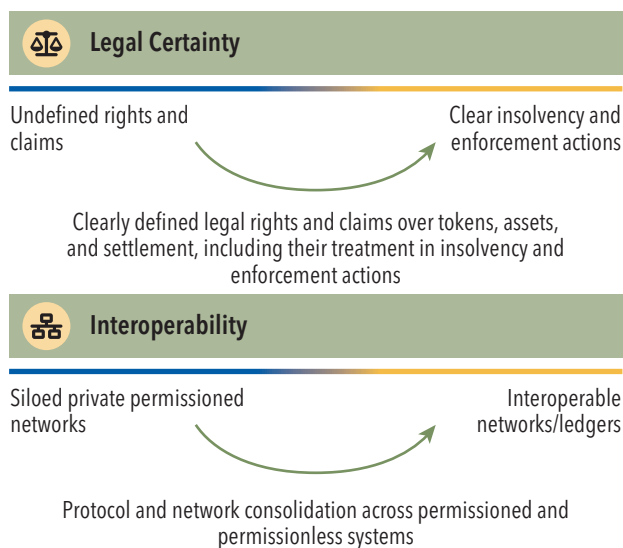
Note: Figures exclude tokenized repurchase agreements and stablecoins. The Figure Technologies HELOC token is also excluded to prevent a single asset from driving the results. Circle and Tether remain in the platform rankings even though the reported values exclude stablecoins. Including stablecoins would make Tether account for more than half of platform asset value and Circle for less than one quarter. A blockchain network refers to the protocol-based ledger technology; a blockchain platform refers to a specific provider offering services on top of one or several blockchain networks.

regulatory clarity). Authorities are using test-and-learn environments (such as policy sandboxes)⁹ to determine potential gaps in existing rules for tokenized assets,

⁹These should not be confused with regulatory sandboxes. Rather than testing products against existing regulation, policy sandboxes test regulation itself as part of the drafting process.

but inconsistent rules across economies could create unnecessary complexity unless regulatory approaches are more coordinated globally.

The benefits of tokenization depend on how well different platforms and systems can work together (interoperability) and scale up. Current activity remains concentrated in fragmented networks, which

Figure 3.5. Key Constraints to Tokenized Market Adoption

Source: IMF staff compilation.

can trap liquidity and reduce secondary market depth, limiting participation by larger investors. Progress is constrained by a coordination problem (Agur and Copestake 2025) whereby low liquidity discourages participation by the very investors who could help deepen markets. Scaling therefore depends on greater interoperability across networks and protocols, common standards across instruments, and support for interoperable settlement assets.

Tokenized markets require safe, sound, and scalable settlement arrangements.¹⁰ Tokenized trading without a trusted cash leg may increase the risks involved in settlement processes, limiting the potential for delivery versus payment, end-to-end programmability, and the full crystallization of tokenization's benefits (see the next section).¹¹ Emerging private settlement assets further introduce credit and liquidity risk into settlement processes unless such risks are properly mitigated, both by issuers and FMIs. Enabling settlement in safe and widely accepted forms of money could attract a broader set of investors by providing clarity on the stability of their on- and off-ramp transactions. In addition, the choice of settlement asset has important implications for financial stability, shaping the degree of interconnectedness with other asset classes, such as sovereign bonds, and institutions, such as banks and money market funds.

Current, Emerging, and Potential Benefits

To assess the potential benefits of tokenization, it is useful to distinguish among benefits that have already materialized across stages of the asset life cycle, those that are currently emerging, and those that remain largely potential. Figure 3.6 maps these potential gains across the five stages of the asset life cycle—

issuance, trading, clearing, settlement, and servicing and reporting—and organizes them according to their degree of maturity.

Importantly, several of these benefits are not exclusive to tokenization and are increasingly achieved through other technologies and market reforms. Capital markets have long been digital, although they operate across fragmented infrastructure and institutional databases. Many jurisdictions have compressed settlement cycles, with same-day settlement available in some markets. For example, India introduced optional same-day settlement for a subset of its equities markets using conventional technology rather than distributed ledgers and tokenization.¹² Both the United Kingdom and the United States plan to extend market opening hours to certain products in equities markets, moving toward nearly continuous operating hours. Programmability can also be implemented on more conventional technology, where it is used to automate processes across the asset life cycle, including the conditional execution of payments, collateral management, and compliance processes. Real-time or nearly real-time monitoring and reporting can be implemented in capital markets using conventional technology, including application programming interfaces. This allows market participants and financial sector authorities to receive automated data feeds and supervisory information without relying on distributed ledgers. Many claimed benefits of tokenization are the benefits of digitalization. However, tokenized markets can apply competitive pressure to transform traditional infrastructure and architecture. Tokenization can also deliver new benefits by combining assets, payments, and programmability on the same or shared platforms.

Current benefits are concentrated in efficiency and transparency gains that build directly on the core properties of distributed ledgers. Recent empirical studies provide early evidence that tokenized bonds may lead to lower issuance costs. For example, Leung and others (2023) find that underwriting fees of tokenized bonds were lower than those of traditional bonds across a sample of bonds in Hong Kong SAR. In clearing and servicing, back-office operations can be streamlined through a shared, auditable record

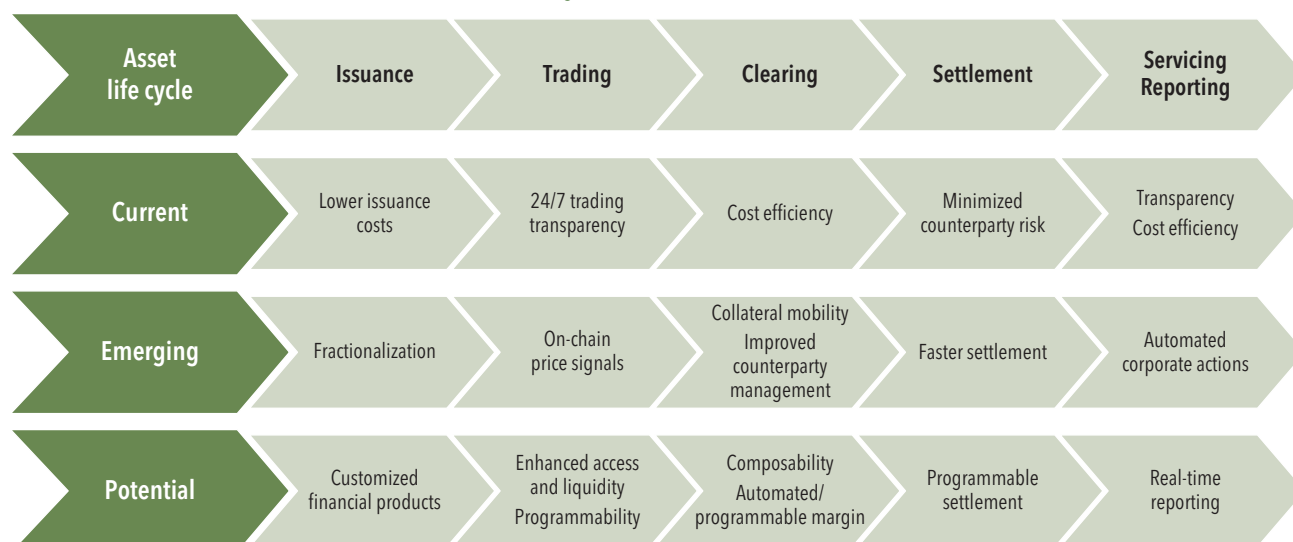
¹⁰Safety, soundness, and scalability are defined as desirable features for settlement assets and FMIs conducting wholesale financial market transactions. Safety refers to the risk profile of assets; soundness refers to an FMI's conduct and operations, and scalability refers to the ability for FMIs to support transactions at scale. The Principles for Financial Market Infrastructures (CPSS-IOSCO 2012) highlight core principles to support the conduct and operations of systemically important FMIs.

¹¹Ensuring settlement of the cash leg in tokenized capital market transactions is a topic of increasing focus (see Duffie [2026] and GFMA [2026]). IMF works covering aspects of payment and settlement in tokenized market include Patel and others (2026), Adrian and others (2026), and Cabedo and others (2026). Reducing settlement risks is one factor in supporting financial stability.

¹²More recently, India advanced its financial market infrastructure by launching a pilot programme for tokenized corporate bonds, integrating Distributed Ledger Technology (DLT) with the RBI's Central Bank Digital Currency (CBDC).

Figure 3.6. Current, Emerging, and Potential Benefits from Tokenization

Current benefits of tokenization remain centered around cost savings.



Source: IMF staff compilation.

that improves transparency and lowers reconciliation costs. In settlement, delivery versus payment on common ledgers minimizes counterparty-principal risk by construction. These benefits are primarily operational—as reductions in cost, time, and reconciliation frictions—and probably will not fully materialize until tokenization scales up, at which point network effects will begin to dominate.

Emerging benefits reflect the next layer of functionality being unlocked as tokenization scales and market infrastructure adapts. On the primary side, fractionalization¹³ is broadening the investor base for traditionally illiquid instruments (such as commercial real estate), while continuous on-chain trading can generate observable market signals that improve pricing. In post-trade activities, programmability is enhancing collateral mobility across venues and strengthening counterparty risk management. It is also shortening settlement cycles materially, while the increasing execution of corporate actions—coupons, dividends, and redemptions—through smart contracts is reducing manual processing risks (Cabedo and others 2026).

¹³Fractionalization allows high-priced equities to be divided into smaller units, lowering the entry threshold for investors who might be unable to afford whole shares.

Potential benefits depend on the growth of tokenized financial assets. At the issuance stage, programmable logic could enable tailored financial products designed around specific investor mandates or contingent payoffs. Broader market access and programmability could deepen liquidity, while automated margining, programmable settlement, and real-time regulatory reporting could shift oversight from periodic reconciliation toward more continuous supervision and monitoring.

