The Great Tokenization Shift

2025 and the Road Ahead

Keyrock

Centrifuge

Foreword

Financial markets are at a turning point. The emergence of tokenization is not just an incremental improvement but a fundamental shift in how value moves across global systems. Just as ETFs revolutionized investing, tokenization is now redefining capital markets by unlocking efficiency, liquidity, and transparency at an unprecedented scale.

At **Keyrock** and **Centrifuge**, we have been at the forefront of this transformation—building the infrastructure, shaping the liquidity landscape, and working with institutional and DeFi-native participants to bridge traditional finance with blockchain technology. The vision is clear: a financial system that is open, efficient, and accessible to all, no longer constrained by unnecessary intermediaries or outdated infrastructure.

Tokenization is not about replicating the old financial system onchain—it is about building something better. By integrating real-world assets into decentralized finance, we create markets that are more transparent, automated, global and capital-efficient than ever before. This shift demands a careful balance between innovation and regulation, security and transparency, compliance and decentralization, and other often opposing forces. Only by achieving this equilibrium can we build resilient systems capable of driving sustainable, long-term transformation.

This report provides an in-depth analysis of the state of tokenized markets, covering U.S. Treasuries, private credit, equities, and commodities, while addressing the opportunities and challenges that lie ahead. We hope it serves as a resource for investors, institutions, policymakers, and builders looking to navigate this rapidly evolving space.

We invite you to join us in shaping the next era of finance.

- Kevin de Patoul, CEO, Keyrock
- Bhaji Illuminati, CEO, Centrifuge

Keyrock

Founded in Brussels in 2017, Keyrock is a global crypto investment firm at the forefront of market making, OTC, and options trading for digital assets. Their 170-strong team operates across 37 countries, providing liquidity to over 85 centralized and decentralized venues worldwide. With entities in Brussels, London, New York, Zurich, and Paris, Keyrock is a key player in the evolving digital asset landscape.

Keyrock's commitment to the industry is practical, not theoretical. They offer in-depth industry insights, co-create DeFi ecosystems, and actively support Web3 startups. With Keyrock, the future of digital assets is not just envisioned; it's actively being built.

Centrifuge empowers asset managers to tokenize, manage, and distribute funds onchain, while providing investors access to a diversified portfolio of tokenized assets. Founded in 2017, Centrifuge was among the first to bring private credit onchain and has since evolved into an asset- and chain-agnostic platform. With composability, chain abstraction, and institutional-grade fund management, it enables seamless integration of tokenized assets into global markets.

As a pioneer in institutional adoption, Centrifuge has driven industry-wide progress, co-founding the Tokenized Asset Coalition, launching the Real-World Asset Summit, and shaping onchain fund infrastructure ERC-7540 standard. Centrifuge is redefining how capital flows into tokenized financial assets, making markets more efficient, transparent, and accessible.

Report contributors

Jakob Wuthrich, Research Analyst, Keyrock
Alessandro Bombarderi, Graphic Design, Keyrock
Kevin de Patoul, CEO, Keyrock
Edu Timmers, Director of Marketing, Keyrock
Bhaji Illuminati, CEO, Centrifuge
Mariia Yatsenko, Director of Product Marketing, Centrifuge

The Great Tokenization Shift: 2025 and the Road Ahead

Keyrock Centrifuge

1 About This Report

Tokenization is gaining traction across financial markets, but adoption patterns differ significantly across asset classes. This report examines the progress of tokenized U.S. Treasuries, private credit, equities, and commodities, assessing the structural advantages of blockchain integration, the barriers to adoption, and the market outlook.

Centrifuge and **Keyrock** bring unique expertise to this analysis. Centrifuge, as a leading tokenization platform for financial assets, has been building onchain infrastructure since 2017. Centrifuge has tokenized many different asset classes, from private credit to treasuries, and brings perspective on the market strengths, weaknesses and opportunities for growth. Keyrock, as a market maker deeply involved in digital asset liquidity, provides insights into how tokenization interacts with broader financial markets. Together, we present a data-driven, market-informed perspective on where tokenization is succeeding—and where it still has room to grow.

Our analysis is grounded in:

- **Market data analysis** – onchain analytics from RWA.XYZ, Allium, Dune, and Flipside, alongside official sources like the U.S. Treasury Department, to track adoption rates, liquidity trends, and pricing structures.
- **Expert insights** – interviews with key industry players, including Centrifuge, Backed, Ondo Finance, Maple Finance, Tradable, Paxos, Chainlink, Plume, Securitize, and Ostium Labs, to provide direct perspectives on tokenization's evolution.
- **Regulatory review** – A breakdown of evolving legal frameworks, including SEC guidance, MiFID II, MiCA, and ESMA reports, assessing how compliance impacts tokenized asset markets.

This report is structured to reflect both current market dynamics and future potential. It begins with tokenized U.S. Treasuries—now the largest and fastest-growing segment—before expanding into private credit, equities, stocks, and commodities. Each section dissects the technological, regulatory, and market forces shaping these asset classes, offering a clear, analytical view of how tokenization is developing across financial markets.

2.