Empirical Assessment of Benefits from Tokenized Equity Markets

An empirical analysis of the five most liquid tokenized US equities was performed across two issuers and compared with their corresponding underlying equity traded on traditional markets.¹⁴ The sample covers 11 trading venues across centralized and decentralized networks,¹⁵ representing approximately \$345 million

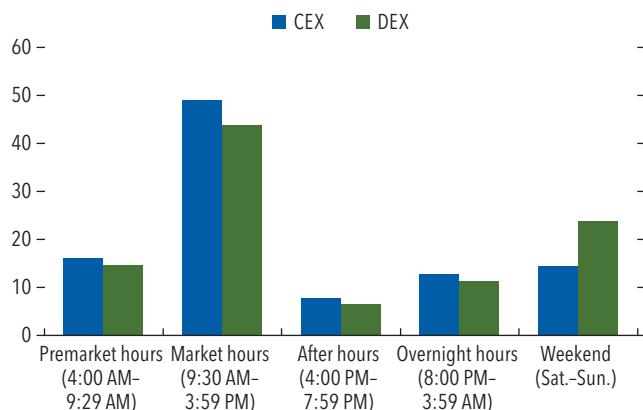
¹⁴Our sample includes tokenized equities for the S&P 500, Nasdaq, Tesla, Google, and NVIDIA that were issued by Ondo and xStocks.

¹⁵Both venues trade the same blockchain-based tokens. Centralized exchanges hold tokens for identified customers and settle trades on their own books. Decentralized exchanges settle each trade on the blockchain, meaning users keep custody, access requires only a wallet, and holders are identified by address rather than name. Tokens can also move directly between wallets without any venue.

Figure 3.7. Tokenized Equities Reveal Multiple Benefits

More than 50 percent of trading occurs outside regular market hours.

1. Volume Distribution across Trading Sessions
(Percent)

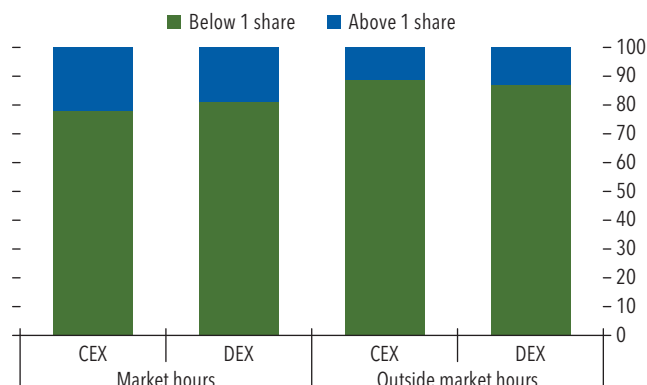


Sources: Allium; CoinDesk; and IMF staff calculations.

Note: CEX = centralized exchanges; DEX = decentralized exchanges.

Current tokenized trading confirms demand for fractionalization.

2. Share of Trades below versus above One Share
(Share of total)



Sources: Allium; CoinDesk; and IMF staff calculations.

Note: CEX = centralized exchanges; DEX = decentralized exchanges.

in reported market value,¹⁶ or about 15 percent of the \$2.3 billion tokenized equity market. The data set covers 365 trading days and more than 2 million observations of price and volume fluctuations during five-minute intervals. Through this analysis, several of the benefits set out in Figure 3.6—current (24/7 trading) and emerging (fractionalization and on-chain price signals)—already have initial empirical support.

Although the analysis provides early evidence on the benefits and risks of tokenization, findings should be interpreted with caution, given the incipient nature of the market.¹⁷ Therefore, market structure and operations can change significantly if tokenization scales. As discussed in the section “Potential Scenarios for the Evolution of Tokenized Markets,” a range of plausible market structures could emerge as tokenization evolves. These different end states would shape the balance of risks and benefits associated with tokenization, implying that current market dynamics may not be representative of the sector’s eventual steady state.¹⁸

Market participants benefit from continuous trading as more than 50 percent of activity in tokenized equities occurs outside regular US market

hours (Figure 3.7, panel 1). Unlike traditional equity markets, which operate within fixed exchange hours, tokenized equities trade on-chain around the clock, allowing investors to transact at any time and across time zones. The volume outside standard hours suggests that 24/7 availability is not merely a technical feature but a source of demand—particularly among investors in regions operating outside US trading hours and those seeking to react immediately to news and price movements when conventional venues are closed.

The market also displays a pronounced tilt toward small transactions, with about 80 percent of tokenized equity trades executed in sizes below one share, suggesting strong demand for fractionalization. The prevalence of subshare trades indicates that the current user base is dominated by smaller retail-oriented participants rather than institutional investors transacting in large blocks (Figure 3.7, panel 2).

Tokenized equity prices also carry information relevant for traditional assets. Drawing on the sample of five liquid tokenized US equities, the analysis regresses each underlying equity’s cumulative return over the first five minutes of the US trading session on the overnight return of its tokenized counterpart—that is, the return accumulated on-chain while traditional markets are closed—to estimate a pass-through coefficient (Figure 3.8). A coefficient of 1 implies the underlying equity has fully absorbed the overnight on-chain information five minutes after

¹⁶As of July 31, 2026.

¹⁷The analysis, using data compiled by RWA.xyz, comprises about 930,000 investors, with the holder count representing unique on-chain addresses holding a nonzero token balance as of July 31, 2026.

¹⁸For a more detailed analysis of tokenized equity markets, see Cong and others (2025).

the open; values below 1 indicate partial absorption, while values above 1 indicate overshooting. The estimates range from 87 percent to 99 percent, suggesting that traditional and tokenized markets respond to similar information sets.

Financial Stability Implications from Asset Tokenization

Tokenization may not fundamentally alter the nature of financial stability risks, but it can reshape the channels through which vulnerabilities accumulate and shocks are transmitted. The distinctive features and design choices of tokenization can increase the prominence of risks related to technology and infrastructure. At the same time, they can create new channels through which traditional risks such as liquidity, interconnectedness, and leverage are amplified and transmitted across markets. (See Online Annexes 3.2 and 3.3 for technical and specific risk details.)¹⁹

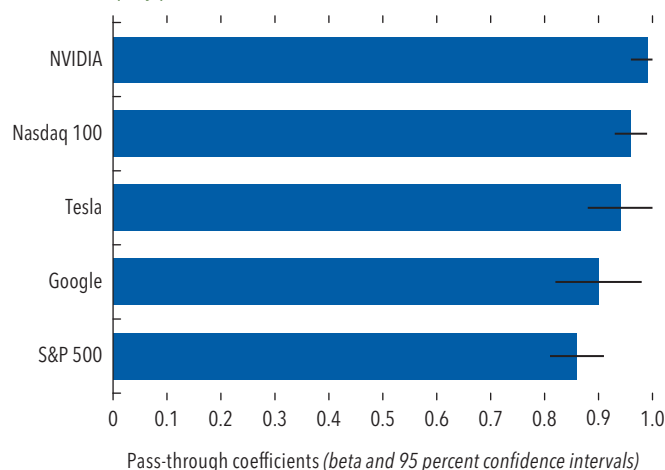
To contextualize how tokenization features influence financial stability outcomes, the key structural features linking tokenized assets to broad categories of risks can be placed within a framework. Unlike existing approaches that connect risk categories primarily by asset class, our framework links key tokenization features and market-design choices to the mechanisms through which risks emerge, are amplified, mitigated, and transmitted across the asset life cycle. For each core feature, the framework identifies a primary channel through which risks are generated directly and secondary channels through which existing risks are amplified or transmitted across markets and infrastructures (Table 3.1; Online Annex 3.2).²⁰ The discussion of risks is organized according to their prominence and directness rather than their overall importance, which may evolve as tokenization progresses. For example, while operational risks and the transmission of shocks to the traditional financial system through direct exposures are the most prominent concerns today, as tokenized markets scale up, smart contracts, composability, and reliance on shared governance arrangements could create new amplification channels that increase

¹⁹Beyond the discussion in the matrix, an emerging challenge may be the role of private settlement assets. Stablecoins, subject to their backing, could face further challenge if large-scale redemptions affect their reserve backing (see Patel and others [2026] and Cabedo and others [2026] for a discussion).

²⁰Online Appendix Table 3.2.2 develops the framework further and provides detailed explanations of the rationale of the matrix.

Figure 3.8. Price Signals in Tokenized Equities

Traditional assets absorb more than 87 percent of the overnight change in tokenized equity prices.



Sources: Allium; CoinDesk; and IMF staff calculations.

Note: The chart shows the pass-through coefficient from a regression of the underlying equity's five-minute return on the overnight tokenized-equity return average of Ondo and xStocks equivalent tokens. See Online Annex 3.1.

financial sector leverage and liquidity risks and new critical infrastructure nodes, adding a new dimension to operational risks.

A key insight is that tokenization can increase the systemic relevance of operational and infrastructure-related risks. Operational and governance risks gain prominence because of their association with distributed technologies, smart contracts, oracles, and code-based execution (see Online Annex 3.3). Market structure and infrastructure risks linked to validators, interoperability arrangements, cloud providers, and tokenization platforms also become more important. Operational and governance risks (blue and brown entries in Table 3.1) are prevalent direct sources of risk, accounting for most direct channels in the matrix. For example, permissionless access models, decentralized governance arrangements, and reliance on external oracles can heighten operational and governance risks by making coordination more complex, diffusing accountability, and introducing dependencies on external data providers (Table 3.1, codes I3–I5).²¹ These risks are concentrated largely in the earlier stages of the asset life

²¹Permissioned networks are networks in which only known actors with specific rights can validate existing records and add new ones, whereas permissionless networks are networks in which anyone can participate in validating existing records and adding new ones (Bains 2025). Permissioning can happen at the infrastructure, platform, or asset level.

Table 3.1. Prevalence and Directness of Risks in Tokenized Markets

The framework's most direct sources of risk are related to technology, whereas traditional risks tend to be amplifiers.

Code	Core Features	Definition or Attribute	Increase Risk			Reduce Risk
Core Tokenization Features		Definition	Direct	Amplification		Mitigation
C1	DLT-based recordkeeping and transfer	Ownership and transfers are recorded on a shared distributed ledger rather than through traditional centralized registries.	Outages and failures	Single-point failures		Reconciliation
C2	Programmability	Rules governing issuance, transfer, settlement, collateral use, and corporate actions can be embedded and automatically executed.	Automation	Contagion	Leverage	Processing
C3	Composability	Assets and applications can interact programmatically with other protocols, allowing assets to be combined, reused, or embedded in broader financial transactions.	Contagion	Leverage	Operational	Coordination frictions
C4	Atomicity	Linked transactions can be executed simultaneously, eliminating principal risk by ensuring that all legs settle together or not at all.	Operational	Liquidity		Contagion
Issuance Design		Attribute				
I1	Nature of claim	Direct claim on underlying asset	Fire sale	Contagion		Contagion
		Claim on issuer-intermediary	Contagion	Liquidity		
I2	Off-chain dependence	Reliance on off-chain assets or processes	Links to traditional fin. system	Reconciliation		DLT dependence
		Fully on-chain	Concentration	Operational		Operational
I3	Access model	Permissionless	Cyber and governance	Coordination		Single-point failures
		Permissioned	Single-point failures	Liquidity		Contagion
I4	Governance structure	Decentralized governance	Accountability	Coordination		
		Centralized governance	Concentration	Governance		Incident response
I5	Oracle dependence	Yes	Manipulation	Contagion		
Trading Structure		Attribute				
T1	Trading venue concentration	Single dominant venue	Single-point failures	Contagion		Liquidity
		Multiple venues	Operational	Fragmentation		Single-point failures
T2	Interoperability	Interoperable networks	Contagion	Infrastructure dependency		Friction
		Siloed network	Silos	Liquidity		Contagion
T3	Trading hours	Continuous (24/7)		Liquidity	Leverage	Funding shocks
T4	Investor access	Institutional only				
		Retail accessible		Liquidity	Contagion	
Settlement and Clearing		Attribute				
S1	Settlement finality	On-chain finality		Settlement speed	DLT reliance	Reconciliation
		Reliance on legal or off-chain finality	Reconciliation			Contagion
S2	Clearing structure	Bilateral clearing/settlement	Contagion	Liquidity		Single-point failures
		Central clearing (or CCP-like model)	Single-point failures	Liquidity		Liquidity
Financial Functions (cross-cycle)		Definition				
F1	Collateral mobility and reuse in tokenized finance	Tokenization enables collateral to move and be redeployed more easily across platforms, transactions, and financial applications.	Leverage	Contagion		Liquidity
F2	Programmable collateral and margining	Collateral management, margining, haircuts, and liquidation processes can be governed and automatically executed through programmable rules.	Leverage	Liquidity		Liquidity

Source: IMF staff.

Note: The table summarizes the channels through which tokenization features and market-design choices can affect financial stability. Entries under "Direct" identify the primary risk category generated by a feature or design choice, while entries under "Amplification" identify risks that may be intensified or transmitted through the feature. Entries under "Mitigation" identify channels through which the feature may reduce risk or strengthen market resilience. Colors correspond to the five financial stability risk categories defined in Table A3.2.1 in Online Annex 3.2: liquidity (red), interconnectedness and contagion (orange), leverage and procyclical deleveraging (purple), operational, technology, and governance risk (blue), and infrastructure and market risk (brown). The classifications are based on the analytical framework presented in Online Annex 3.2, which describes the methodology, rationale, and assignment of risks across the tokenized asset life cycle. CCP = central clearing counterparty; DLT = distributed ledger technology.

cycle, where technology, governance, and market-design choices are established.

Traditional risks—such as fire sales and liquidity runs, contagion through heightened interconnectedness, and leverage—can arise through new transmission and amplification mechanisms in tokenized markets. For example, greater collateral mobility with tokenized repo can facilitate the use of collateral across platforms, supporting larger leverage positions and potentially amplifying deleveraging pressures during stress (Table 3.1, code F1). In decentralized finance derivatives markets, tokenized money market funds or other tokenized assets could, in the future, be programmed to serve as margin collateral and reused across multiple transactions, creating collateral chains across interconnected platforms (Table 3.1, codes C3, F1, and F2).

Similarly, liquidity and contagion risks can propagate through new transmission channels in tokenized markets. Examples include automated programmable collateral management further accelerating margin calls and asset liquidations compared with traditional arrangements, intensifying liquidity strains during stress (Table 3.1, codes C2 and F2). Likewise, real-time settlement, 24/7 trading, and automated liquidation mechanisms may increase redemption pressures in tokenized investment vehicles like tokenized money market funds, accelerating liquidity stress and transmitting shocks to both tokenized and traditional markets through the underlying assets they hold (Table 3.1, codes C2, C4, I1, and T3). Contagion may also spread through interoperable platforms, composable applications, and automated collateral-management arrangements that facilitate the rapid transmission of shocks across markets and infrastructures (Table 3.1, codes T2, C3, and F1).

The examples presented illustrate that traditional financial stability risks often operate less as an originating source of vulnerabilities and more as a mechanism through which shocks are propagated and amplified across markets. Moreover, all three traditional risks appear to emerge more strongly further along the asset life cycle, as tokenized assets become integrated into trading, settlement, funding, and collateral-management activities in which leverage can build, liquidity pressures can materialize, and shocks can propagate across interconnected markets.²²

²²Contagion becomes more prominent in the trading, settlement, and clearing layers, in which interoperability arrangements, settlement dependencies, and liquidity pressures can propagate stress across market participants and infrastructures. Liquidity risk becomes

Another key insight from the framework is that the financial stability implications of tokenization are shaped by trade-offs between risk mitigation and risk amplification. Table 3.1 illustrates how individual tokenization features can cut both ways as they reduce some vulnerabilities while giving rise to others. Programmability, for example, can lower operational risk and legal uncertainty by automating issuance, settlement, and corporate actions, but the same automation can amplify procyclicality and contagion while introducing new vulnerabilities stemming from smart contract design flaws or cyber incidents (Table 3.1, code C2). Composability can improve coordination and capital efficiency, yet it also propagates contagion and leverage across interconnected applications and expands the operational attack surface (Table 3.1, code C3). Atomicity reduces counterparty and principal risk by ensuring that all transfers occur near-simultaneously, but in doing so it heightens dependency on the underlying infrastructure and removes temporal buffers that in traditional transactions help absorb operational disruptions and liquidity shocks (Table 3.1, code C4 and S2; Box 3.2). Overall, by reducing the friction, buffers, and intermediation arrangements that traditionally help absorb shocks, these features can also alter how vulnerabilities accumulate and shocks are transmitted across markets and infrastructures.

The analysis also suggests that risks may emerge through new channels, potentially affecting financial market authorities' ability to conduct effective supervision. Although the use of public networks may improve transparency, in practice, market participants may prefer private networks or the use of privacy technologies to ensure proprietary and client transactions are no more transparent than they are today. Tokenization is not inherently a risk for anti-money laundering/combating the financing of terrorism. Yet, the registration or servicing of tokenized assets through offshore jurisdictions, as evidenced in the case of equities, can increase such vulnerabilities when it creates regulatory, supervisory, or transparency gaps (FATF 2026). Supervisors may need to expand their monitoring across new trading venues and asset classes as well

the leading traditional risk in the trading layer, reflecting how venue structure, fragmentation, and continuous trading reshape market depth and price dynamics. Leverage risk is concentrated in the collateral-management and margining functions that span the asset life cycle, in which tokenized collateral can support leverage and amplify deleveraging pressures through collateral mobility, reuse, and automated margining arrangements (Table 3.1, codes F1 and F2).

as understand new market infrastructure and protocols (like smart contracts) and their effect on market integrity rules, which may challenge resources and expertise. This challenge is compounded by the need to identify whether existing tools (such as circuit breakers) are effective, reconciling data on-ledgers and off-ledgers, and potentially dealing with entities domiciled outside their jurisdiction.

Empirical Evidence of Fragmentation and Volatility in Tokenized Markets

Tokenized equity markets are considerably less liquid than traditional markets, especially on decentralized exchanges (Figure 3.9, panel 1), also because of the absence of trading by institutional investors. Using the same data on venues, tokens, and time period as in the “Empirical Assessment of Benefits from Tokenized Equity Markets” section, it is evident that certain risks also have empirical support: heightened volatility, illiquidity, and price dispersion. Using the Amihud measure—defined as the median absolute five-minute price change per \$1 billion of daily volume, with higher values denoting greater illiquidity—traditional markets are the most liquid, centralized exchanges are materially less so, and decentralized exchanges are the least liquid by a wide margin. This pattern suggests that a given volume of trading currently has a much larger effect on prices in tokenized venues, reflecting shallower liquidity and limited market-making activity.

Tokenized equities exhibit significantly higher volatility than equivalent equities traded in traditional markets. Realized volatility is approximately 1.5 times higher (Figure 3.9, panel 2). Volatility rises from traditional markets to centralized exchanges and is highest on decentralized exchanges. Part of this gap reflects that tokenized venues are less liquid and trade continuously, so their volatility captures price movements during lower-volume overnight and weekend periods.