Introduction

The Emergence of Tokenization

2 Introduction: The Emergence of Tokenization

In 2009, BlackRock's acquisition of Barclays Global Investors was met with skepticism. Many questioned whether an active investment firm could successfully integrate passive ETFs into its strategy. Yet, in the years that followed, ETFs transformed global investing, proving to be one of the most significant financial innovations of the 21st century. Today, ETFs account for over $13 trillion in assets, with BlackRock alone managing $3.5 trillion in ETF products[1].

That same skepticism now surrounds tokenization—the next step in the evolution of financial markets. Again, BlackRock is at the forefront of this shift.

> *"I believe the next generation of markets, the next generation of securities, will be tokenization."*
>
> – Larry Fink, CEO, Blackrock[2]

Just as ETFs democratized access to markets, enhanced liquidity, and streamlined portfolio management, tokenization has the potential to fundamentally reshape the financial system. The rapidly developing infrastructure for tokenized assets is already enabling 24/7 global trading, fractional ownership, and programmable finance—benefits that were impossible in traditional markets. As institutional adoption accelerates and liquidity providers enter the space, the transformative potential of tokenized markets is beginning to be realized, setting the stage for exponential growth in trading volumes and accessibility.

Broader forecasts echo this optimism. The World Economic Forum estimates that by 2027, tokenization could account for 10% of global GDP[3], as trillions of dollars of assets migrate on-chain. Boston Consulting Group projected up to $16 trillion of tokenized assets by 2030[4].

"ETF markets changed forever in 2009. We went from wide spreads and portfolio managers refusing to admit allocations, to BlackRock advocating that ETFs should be a standard portfolio component. Markets do not repeat, but they certainly rhyme. Larry Fink is now seeing the inordinate power of tokenization, and is back on the road."

– Anil Sood, Centrifuge Chief Strategy & Growth Officer, Anemoy Co-Founder

This movement envisions restructuring global finance by democratizing access, increasing efficiency, and enhancing transparency across asset classes. Instead of slow settlement pipelines, markets could operate on blockchain rails with near-real-time settlement and verifiable ownership records, reducing counterparty risks and back-office friction. Fractional ownership via tokens can open investment in high-value assets—such as commercial real estate or fine art—to a broader base of investors, bringing with it:

- **Instantaneous settlement**, eliminating costly delays in bond and equity transactions.
- **Full transparency**, where every beneficial owner and seller is recorded on a distributed ledger.
- **More efficient market structures**, reducing reliance on intermediaries and cutting costs.

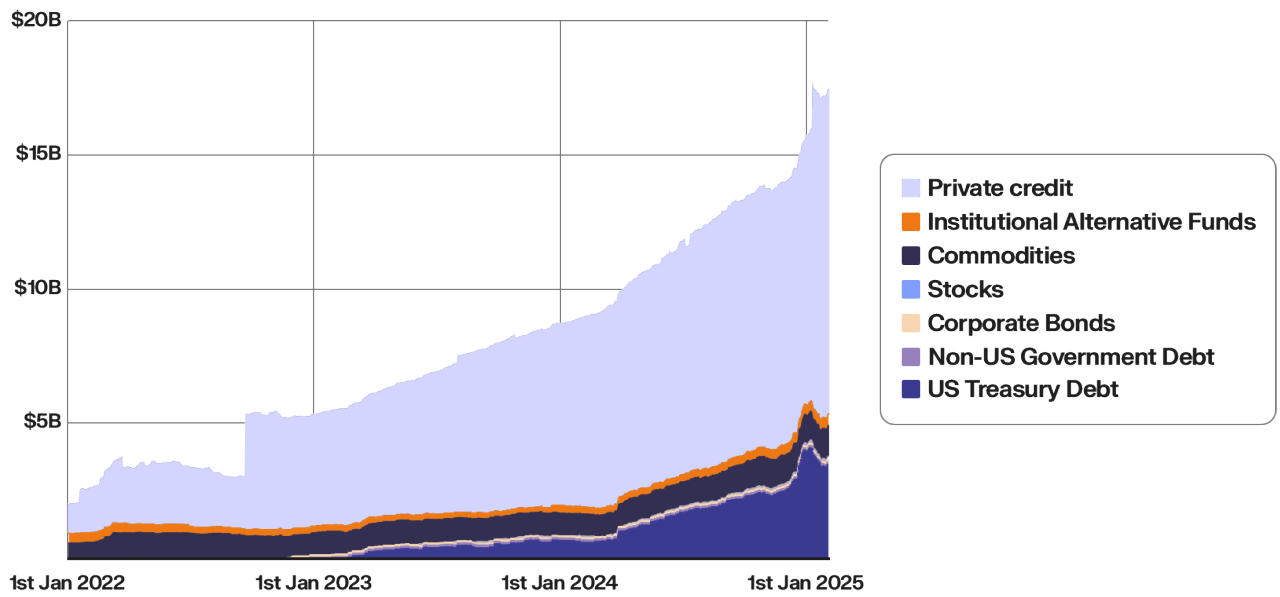
These promises of tokenization target inefficiencies in current financial systems:

"As the tokenized asset economy continues to grow, it's critical for institutions to have secure cross-chain interoperability that enables them to use existing interfaces and messaging standards to interact with tokenized assets across blockchains. The Chainlink standard solves this issue with Chainlink CCIP, the most secure and reliable blockchain interoperability protocol in the industry. Moreover, CCIP is the only cross-chain interoperability protocol that includes a way to manage global compliance and regulatory policies through the Risk Management Network."