Despite higher volatility and lower liquidity, tokenized equities generally remain closely aligned with prices in traditional markets. Panel 3 in Figure 3.9 plots the kernel density of the five-minute price spread against traditional markets during US market hours when a contemporaneous traditional price is available. For both centralized and decentralized exchanges, distributions of price differences show peaks close to zero, indicating that, on average, tokenized prices track their underlying equities closely. However, the decentralized exchange distribution is visibly flatter and wider than

the centralized exchange distribution, suggesting larger and more frequent deviations in decentralized venues, consistent with their weaker liquidity.

Price alignment between tokenized and traditional markets is strongly linked to trading activity, with higher-volume venues tracking traditional prices more closely. Plotting each venue’s median absolute five-minute deviation from traditional prices against its median daily volume per token—both on log scales, with bubble size proportional to average trades—reveals a clear downward-sloping relationship (Figure 3.9, panel 4). Venues with higher trading volumes tend to track traditional market prices more closely, whereas low-volume venues have substantially larger pricing errors.

Potential Scenarios for the Evolution of Tokenized Markets

The pace and direction of adopting tokenization ultimately depend less on the underlying technology than on incentives facing market participants. Legal and regulatory frameworks and safe settlement assets are key drivers of adoption (Adrian 2026). Figure 3.10 illustrates the potential progression from today’s fragmented ecosystem toward a more integrated tokenized financial system. Network effects can make the adoption of tokenization nonlinear: early adoption may be slow because the benefits of participation are limited when few participants are on the network, but once a critical mass is reached, adoption can accelerate rapidly.

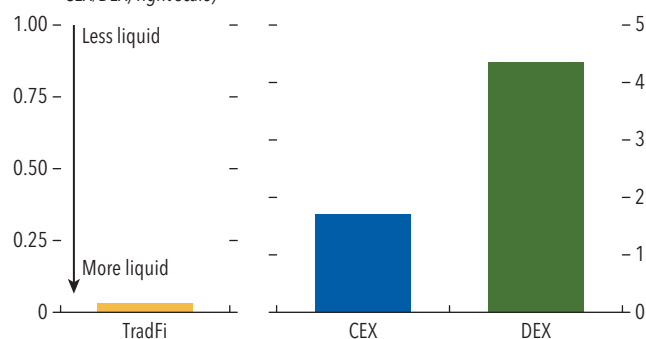
Today, tokenization remains largely confined to specific use cases that can achieve immediate efficiency gains without the need for broad market coordination. Activities such as tokenized repos, collateral management, tokenized money market funds, and selected sovereign bond issuances are mostly concentrated on private permissioned platforms. Platforms are largely siloed and operated by individual institutions or consortiums, whereas trading and settlement continue to rely heavily on traditional infrastructure. Legal certainty is often missing across jurisdictions, and regulatory treatment differs substantially across markets, creating doubts about ownership rights, custody, insolvency treatment, and cross-border enforceability. This fragmented equilibrium also partially reflects that incumbents have limited incentives to support open interoperability, because proprietary infrastructures allow them to maintain control over clients, deposits, and market access (Agur and Copestake 2025). In this environment, systemic risks remain limited because

Figure 3.9. Tokenized Equity Markets: More Volatile, Less Liquid, but Closely Priced

Tokenized equity markets are far less liquid, especially on decentralized exchanges ...

1. Amihud Illiquidity Measure

(Price impact per unit of volume, Lower = more liquid; TradFi, left scale; CEX/DEX, right scale)



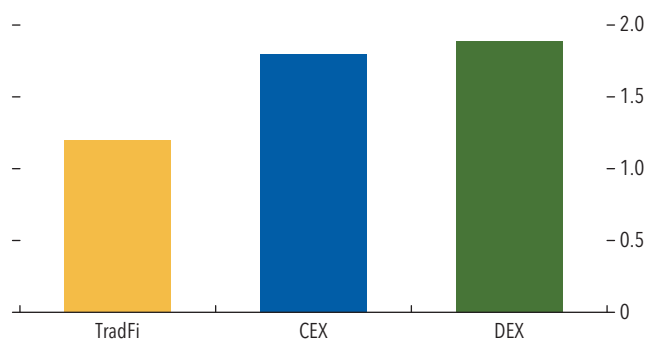
Sources: Allium; Bloomberg Finance L.P.; CoinDesk; and IMF staff calculations.

Note: Amihud illiquidity is the median absolute five-minute price change divided by median daily volume, scaled per \$1 trillion for traditional markets (market hours) and per \$1 billion for centralized and decentralized exchanges (24/7). All measures use volume-weighted venue prices within five-minute bins, are winsorized at the 1st/99th percentile, require more than one trade per decentralized exchange bin, and report medians. CEX = centralized exchanges; DEX = decentralized exchanges; TradFi = traditional finance (exchanges).

... and 1.5 times more volatile than traditional markets ...

2. Realized Volatility

(Percent)



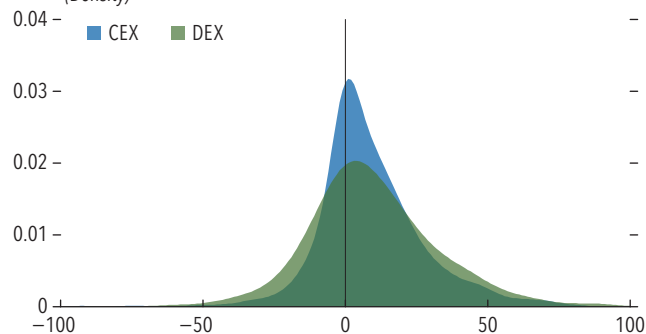
Sources: Allium; Bloomberg Finance L.P.; CoinDesk; and IMF staff calculations.

Note: Realized volatility is the median across token-days of the square root of the sum of squared five-minute log returns (Andersen-Bollerslev-Diebold-Labys), in percentage per day; traditional markets cover US market hours, while centralized and decentralized exchanges cover all hours (24/7). All measures use volume-weighted average prices within five-minute bins, are winsorized at the 1st/99th percentile, require more than one trade per decentralized exchange bin, and report medians. CEX = centralized exchanges; DEX = decentralized exchanges; TradFi = traditional finance (exchanges).

... but still remain closely priced relative to traditional markets.

3. Spread Distribution: Tokenized versus Traditional

(Density)



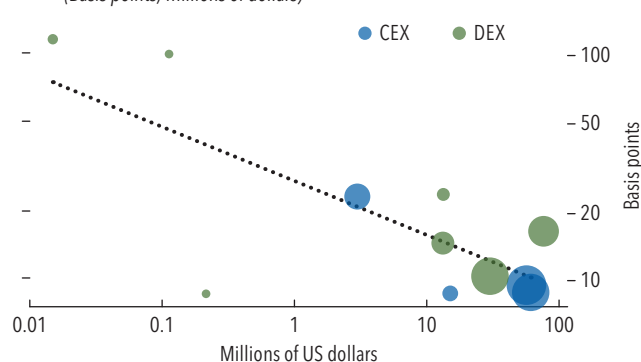
Sources: Allium; Bloomberg Finance L.P.; CoinDesk; and IMF staff calculations.

Note: Distribution of the five-minute price spread versus traditional markets, spread = $10,000 \times (\log \text{volume-weighted average price} - \log \text{Bloomberg price})$; US market hours for all venues since a contemporaneous traditional price is required; curves are kernel density estimates. All measures use volume-weighted average prices within five-minute bins, are winsorized at the 1st/99th percentile, require more than one trade per decentralized exchange bin, and report medians. CEX = centralized exchanges; DEX = decentralized exchanges.

Higher-volume exchange venues track traditional prices more closely.

4. Price Deviation, by Venue Volume

(Basis points; millions of dollars)



Sources: Allium; Bloomberg Finance L.P.; CoinDesk; and IMF staff calculations.

Note: Price deviation is each venue's median absolute five-minute deviation from traditional prices (y-axis, log scale) versus median daily volume per token (x-axis, log scale); the bubble sizes represent the average trades per token; the trendline is a log-log fit across all venues. All measures use volume-weighted average prices within five-minute bins, are winsorized at the 1st/99th percentile, require more than one trade per decentralized exchange bin, and report medians. CEX = centralized exchanges; DEX = decentralized exchanges.

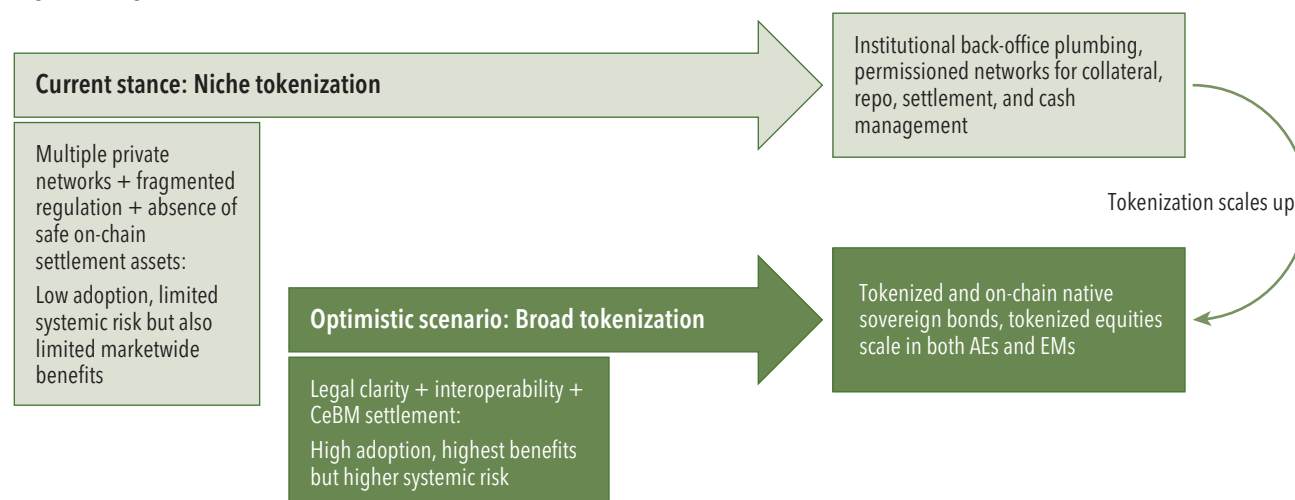
adoption is small, but the broader efficiency gains associated with tokenization—including composability, liquidity aggregation, and integrated settlement—also fail to materialize.

The current trajectory points to limited scaling and adoption. Continued fragmented regulation, limited interoperability, and uncertainty regarding the suit-

ability of available settlement assets could prevent markets from reaching the scale necessary to generate meaningful network effects. Under this scenario, a fragmented equilibrium would deliver localized efficiencies. Tokenization would remain concentrated in specific use cases, pilot projects, and isolated issuance programs. Secondary markets would remain illiquid,

Figure 3.10. Paths for Adopting Tokenization in Financial Markets

How fast tokenization grows depends on how multiple constraints are resolved, with low adoption (current stance) because of multiple private networks, fragmented regulation, and absence of safe settlement assets.



Source: IMF staff compilation.

Note: AEs = advanced economies; CeBM = central bank money; EMs = emerging markets.

investor participation would narrow, and many of the purported benefits would not materialize. Tokenization would therefore continue to have modest economic significance.

A potential medium-term scenario is the adoption of tokenization to improve the financial market's technical infrastructure. Under this scenario, tokenization becomes increasingly embedded in repo markets, collateral management, securities servicing, and cash management, while remaining largely invisible to end investors. Permissioned networks operated by banks, custodians, exchanges, and FMIs dominate activity. Much of the recent growth in tokenized repo activity and private permissioned networks points toward this trajectory, which could offer meaningful operational benefits. Institutions can reduce reconciliation costs, mobilize collateral more efficiently, shorten settlement timelines, and automate selected post-trade functions. This model does not require fully harmonized regulation or universal interoperability to generate benefits. Instead, gains arise from optimizing existing market structures. As Aldasoro and others (2023) note, in large, high-turn-over markets such as government bonds, even small per-trade efficiency gains from tokenization can translate into substantial aggregate benefits when trading is automated on a common platform.

Broad tokenization adoption may emerge if current constraints are addressed. Under this scenario, tokenized markets can evolve beyond isolated institutional applications and become an integrated layer for issuance, trading, settlement, and servicing across multiple asset classes. Tokenized sovereign bonds, equities, deposits, money market instruments, and other financial assets would coexist on interconnected networks governed by common standards. Arrangements that allow settlement in central bank money would provide a highly trusted and stable settlement option. Such a scenario would allow tokenization to generate and amplify network benefits. Liquidity could move seamlessly across platforms, collateral could be mobilized in real time, and secondary markets could deepen substantially. Interoperability would reduce the current fragmentation of investors and trading order flow, while legal frameworks would support cross-border trading and issuance. Emerging markets could also benefit disproportionately because tokenization could lower some issuance costs, broaden investor access, and facilitate participation in global capital markets. This scenario would also have significant implications for financial stability as many of the same features that generate the largest efficiency gains from broad tokenization can also create new vulnerabilities and amplify existing transmission channels.

The broad tokenization scenario highlights that further growth of tokenized finance also depends on coordination across institutions and jurisdictions. The benefits and risks of tokenization increase nonlinearly with adoption because liquidity, interoperability, and standardization reinforce each other. Individual institutions may not have enough incentive to bear the initial cost of creating open standards or interoperable infrastructures if competitors can benefit. While coordination problems may be resolved in time by markets themselves, public policy may help expedite an optimal outcome.

Policy Recommendations

Tokenization is one of several innovations that could help address inefficiencies in financial markets. To support safe and efficient market development, policymakers should adopt a technology-neutral approach that allows different technologies to compete on their merits. Removing unnecessary constraints to tokenization while safeguarding financial stability is the first step toward enabling tokenized markets to develop. This implies assuring legal certainty and improving regulatory clarity, focusing on potential operational, governance, and infrastructure risks and upgrading supervisory capacity.

In emerging markets, although tokenization could support and complement efforts to deepen and develop capital markets, fundamental reforms remain paramount. Tokenization may allow some emerging market and developing economies to “leapfrog” legacy market infrastructure but not the broader process of capital market development itself. Where incumbent systems are less entrenched, newer arrangements, such as on-chain native bond issuance, can be adopted without replicating the infrastructure architecture of mature markets. Infrastructure, however, is only one pillar of capital market development, and the costs of adoption warrant careful consideration. Building tokenized infrastructure, adapting legal frameworks, and developing supervisory capacity require substantial fixed investments, whereas efficiency gains tend to increase with transaction volumes. In low-turnover markets, whether the potential gains will outweigh the costs remains uncertain. Authorities should advance the foundational elements of capital market development, including a broad investor base, benchmark pricing, secondary market liquidity, and robust legal and supervisory safeguards in parallel with technology

adoption. Otherwise, tokenization may add operational, cyber, and governance risks to shallow markets that lack legacy infrastructure and established institutional arrangements to fall back on.

Promote Technology Neutrality by Removing Unnecessary Constraints

Legal Certainty

To promote technology neutrality, national authorities should first review their legal frameworks and ensure that laws provide legal certainty for tokenized assets. The law needs to establish clear rights and claims over tokens and define the legal relationship between tokenized assets and their real-world equivalents. It should also address key issues across the tokenized asset life cycle, including issuance, transfer, redemption, insolvency treatment, and enforcement actions, as well as jurisdictional and conflict-of-law rules in cross-border transactions. In doing so, authorities should clarify the rights conveyed by tokenized assets, including whether they confer direct rights over the underlying asset or claims against the issuer (Garrido 2023).²³

Regulatory Clarity

Second, financial sector authorities should provide regulatory clarity. In the short term, existing securities, banking, and payments regulations can and should be applied to tokenized markets. Consistent with the principle of “same activity, same risk, same regulatory outcome,” international standard setters generally adopt a technology-neutral approach focused on the underlying asset, activity, and risks rather than the technology used. As a result, tokenized securities should generally be subject to securities regulation, tokenized deposits to banking regulation, and tokenized payment arrangements to payments regulation. Similarly, requirements governing issuance, disclosure, transparency, market conduct, corporate governance, best execution, market surveillance, and consumer protection should continue to apply in tokenized markets. This approach helps prevent regulatory arbitrage while allowing innovation to develop within established legal and regulatory frameworks.

²³Some jurisdictions are providing legal certainty for both tokenized representations of real-world assets and natively issued on-chain assets.

In the medium term, some functions and prudential metrics may require additional regulatory clarity and targeted adjustments. Custody is one area where greater adaptation may be needed, although the starting point should remain client asset rules. Although fundamental regulatory principles on asset segregation and safekeeping should continue to apply, additional considerations are necessary for private key custody, including the use of different types of wallets (hot, cold, warm).²⁴ Furthermore, some prudential metrics, including leverage ratio limits, are generally constructed from point-in-time or end-of-day snapshots rather than continuous intraday monitoring. As a result, intraday transactions that are open and unwind within the same business day, before a reporting snapshot is taken, may not be fully reflected in reported balance sheet metrics, even if real funding and counterparty exposure existed for part of the day. Supervisors should assess whether existing reporting frameworks adequately capture intraday exposures associated with tokenized funding and securities markets (see also Singh 2026).

Over the longer term, if tokenization scales, recordkeeping, clearing, and settlement will require greater regulatory review. The use of public permissionless networks for tokenized assets can challenge regulatory assumptions, particularly in areas of finality. For example, the Principles for Financial Market Infrastructures (PFMIs) require clear and final settlement for designated FMIs (CPSS-IOSCO 2012), whereas many public permissionless networks can provide only probabilistic technical finality that converges to economic and legal finality over time. Although recent technical developments have increased confidence in settlement finality from a technical perspective,²⁵ legal and regulatory uncertainty remains in many jurisdictions. Where distributed ledgers perform recordkeeping functions, existing regulation can create friction with the efficiencies offered by tokenization. For example, some jurisdictions require securities to be recorded and maintained through central securities depositories. Such requirements may need to be adapted when

equivalent functions are carried out on distributed ledgers. Likewise, smart contracts challenge clearing frameworks designed around intermediaries such as central counterparties. In addition, atomicity may require regulators to reconsider assumptions about clearing, the treatment of netting arrangements, and the allocation of risk-management responsibilities.

Financial sector authorities with resources and expertise can use policy sandboxes to identify regulatory constraints and assess whether existing rules need to be adapted.²⁶ By providing flexibility within a controlled environment, these frameworks can help regulators better understand how tokenization interacts with regulation and should be considered in the drafting process for new legislation or regulation. Sandboxes can also help authorities distinguish between rules that remain appropriate and those that create unnecessary barriers to innovation. To be effective, such initiatives should have clear objectives, realistic timelines, and a transparent process for translating lessons from testing into regulatory or legislative reforms (also see Bains and Wu 2023). Not all financial sector authorities could, or should, build policy sandboxes, especially those in low-income countries with limited resources. In these instances, regulatory adjustments can be informed by pilots and experiments being conducted in more advanced or larger emerging markets.