– Colin Cunningham, Head of Tokenization & Alliances, Chainlink Labs

While much of this remains aspirational, the trend has already gained significant momentum. Stablecoins have exploded into a $210+ billion market[5], effectively functioning as digital dollars. Beyond stablecoins, onchain real-world asset value grew ~85% year-on-year in 2024 to reach $15.2 billion, spanning private debt, commodities, real estate, and bonds. Notably, tokenized U.S. Treasury products more than doubled from $1 billion to $2 billion in just five months in 2024 and surged past $4 billion by early 2025, driven by investors seeking onchain yields from government debt[6].

Growth of Real-World Asset Tokenization | Total Value Locked



One driver behind this expansion is the ability to tokenize an extensive range of tangible and intangible assets. Real-world assets can become easier to trade, settle more rapidly, and be structured into novel DeFi products. Platforms central to these developments—such as **Circle** (advancing stablecoin infrastructure through its USDC), **Centrifuge** (leading institutional-grade tokenization for financial assets), and **Figure** (a major HELOC provider using blockchain to streamline lending)—are pushing the boundaries of what tokenization can achieve.

However, this time the driver for change is not limited to traditional finance alone. DeFi-native platforms have spent years developing the infrastructure necessary for bringing real-world assets onchain—to prepare for the time when major asset managers signaled interest. As the broader DeFi ecosystem has matured, many investors are looking beyond zero-yield stablecoins or volatile crypto tokens toward real-world assets, boosting the visibility and potential of tokenization initiatives.

At the same time, tokenization provides more granular risk management. Investors can hold fractional shares of multiple tokenized instruments, distributing exposure across sectors, geographies, and custodians. This unlocks a level of portfolio fine-tuning that was difficult to achieve with traditional structures, enabling dynamic hedging strategies and real-time collateral adjustments.

Drawing on the transformative history of ETFs, this report examines how tokenization is positioned to disrupt four key sectors: **U.S. Treasuries, stocks, commodities, and private credit**. Each sector has undergone historical shifts that paved the way for innovation, and tokenization represents the next logical step in that process. While the liquidity of tokenized assets remains a work in progress, the potential for cost savings, faster settlements, fractional ownership, and broader market participation is drawing growing attention from both DeFi and traditional players.

In the pages that follow, we will explore how these developments are unfolding, the challenges that remain, and the outlook for 2025 and beyond—an era in which tokenization will be recognized as a cornerstone of modern finance.

3.

Tokenized U.S. Treasury Securities

Modernizing a Legacy Market

3.1 Traditional Infrastructure: Limitations and Rationale for Innovation

The U.S. Treasury market, with over $28 trillion[7] in outstanding debt, represents the world's largest and most systematically important financial market. Yet despite its scale and significance, the infrastructure supporting Treasury trading remains surprisingly antiquated, creating three fundamental inefficiencies:

- **Settlement Delays:** Treasury trades typically settle on a T+1 or T+2 basis, leaving counterparty risk exposure during this gap and tying up capital that could be deployed elsewhere.
- **Excessive Intermediation:** The settlement chain involves multiple brokers, clearing banks, custodians, and depositories—each extracting fees and adding operational complexity.
- **Fragmented Access:** Information is only available in periodic reports, and retail participation remains limited.

Traditional Treasury trading involves a complex network where primary dealers interact with the Federal Reserve, electronic trading platforms connect with clearing services through the Fixed Income Clearing Corporation (FICC), and custody is managed through entities like the DTCC. This multi-layered system creates both operational risks and elevated costs.