Although national initiatives provide regulatory clarity to help ensure technology neutrality, greater international coordination is needed to prevent national approaches from diverging. Cross-border cooperation is necessary to reduce risk of global regulatory arbitrage and further fragmentation of tokenized markets. If tokenized markets grow, international organizations and standard-setting bodies should play a role in coordinating and providing such clarity in line with their mandates.

Interoperability

Policymakers should ensure there are no unnecessary inhibitors to developing interoperability across networks while safeguarding resilience. Financial sector authorities can, in collaboration with other relevant authorities and market participants, help prevent the emergence of fragmented tokenization silos if they support the development of common standards for asset representation and messaging along with resilient

²⁴Hot wallets are connected to the internet and convenient for frequent transactions but open to greater cyberattacks. Cold wallets store private keys offline and are commonly used for long-term or larger storage. Recently developed warm wallets allow only brief connections to the internet while having additional controls in place.

²⁵For example, the use of checkpoints as part of the Ethereum Network's finalization process or known validator sets and the use of Tower Byzantine Fault Tolerance in Solana. See also Bains (2025).

²⁶Examples include the United Kingdom's Digital Securities Sandbox, and the European Union's DLT Pilot Regime.

and scalable settlement arrangements that allow assets and money to be transferred across platforms with little risk. These measures could ease the fragmentation and coordination frictions that currently trap liquidity and deter larger investors. However, bridges and other interoperability arrangements can introduce operational vulnerabilities, including by widening the surface for cyberattacks. Efforts to promote interoperability should therefore be accompanied by robust standards and risk-management frameworks for bridges, oracles, message layers, and other cross-network connections. This would ensure that efficiency gains do not come at the expense of cyber and operational resilience.

Safe, Sound, and Scalable Settlement

Authorities should ensure that tokenized securities are settled through strong FMIs and in safe and widely accepted forms of money. All securities settlement systems are systemic and must comply with the risk-management expectations set out in the PFMI: securities are settled using central bank money in wholesale capital markets where practical and available. Without an interoperable form of central bank money, private settlement assets—tokenized deposits or stablecoins—could become the preferred settlement instruments for capital market transactions. The use of private settlement assets introduces credit and liquidity risks associated with their issuer. In tokenized capital markets, stress affecting one counterparty may be transmitted more rapidly to an FMI if the FMI lacks adequate risk-management controls. An FMI may also face heightened concentration risk where, for example, one private settlement asset becomes the preferred settlement asset on a platform, increasing the FMI's exposure to its issuer. Policymakers should therefore consider how to best support the development of settlement assets, underpinned by central bank money that is either interoperable with existing forms of central bank money or issued directly on-chain (tokenized reserves).^{27,28} They should also ensure that any private settlement infrastructures conducting settlement with

commercial bank money mitigate risks carefully, aligning with the PFMI and prudential standards.²⁹ This would safeguard settlement finality and resilience without forcing tokenized assets to defer to legacy settlement methods, which may erode the efficiency gains from on-chain settlement.

Safeguard Financial Stability

Operational, Governance, and Infrastructure Risks

To protect financial stability, public authorities should intensify monitoring and mitigation of operational, governance, and infrastructure risks. As tokenized markets grow, these risks are likely to become increasingly important. To address them, authorities should do the following:

- *Adapt supervision to the operational and cyber risks of distributed networks.* Supervisors should assess how the design of DLT networks, including their degree of decentralization and reliance on interoperability solutions such as bridges and oracles, affect operational and cyber resilience. Authorities should also develop a systemwide map of DLT networks and the interoperability arrangements that connect them to identify concentration risks, critical dependencies, and potential channels of contagion.
- *Establish robust third-party risk and outsourcing frameworks.* As tokenization increases reliance on external technology providers, smart contracts, and distributed networks, authorities should ensure that regulated entities remain accountable for managing operational and cyber risks in line with PFMI expectations. Key safeguards include business continuity arrangements, smart contract audits, and resilient on- and off-chain data management. More direct oversight may be warranted where a small number of networks become dominant.
- *Safeguard recordkeeping integrity and settlement infrastructure resilience.* Financial sector authorities should require robust reconciliation between on- and off-chain records, clear legal recognition of the authoritative record of ownership, and resilience standards consistent with the PFMI for settlement infrastructure. These safeguards can help prevent ownership disputes, operational disruptions, and concentration risks as recordkeeping and settlement functions migrate onto distributed ledgers. If tokenized mar-

²⁷As tokenized market infrastructure scales, jurisdictions may also examine whether certain FMIs may eventually require access not only to central bank money for settlement but also to central bank liquidity facilities under stressed conditions.

²⁸Several central banks are actively exploring these issues. For example, the ECB's Project PONTES seeks to enable the settlement of DLT-based transactions in central bank money while promoting interoperability between distributed ledger platforms and existing market infrastructures.

²⁹See Patel and others (2026) for a further discussion on the role of central bank money in tokenized settlement.

kets were to grow, bank resolution authorities might consider adapting their frameworks to address the transfer of tokenized assets during resolution.

Supervisory Capacity

Supervisors need the skills, tools, and resources to oversee tokenized markets safely and effectively. This will require building capacity in areas such as custody, smart contracts, intraday liquidity, third-party dependencies, privacy technologies, and tokenized exposure reporting. Supervisors must also identify new channels of market abuse. Given resource constraints, domestic and cross-border supervisory cooperation will be increasingly important. The use of blockchain analytics providers could also be one tool in a broader toolkit to assist in market monitoring.

Authorities should also ensure that anti-money laundering/combating the financing of terrorism frameworks remain effective in tokenized environments, including with respect to effective customer due diligence measures, beneficial ownership transparency, and cross-border supervision.

Liquidity Runs and Fire Sale Risk

Assess and manage the liquidity implications of atomic settlement. While atomicity reduces counterparty risk, it can increase intraday liquidity needs by requiring prefunding and eliminating timing gaps that traditionally help absorb liquidity shocks. Financial sector authorities should ensure that frameworks to manage liquidity risk, including intraday liquidity monitoring and supervisory requirements, keep pace with the adoption of atomic and near-instant settlement arrangements. Financial institutions should maintain sufficient liquidity buffers to meet prefunding obligations under stress without resorting to fire sales. Authorities should also strengthen intraday and out-of-hours liquidity monitoring and stress testing, incorporating tokenization-specific disruptions such as smart contract failures and trading suspensions to better manage emerging risks.

Interconnectedness, Contagion, and Deleveraging Risk

Develop circuit breakers and liquidity safeguards for 24/7 tokenized trading environments. While round-the-clock trading is not unique to tokenized markets, tokenized infrastructure can support continuous trading and near-instant execution natively. Absent appropriate safeguards, continuous trading and instant, automated liquidations could amplify price volatility and fire sales during stress. Authorities should examine whether existing tools, including circuit breakers, trading halts, liquidity fences, redemption gates and fees, and continuous margining remain effective in always-on DLT infrastructure and consider adapting them where needed. Existing crisis-management arrangements may also need to be enhanced to better enable continuous monitoring, expanded operational readiness, and intervention tools adapted to always-on financial markets.

Strengthen monitoring of linkages between tokenized and wider financial markets. Because redemption pressures in tokenized vehicles (for example, tokenized money market funds) can transmit to the underlying assets they hold, liquidity stress can propagate between tokenized and traditional markets. Financial sector authorities should monitor interconnections between tokenized and traditional markets, including the use of settlement assets for tokenized asset transactions, so that stress originating in tokenized markets does not spill over undetected into core funding and securities markets.

Monitor collateral reuse and procyclical deleveraging. Greater collateral reuse—including through tokenized money market funds or other tokenized assets posted as margin and reused across platforms—can lengthen collateral chains and amplify deleveraging pressures during stress. Financial sector authorities should monitor collateral velocity and reuse, consider limits or haircuts on the reuse of tokenized collateral, and ensure that automated margining does not trigger simultaneous, self-reinforcing liquidations across interconnected protocols.

Box 3.1. Does Tokenization Change Market Structure?

Tokenization could structurally change financial infrastructure and the organization of financial services but may not eliminate the need for intermediaries. Traditional markets rely on intermediaries such as custodians, central securities depositories, and central counterparties to coordinate activity across fragmented infrastructures and maintain trust in the transaction process. While distributed ledgers and smart contracts may automate some operational functions, many activities may continue to require governance, legal accountability, risk management, and regulatory oversight (Cabedo and others 2026). In this box, intermediation refers primarily to how trading, clearing, settlement, custody, and related services are organized and delivered rather than to the underlying economic functions of intermediaries such as liquidity provision or market-making.

Still, tokenization could change the organization of market structure substantially. Today, many FMIs and service providers are vertically integrated, operating both the infrastructures (platforms) on which transactions occur and the assets and services performed on that infrastructure. Tokenization could allow some functions to be provided more independently on shared platforms, encouraging competition (Budau and Tourpe 2024; Adrian and others 2026). For example, a central clearing counterparty (CCP) today typically operates the infrastructure through which parties are authorized and new contracts novated and cleared while also performing the associated risk-management functions. In tokenized markets, a CCP could focus on contract novation and risk management, with these services delivered on a shared market infrastructure rather than a platform operated by the CCP itself.

Tokenization could reshape the structure of intermediation across the asset life cycle, although it remains uncertain which market model will ultimately prevail. One possibility is a single shared platform where all parties transact (IMF 2024). Such an arrangement could reduce the number of intermediaries involved

and maximize the benefits of tokenization by enhancing the scope for programmability and reducing operational friction and transaction failures. However, a shared platform would also create concentration risks and would require participants to agree on common governance arrangements and operating protocols.

A more likely outcome in the medium term may be the emergence of multiple ledgers and networks serving different markets and assets (IMF 2024). In such an environment, market participants could still benefit from the shared state within individual networks and platforms. However, while participants and assets within one network and platform may easily trade with each other, distributed ledger technology networks are not inherently interoperable.

This structure requires new mechanisms that provide coordination layers across ledgers and networks, such as bridges, and oracle services. Bridges and other interoperability solutions facilitate the technical communication needed to enable transfers across otherwise separate ecosystems. Oracle providers supply external information from outside a ledger—including prices, interest rates, reference data, and corporate actions—to smart contracts operating on other distributed ledgers. However, these additional layers create a trade-off among competition, resilience, and efficiency. As the number of ledgers increases, so does the need for bridges and interoperability mechanisms, potentially making the system operationally more fragile and fragmenting liquidity across different platforms.

Different ledger configurations may lead to an outcome in which infrastructure becomes increasingly concentrated in a small number of dominant networks that effectively act as private “public utilities.” Concentration may reduce some operational and cybersecurity risks compared with highly fragmented architecture. However, a small number of network operators may acquire substantial influence over market rules, pricing structures, and access conditions. The resulting market structure may be more efficient but not necessarily more competitive. Entities that remain legally responsible for critical functions of FMIs are still required (Cabedo and others 2026).

This box was prepared by Manisha Patel, Kleopatra Nikolaou, and Mindaugas Leika.

Box 3.2. Tokenized Repos and Broker-Dealer Balance Sheets

Distributed ledger technology (DLT) is widely seen as boosting repo market efficiency through improved collateral mobility, with knock-on benefits for dealer balance sheet capacity. One use case for tokenized repos, as reflected in the growth of platforms such as Broadridge's Distributed Ledger Repo, is allowing transactions to be settled with greater precision, including on an intraday basis and over weekends. Rather than defaulting to overnight cycles, cash and collateral could exchange at a pre-agreed time, allowing dealers to shorten the time a position occupies balance sheet capacity. Moreover, by providing an instrument for immediate liquidity provision for short intervals, intraday repo can reduce precautionary liquidity buffers that cover intraday funding shortfalls, lowering effective balance sheet usage (DTCC 2026; Galper 2026; TBAC 2026).

However, much of dealers' current balance sheet efficiency comes from netting, not settlement speed. In the conventional repo market, dealers have designed their operations around matched trades to reap maximum benefits from netting procedures, that is, the ability to offset cash and securities flows, so that only a net balance needs to be settled (Bowman, Huh, and Infante 2024). This approach materially reduces gross settlement volumes and intraday liquidity needs.

Shorter settlement cycles can reduce bilateral netting opportunities (McLaughlin 2023). As settlement moves closer to real time, the share of transactions that can be netted could fall substantially, leaving a dealer running a matched book exposed to gross bilateral positions and higher balance sheet and liquidity needs. This may be particularly relevant in arrangements involving multiple intraday atomic bilateral settlements, which can require participants to prefund transactions by holding the full amount of cash or securities needed for settlement.

If transactions increasingly settle outside central clearing counterparties (CCPs), multilateral netting benefits may also decline. Unlike a decentralized DLT environment, CCPs centralize trading exposures, enabling the offset of positions across all clearing participants through multilateral netting. By contrast, DLT-based market structures, in their purest form,

push toward gross, atomic, bilateral settlement. While CCPs could benefit from adopting tokenization and DLT technologies to enhance collateral management, margining, and post-trade processes, the extent to which netting efficiencies are preserved depends on whether central clearing remains an integral part of the market structure (Eurex 2025). Overall, the efficiencies gained from faster settlement may come at the cost of lower netting efficiency.

Programmable batching could partly restore the efficiency gains from netting, albeit at the cost of settlement speed. Tokenized market infrastructure can use smart contracts to separate the timing of trade execution from the timing of settlement. Instead of settling each transaction immediately, trades can be grouped and settled periodically in batches, allowing offsetting positions to be netted against each other. This can reduce the amount of cash and securities needed for settlement and partly recover the efficiency benefits of today's market infrastructure. Evidence from equity trading suggests that, combined with central clearing, such arrangements may preserve substantial netting efficiencies, even with settlement windows as short as one hour in an equity-trading setting (McLaughlin 2023).

Both traditional and tokenized repo market data suggest that demand for intraday funding remains limited. In the United States, a very small share of traditional bilateral repo trades are intraday transactions (Figure 3.2.1, panel 1). Similarly, the use of Federal Reserve daylight overdrafts, a form of intraday credit, has remained at historically low levels (Figure 3.2.1, panel 2). Anecdotal evidence points to a similar pattern in Europe, where same-day trades account for a small share of repo activity, despite some recent growth.

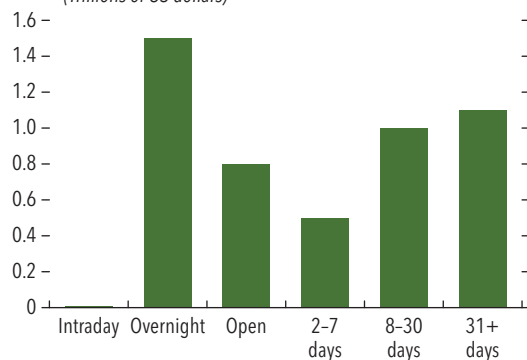
Taken together, these findings suggest that the net effect of tokenized repo on broker-dealer balance sheet utilization can be constrained by the loss of netting efficiencies. Settlement speed alone is unlikely to determine net benefits. Instead, specific design choices embedded in tokenized infrastructure—particularly the extent to which such infrastructure preserves or recreates opportunities for bilateral or multilateral netting alongside faster settlement—remain key.

This box was prepared by Kleopatra Nikolaou.

Box 3.2 (continued)**Figure 3.2.1. Funding Volumes in Repo Markets**

Intraday repo is negligible in the US noncleared, bilateral repo market segment.

1. Outstanding Repo Volumes, by Tenor
(Trillions of US dollars)

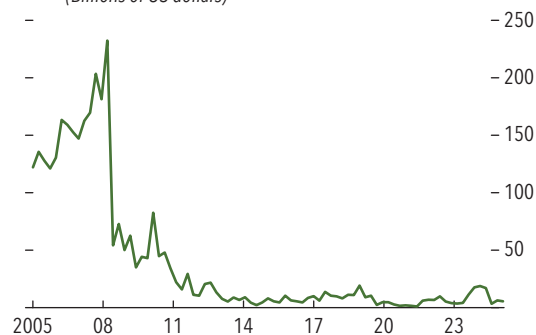


Sources: OFR 2026; and authors' analysis.

Note: Data are from July 1, 2025, through March 31, 2026. Values are average daily outstanding.

Daylight overdrafts from the Federal Reserve have dwindled considerably since the global financial crisis.

2. US Federal Reserve Peak Overdrafts
(Billions of US dollars)



Source: Board of Governors of the Federal Reserve System.

Box 3.3. Selected Experiences in Hong Kong SAR with Building a Tokenized Bond Market through Iterative Infrastructure Development

Hong Kong SAR is one of the leading jurisdictions in tokenized government bonds, with cumulative issuance of about US\$2.2 billion. Its experience is notable for the continuous exploration of new features in each issuance.

A Sequenced Transition from Pilot Issuance to Scalable Infrastructure

The first issuance in 2023 was designed to test whether tokenized bonds could be issued and settled in practice, both legally and operationally. The bond was issued by the Government of Hong Kong SAR and tokenized through Goldman Sachs's Digital Asset Platform, while the Central Moneymarkets Unit of the Hong Kong Monetary Authority handled clearing and settlement. Investors received digital tokens representing beneficial interests in the bond, and transactions were settled on a T+1 basis through the simultaneous exchange of securities and platform-specific cash tokens representing a claim for fiat in Hong Kong dollars against the Hong Kong Monetary Authority. While technically successful, the pilot also exposed a key limitation: investors or their custodians had to join the platform to participate creating "islands" disconnected from broader market infrastructure.

The second issuance in 2024 addressed this constraint by introducing a dual-access model. Investors could participate directly through the distributed ledger technology platform or indirectly through

Central Moneymarkets Unit (CMU) and its external linkages, including Euroclear and Clearstream. The transaction also expanded to four currencies and reached HK\$6 billion equivalent in issuance size. It was also Hong Kong SAR Government's first on-chain native bond issuance. Records on platform of claims against CMU, in the form of settlement tokens, were used for issuance's settlement. By leveraging existing infrastructure and linkages to Euroclear and Clearstream, the issuance expanded its reach to a broader global investor base.

The 2025 issuance further scaled the model. For the Hong Kong dollar and renminbi tranches, the option to settle using tokenized central bank money (in the form of e-HKD and e-CNY) was introduced alongside traditional settlement rails. This demonstrated the potential for tokenized central bank money in wholesale securities settlement and underscored that, for now, multicurrency tokenized settlement depends on a combination of instruments.

Implications and Remaining Constraints

Hong Kong SAR's experience points to two broader lessons. First, bond tokenization delivers limited market value if it is implemented as a standalone technology layer; digital platforms need to connect with existing market infrastructure that can contribute to scalability. Second, deep and liquid secondary markets require more than tokenized issuance alone. They also require sufficient issuance volume, broader investor participation, and trading conditions comparable with conventional bond markets.

This box was prepared by Jose De Luna Martinez and Xuege Zhang. Data sources: authors' calculations and HKMA press releases.