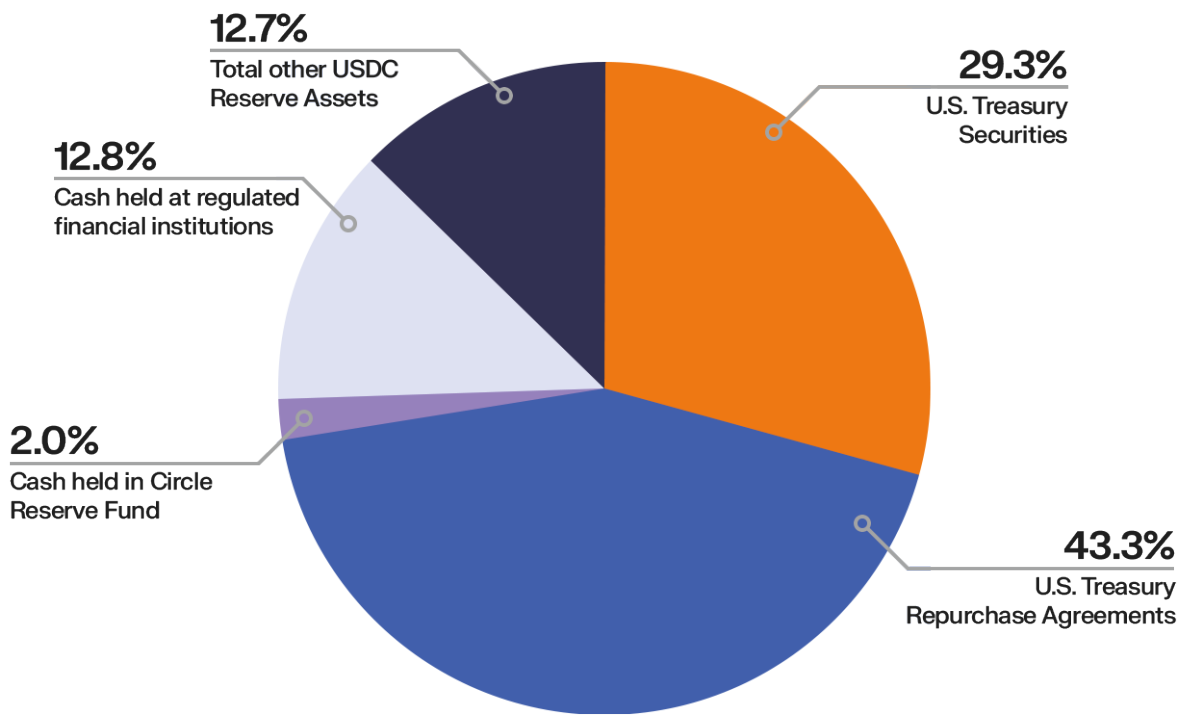
The Securities Industry and Financial Markets Association (SIFMA) recognized these limitations in their December 2024 study of a blockchain-based Regulated Settlement Network. Their findings confirmed that distributed ledger technology could potentially eliminate reconciliation errors, reduce counterparty risk, and lower settlement times[8]—capabilities that modern blockchain networks already deliver.

While these operational inefficiencies create a compelling case for modernization, the rise of tokenization is equally driven by demand from the growing $210 billion in onchain stablecoin wealth. This sophisticated crypto-native user base increasingly seeks stable, yield-bearing alternatives beyond volatile cryptocurrencies and non-interest-bearing stablecoins. By wrapping treasuries into standardized tokens (typically ERC-20 tokens), blockchain-based treasuries enable 24/7 global trading and direct integration with DeFi protocols—letting these assets function as both yield instruments and programmable collateral.

A prime example of tokenized treasuries in practice is the Janus Henderson Anemoy Treasury Fund, launched on Centrifuge. Rated Aa by Moody's and A+ by Particula, it provides institutional access to U.S. Treasuries onchain with 24/7 redemptions of up to $125 million[9].

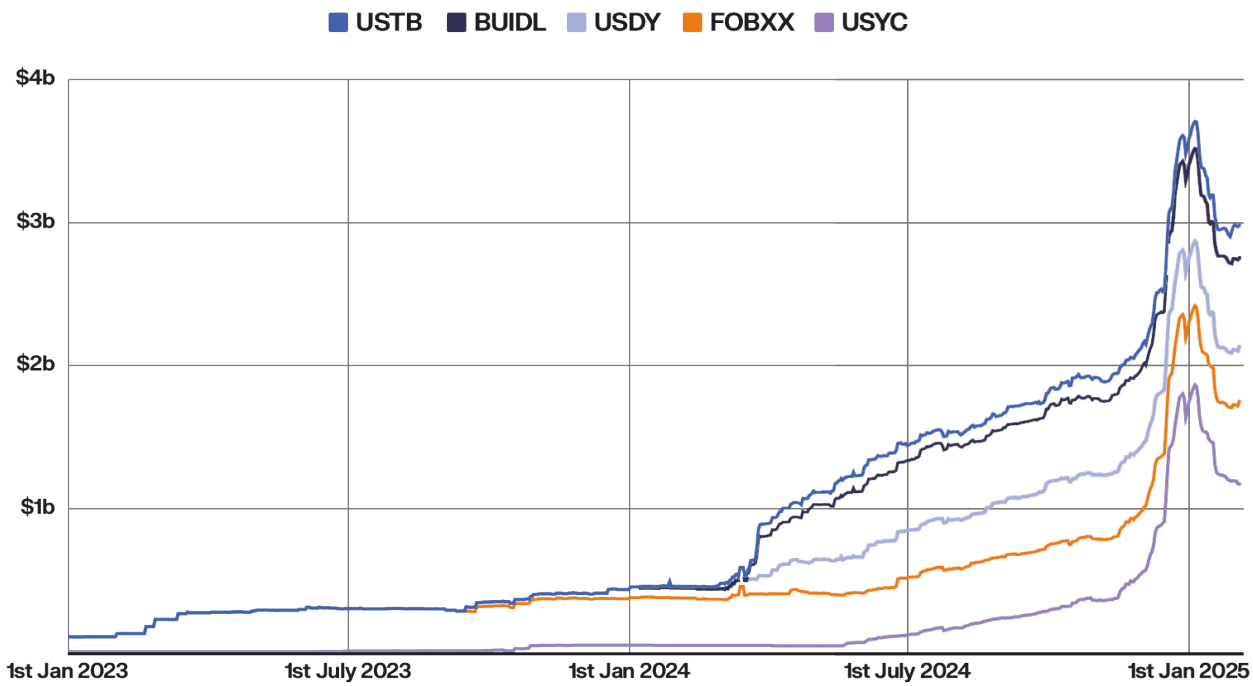
The success of stablecoins as a tokenized representation of U.S. dollars underscores this potential. With stablecoins circulating approximately $208 billion and handling over $4 trillion in transactions in February[10], the transition to tokenized treasuries appears to be a natural evolution. For instance, while Circle's USDC—a stablecoin with a $55 billion supply—holds a substantial portion of its reserves in treasuries, the yield from these assets currently benefits Circle rather than the token holders.

USDC Cash Reserves Breakdown



In contrast, on-chain treasuries enable investors to capture yield directly. **Despite onchain treasury assets totaling $4 billion today[11], they represent only 2% of the overall stablecoin market cap—a share that is ready for significant expansion.**

Growth of Onchain Treasury Products | Total Value Locked



Circle has recognized this opportunity and adapted its strategy. In a transformative development for the tokenized treasury market, Circle announced its acquisition of Hashnote, the issuer of USYC, in January 2025.

> *"The integration of USYC and Hashnote into Circle's platform marks a major moment in the evolution of the stablecoin market, as cash and yield-bearing short-duration treasury bill assets become fungible and convertible at the speed of blockchains and crypto capital markets. This is a huge unlock for a market that is increasingly being driven by institutional adoption, and where participants increasingly expect market structures that are common in traditional finance."*
>
> – Jeremy Allaire, CEO, Circle[12]

Securitize, an SEC-registered broker-dealer and transfer agent specializing in digital securities, has emerged as a key infrastructure provider for regulated tokenized assets. As the transfer agent for BlackRock's USD Institutional Digital Liquidity Fund (BUIDL), Securitize provides the regulatory compliance layer that has helped BlackRock bring its first tokenized product to market:

> *"Today, we're seeing meaningful adoption, led by the tokenization of dollars in the form of stablecoins. The next natural progression is the tokenization of treasuries, offering the security of government bonds with added efficiency and yield. From there, we expect to see further expansion into private credit and, eventually, a broader range of RWAs"*
>
> – Carlos Domingo, CEO, Securitize

This institutional adoption is significant because it demonstrates how traditional finance giants are validating the tokenization thesis. Unlike previous experimental DeFi protocols, Securitize enables regulatory-compliant tokenization through their SEC and FINRA-registered status, providing a bridge between traditional asset managers and blockchain technology.

> *"Tokenized U.S. Treasuries, which have surged by 415% year-over-year, from $800 million to $4 billion, with Securitize and BlackRock's BUIDL leading the charge."*
>
> – Carlos Domingo, CEO, Securitize

Securitize is a leading financial technology company specializing in the digitization and tokenization of alternative investments. By enabling businesses to raise capital through digital securities, Securitize has facilitated the TVL of over $1B of onchain US treasuries, partnering with top-tier asset managers such as Apollo, BlackRock, KKR, and Hamilton Lane.

The company operates as a SEC-registered broker-dealer, digital transfer agent, fund administration services, and manages a SEC-regulated Alternative Trading System (ATS), providing a comprehensive, end-to-end tokenization solution that enhances access and liquidity within a transparent regulatory framework. Their platform offers a transparent and secure tokenization path for institutions and investors, transforming real-world asset investments.