Glossary

anti-money laundering	Laws, regulations, and controls designed to prevent money laundering.
bridge	A mechanism that enables interoperability by connecting two or more distributed ledgers, allowing for the transfer of information and assets between them while preserving the integrity and consistency of those assets.
combating the financing of terrorism	Measures to detect and prevent terrorist financing.
composability	The ability of tokenized assets, liabilities, smart contracts, and protocols to be combined and reused across applications.
DLT	Distributed ledger technology, a shared database in which multiple participants maintain synchronized records without a single central administrator. Data can be shared or distributed to varying degrees, and control of those data can be decentralized to varying degrees.
oracle	A system that securely supplies and verifies off-chain real-world data (for example, macroeconomic data) on-chain.
platform	A software infrastructure provider that creates, issues, manages, and tracks tokens.
RWA	Off-chain assets—such as bonds, funds, real estate, and commodities—represented on a digital ledger as tokens.
tokenized reserves	A form of central bank reserves represented—“tokenized”—or natively issued on distributed ledger technology. Sometimes used interchangeably with wholesale central bank digital currency.
TradFi	TradFi (traditional finance) refers to regulated financial markets and services whose core business models are not predicated on distributed ledgers. This includes most banks, payment and remittance providers, insurers, investment firms, pension funds, and others.

References

- Adrian, T. 2026. “Tokenized Finance.” IMF Note 2026/001, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798229042468.068>
- Adrian, T., Y. Cabedo, and T. Mancini Griffoli. 2026. “The Rise of Tokenization: Deciphering New Trends in Payments and Asset Tokenization.” IMF Note 2026/006, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798229049054.068>
- Agur, I., G. Villegas-Bauer, T. Mancini-Griffoli, and M. S. Martinez Peria. 2025. “Tokenization and Financial Market Inefficiencies.” IMF Fintech Note 2025/001, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798400298905.063>
- Agur, I., and A. Copestake. 2025. “Optimal Policy for Financial Market Tokenization.” IMF Working Paper 2025/185, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798229026505.001>
- Aldasoro, I., G. Cornelli, J. Frost, P. Wilkens, U. Lewrick, and V. Shreeti. 2025. “Tokenization of Government Bonds: Assessment and Roadmap.” BIS Bulletin 107, Bank for International Settlements, July 10.
- Aldasoro, I., S. Doerr, L. Gambacorta, R. Garratt, and P. Wilkens. 2023. “The Tokenisation Continuum.” BIS Bulletin 72, Bank for International Settlements, April 11.
- Bains, P. 2025. “Blockchain Consensus Mechanisms: A Primer for Supervisors (2025 Update).” IMF Working Paper 2025/186, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798229024815.001>
- Bains, P., and C. Wu. 2023. “Institutional Arrangements for Fintech Regulation: Supervisory Monitoring.” IMF Fintech Note 2023/004, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798400245664.063>
- Bank for International Settlements (BIS). 2025. “Next-Generation Monetary and Financial System Takes Shape, Based on a Tokenised Unified Ledger.” In *Annual Economic Report*. Basel, Switzerland: Bank for International Settlements.
- Bank for International Settlements (BIS) and Committee on Payments and Market Infrastructures (CPMI). 2024. “Tokenisation in the Context of Money and Other Assets: Concepts and Implications for Central Banks.” Joint report, October.
- Bank of England. 2024. “The Bank of England’s Approach to Innovation in Money and Payments.” Discussion Paper, July, Bank of England, London, UK.
- Born, A., J. Evrard, C. Lambert, E. Wagner, and A. Tskhakaya. 2026. “Tokenized Bonds: Assessing Efficiency and Liquidity in a Nascent Market.” ECB Macprudential Bulletin No. 33, European Central Bank, Frankfurt, Germany.
- Bowman, D., Y. Huh, and S. Infante. 2024. “Balance-Sheet Netting in U.S. Treasury Markets and Central Clearing.” Finance and Economics Discussion Series 2024-057, Board of Governors of the Federal Reserve System, Washington, DC. <https://doi.org/10.17016/FEDS.2024.057>
- Budau, V., and H. Tourpe. 2024. “ASAP: A Conceptual Model for Digital Asset Platforms.” IMF Working Paper 2024/19, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798400266157.001>
- Cabedo, Y., T. Mancini-Griffoli, F. Schär, and N. Zhang. 2026. “Financial Market Infrastructures Evolution in a Tokenized Economy: Exploring Blockchain Implementation Options for Issuance, Central Clearing, Settlement, and Reporting.” IMF Working Paper 2026/136, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798229051354.001>
- Carapella, F., G. Chuan, J. Gerszten, C. Hunter, and N. Swem. 2023. “Tokenization: Overview and Financial Stability Implications.” Finance and Economics Discussion Series, 2023-060. Board of Governors of the Federal Reserve System, Washington, DC.
- Committee on Payments and Settlement Systems (CPSS) and International Organization of Securities Commission (IOSCO). 2012. “Principles for Financial Market Infrastructures.” Bank for International Settlements, Basel, Switzerland. <https://www.bis.org/cpmi/publ/d101.htm>
- Cong, L. W., W. R. Landsman, D. Rabetti, C. Zhang, and W. Zhao. 2025. “Tokenized Stocks.” SSRN.
- De Luna Martinez, Jose, and Xuege Zhang. Forthcoming. “Government Bond Tokenization.” IMF Working Paper, International Monetary Fund, Washington, DC.
- Depository Trust and Clearing Corporation (DTCC). 2026. “Collateral Infrastructure for Tokenized Capital Markets Just-in-Time Mobility, Capital Efficiency, and Market Resilience.” White paper, Jersey City, New Jersey, DTCC.
- Duffie, D. 2020. “Interoperable Payment Systems and the Role of Central Bank Digital Currencies.” In *Annual Report: Finance and Insurance Reloaded*. Paris, France: Institut Louis Bachelier.
- Duffie, D. 2026. “Tokenized Finance and the Perimeter of Central Banking.” Paper presented at the Jackson Hole Economic Policy Symposium, August 27–29.
- Eurex. 2025. “The Role of Central Counterparties in a DLT Environment.” White paper, Eurex, Frankfurt, Germany. https://www.eurex.com/resource/blob/4304182/afad77fd7010811b4d9e86f4b7027f18/data/whitepaper_the-role-of-central-counterparties-in-a-dlt-environment.pdf
- Financial Action Task Force (FATF). 2026. “Understanding and Mitigating the Risks of Offshore Virtual Asset Service Providers (oVASPs).” Report, FATF, Paris, France. <https://www.fatf-gafi.org/en/publications/Virtualassets/Understanding-Mitigating-Risks-Offshore-VASPs.html>
- Financial Stability Board (FSB). 2024. “The Financial Stability Implications of Tokenisation.” Report to the G20, October 22, FSB, Basel, Switzerland.

- Galper, J. 2026. “Bank Balance Sheet Benefits from Intraday Distributed Ledger Repo.” Concord, MA: Finadium. <https://finadium.com/bank-balance-sheet-benefits-from-intraday-distributed-ledger-repo/>
- Garrido, J. M. 2023. “Digital Tokens: A Legal Perspective.” IMF Working Paper 2023/151, International Monetary Fund, Washington, DC. <https://doi.org/10.5089/9798400250149.001>
- International Monetary Fund (IMF). 2012. “The Liberalization and Management of Capital Flows: An Institutional View.” IMF Policy Paper, International Monetary Fund, Washington, DC. <https://www.imf.org/en/publications/policy-papers/issues/2016/12/31/the-liberalization-and-management-of-capital-flows-an-institutional-view-pp4720>
- International Monetary Fund (IMF). 2024. “G-20 Note on Financial Platforms: What Are They and What Are Their Macro-Financial Implications?” Note to the G20, October, International Monetary Fund, Washington, DC. <https://www.imf.org/en/research/imfandg20>
- International Organization of Securities Commissions (IOSCO). 2025. “Tokenization of Financial Assets.” Final Report FR/17/2025, IOSCO, Madrid, Spain.
- Leung, V., J. Wong, A. Ying, and W. Wan. 2023. “An Assessment on the Benefits of Bond Tokenization.” Research Memo 04/2023, Hong Kong Monetary Authority, Hong Kong SAR.
- McLaughlin, D. 2023. “The Trade-Off between Shorter Settlement Times and Multilateral Netting Benefits in Deferred Net Settlement.” *Journal of Financial Market Infrastructure* 11:1–17.
- Office of Financial Research (OFR). 2026. “A Closer Look at the U.S. NCCBR Market.” By Cenicola, Ashlyn, and Corey Garriott. OFR Brief Series No. 26-05. Office of Financial Research, U.S. Department of the Treasury, August 18.
- Patel, M., J. De Luna Martinez, T. Kunaratskul, K. Nikolaou, and X. Zhang. 2026. “Tokenized Reserves and Next-Generation Capital Markets.” In CBDC Virtual Handbook, Chapter 18. Washington, DC: International Monetary Fund. <https://www.imf.org/en/topics/digital-payments-and-finance/central-bank-digital-currency/virtual-handbook>.
- Singh, M. 2026. “Collateral Velocity Is Disappearing behind a Digital Curtain.” Risk.net, January 12. <https://www.risk.net/comment/7962922/collateral-velocity-is-vanishing-behind-a-digital-curtain>
- Treasury Borrowing Advisory Committee (TBAC). 2026. Intraday Repo. Treasury Borrowing Advisory Committee Chargebook, August.
- US Securities and Exchange Commission (SEC). 2026. “Statement on Tokenized Securities,” Washington, DC, January 28. <https://www.sec.gov/newsroom/speeches-statements/corp-fin-statement-tokenized-securities-012826-statement-tokenized-securities>
- World Federation of Exchanges. 2025. “Mimicking Tokenised Equities.” WFE Regulatory Affairs Team, London, August 26. <https://www.world-exchanges.org/our-work/articles/mimicking-tokenised-equities>
- Wu, W. 2025. “Why Quantum Matters Now for Blockchain.” Judge School of Business, University of Cambridge. <https://www.jbs.cam.ac.uk/2025/why-quantum-matters-now-for-blockchain/>