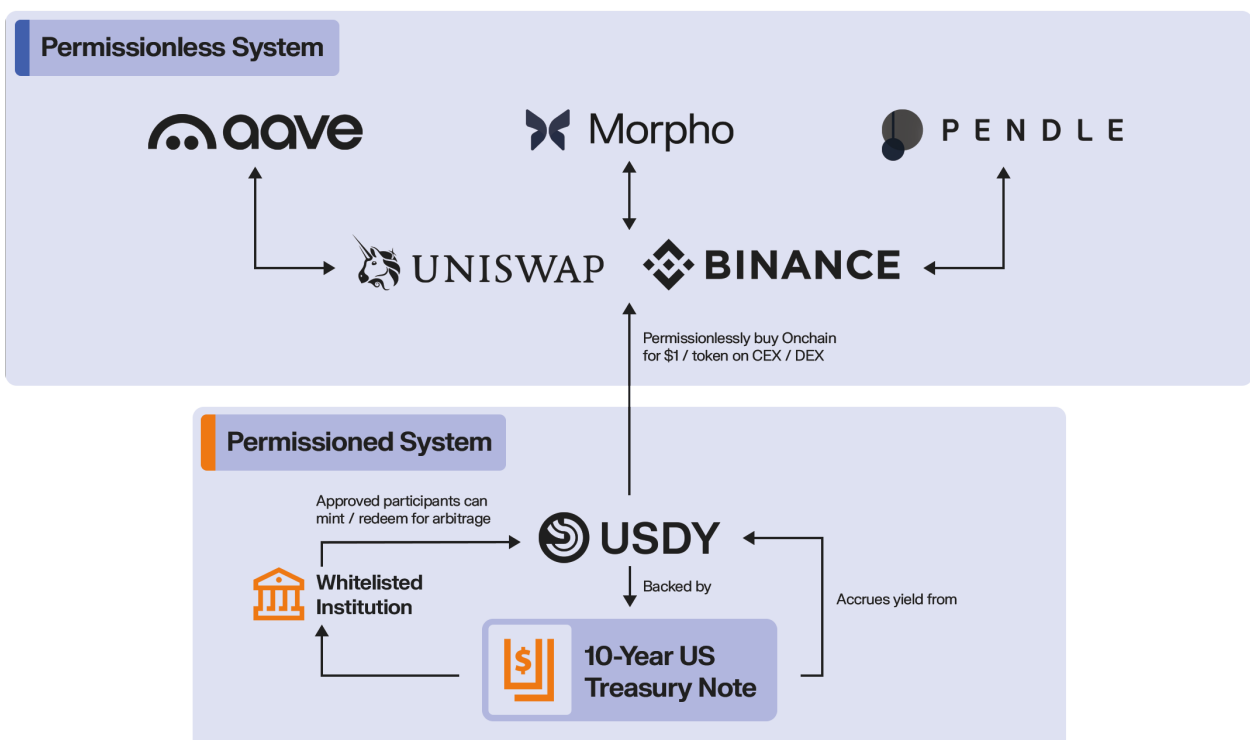
3.2 Permissioning: Operational Frameworks and Key Participants

In response to the inefficiencies of traditional systems and the lack of yield from stablecoins, a new generation of tokenized treasury products has emerged. These products operate within a few different frameworks, from fully permissioned to semi-permissionless, wherein only pre-approved institutions are authorized to mint and redeem treasury tokens. Custodians hold the underlying treasury products and investors get a token that represents a share of the fund itself.

In practice, this model comprises two primary functions:

- **Minting and Redemption (Centralized):** Investor receives tokenized fund share that can be redeemed in kind.
- **Onchain Utillity (Permissionless):** Once issued, these tokens seamlessly integrate into broader DeFi ecosystems, enabling trading, lending, or staking on platforms such as Uniswap, Aave, Morpho, and Pendle.

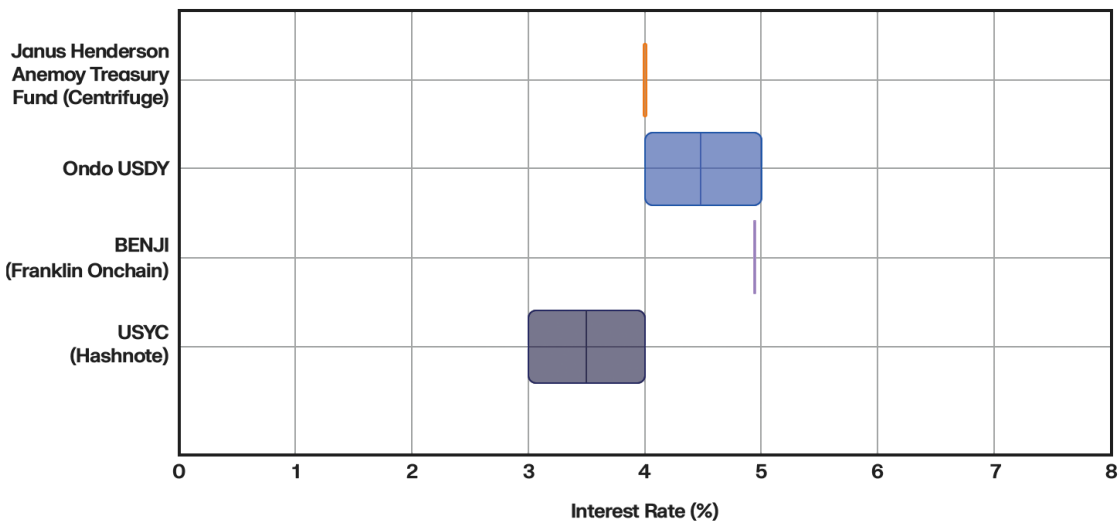
Flow of Tokenized Treasury Stablecoins: Permissioned vs. Permissionless Systems



This hybrid approach has spurred competitive innovation across products, each competing on factors such as structure, liquidity, fees, and user accessibility. The table below summarizes key offerings currently available in the market:

Product	Structure	Key features	Approx. yield (Recent)	Fees	Accessibility	Custodian
Janus Henderson Anemoy Treasury Fund (Centrifuge)	BVI-registered Professional Fund (offshore), managed by Anemoy Capital	Short term U.S Treasury with 0-3 months maturity	4.00%	0.15% Management fees	Non-U.S. Professional Investors only (excludes U.S.)	Pershing LLC
USYC (Hashnote)	Cayman private fund + US feeder fund (CFTC)	ERC-20, Overnight repo & T-Bills	~3–4% net	10% performance fee on yield, 0.10% redemption fee (USDC)	Non-US or US QEP (CFTC)	Bank of New York Mellon
BENJI (Franklin OnChain)	SEC-registered 1940 Act gov't money market fund	Government securities, partial onchain record-keeping	4.55%	0.15% Management Fees	U.S. retail/ institutional, stable $1.00 NAV	J.P. Morgan
Ondo USDY	Tokenized note from a bankruptcy-remote SPV (Reg S)	Over-collateralized T-Bills, on-chain token, 40-day restriction	~4–5% net (monthly set)	0.20% redemption fee, no mgmt/perf fee	Non-U.S. persons only, full KYC, on-chain liquidity after ~40 days	Morgan Stanley Smith Barney LLC

Interest Rate Comparison Across Treasury Investment Products



One persistent criticism of tokenized assets has been limited secondary market liquidity—a challenge now being addressed through institutional-grade liquidity provision networks. The Anemoy Liquidity Network (ALN), launched by Anemoy and Centrifuge in November 2024, represents a critical infrastructure development that directly addresses these concerns. Anemoy leverages partnerships with specialized market makers such as Keyrock to guarantee $125 million in instant redemptions and an additional $100 million in same-day liquidity for its Janus Henderson Anemoy Treasury Fund[13].

This development is particularly significant because it implements ETF-style market-making infrastructure for tokenized assets—solving a core problem that previously limited institutional participation.

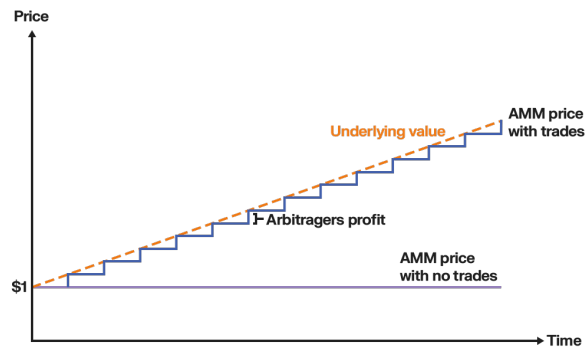
> *"We built the Anemoy Liquidity Network with one simple objective: ensure liquidity is accessible when investors need it most. Having been part of the ETF market-making ecosystem for over 15 years, I'm convinced that for RWAs to reach their full potential, we must apply the lessons from ETF capital markets. That's exactly what we're doing at Anemoy and Centrifuge"*
>
> – Anil Sood, Centrifuge Chief Strategy & Growth Officer, Anemoy Co-Founder[14]

3.3 Pricing Mechanisms and Technical Constraints

The technical design of tokenized Treasury products presents unique challenges that directly impact their adoption and utility. Two competing pricing models have emerged, each with distinct trade-offs:

Accruing Model (Price Appreciation):

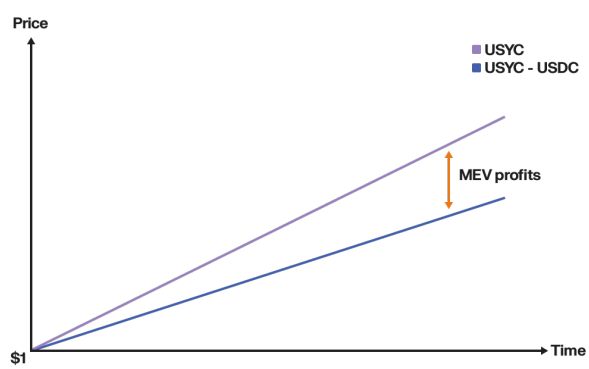
In this design, a token's price gradually increases to reflect accrued yield, starting at $1.00 and drifting upward over time (e.g., $1.02 after accumulating 2% yield). While this accurately represents the underlying asset's economics, it creates liquidity provision challenges.



- Automated Market Makers (AMMs) like Uniswap v3 rely on static price ranges, forcing liquidity providers (LPs) to constantly adjust positions or rely on arbitrage to capture yield.
- This often results in impermanent loss, as LPs may experience negative returns when tokens trade below their intrinsic value, reducing liquidity depth and discouraging market-making.

Rebasing Model (Quantity Adjustment):

This model keeps the token price fixed at $1.00 but adjusts token balances in holders' wallets periodically to distribute yield. While this prevents price drift, it introduces predictable rebasing events that sophisticated traders can exploit.



- Bots can front-run rebases by purchasing tokens immediately before a balance adjustment and selling right after, extracting value from long-term holders.
- This practice—often referred to as Rebasing Backrun Arbitrage (RBA)[15]—can distort market incentives and reduce capital efficiency.

These pricing complexities contribute to thin onchain liquidity, leading many tokenized treasuries to depend on oracles that assume a fixed 1:1 peg with the underlying collateral, rather than using dynamic pricing feeds from centralized or decentralized exchanges. This assumption limits their adoption as collateral in blue-chip DeFi applications like Sky (formerly MakerDAO) and Aave, which rely on robust, real-time price discovery to manage risk.

Solving this oracle and pricing challenge could unlock billions in additional demand, allowing tokenized treasuries to serve as high-quality collateral across DeFi lending markets

Similarly, the reliability of price data is crucial for institutional adoption of tokenized assets. Chainlink, the dominant oracle provider that enabled over $19 trillion in transaction value has been instrumental in addressing these data challenges[16]. By providing verified price feeds that connect onchain protocols with off-chain financial data, Chainlink solves a critical infrastructure problem that previously limited the use of tokenized treasuries as collateral. Their perspective on the technical requirements highlights why reliable pricing is fundamental to tokenization's success:

> *"Chainlink provides utility to tokenized assets by solving three major tokenization challenges around data and compliance, liquidity, and cross-chain synchronization. Solving these problems bolsters the quality of a tokenized asset and paves the way for replatforming the world's value into a tokenized format. Services like SmartData, Data Feeds, CCIP, Proof of Reserve, and more all being available in a single platform make Chainlink the only infrastructure capable of solving these core challenges."*
>
> – Colin Cunningham, Head of Tokenization & Alliances, Chainlink Labs

Chainlink is the standard for onchain finance, verifiable data, and cross-chain interoperability. Chainlink is unifying liquidity across global markets and has enabled over $19 trillion in transaction value across the blockchain economy.

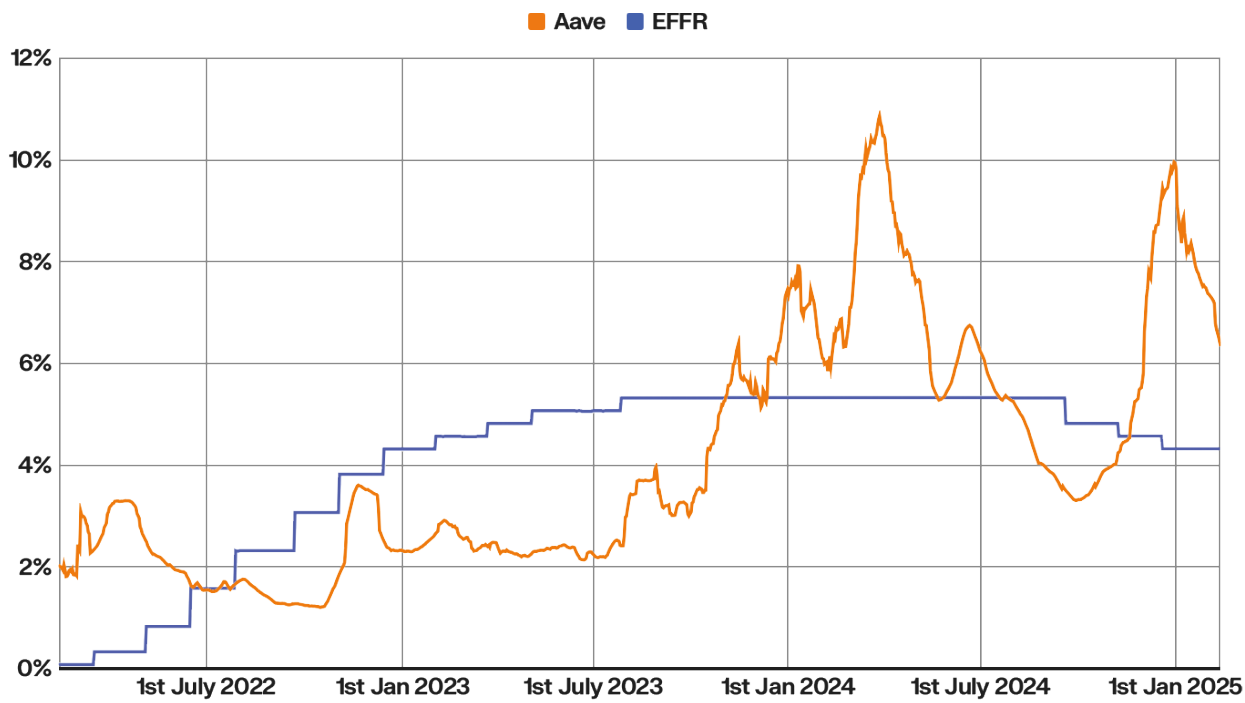
Major financial market infrastructures and institutions, such as Swift, Fidelity International, and ANZ Bank, as well as top DeFi protocols including Aave, GMX, and Lido, use Chainlink to power next-generation applications for banking, asset management, and other major sectors.

Moreover, Treasury-backed tokens exhibit yield behaviors that are particularly sensitive to macroeconomic shifts:

- **Low Treasury Yields** typically increase onchain borrowing costs, as risk-free alternatives become less attractive, driving demand for leverage. This enhances the value of high-quality collateral like USDC, which remains in strong demand as a borrowing asset.

- **High Treasury Yields** can reduce demand for stablecoin collateral, as investors shift toward earning yield directly from tokenized treasuries instead of using stablecoins in DeFi lending markets. As a result, borrowing costs on platforms like Aave tend to decrease, since more capital is allocated to higher-yielding, lower-risk opportunities.

Interest Rate Comparison: EFFR Rates vs. Aave USDC



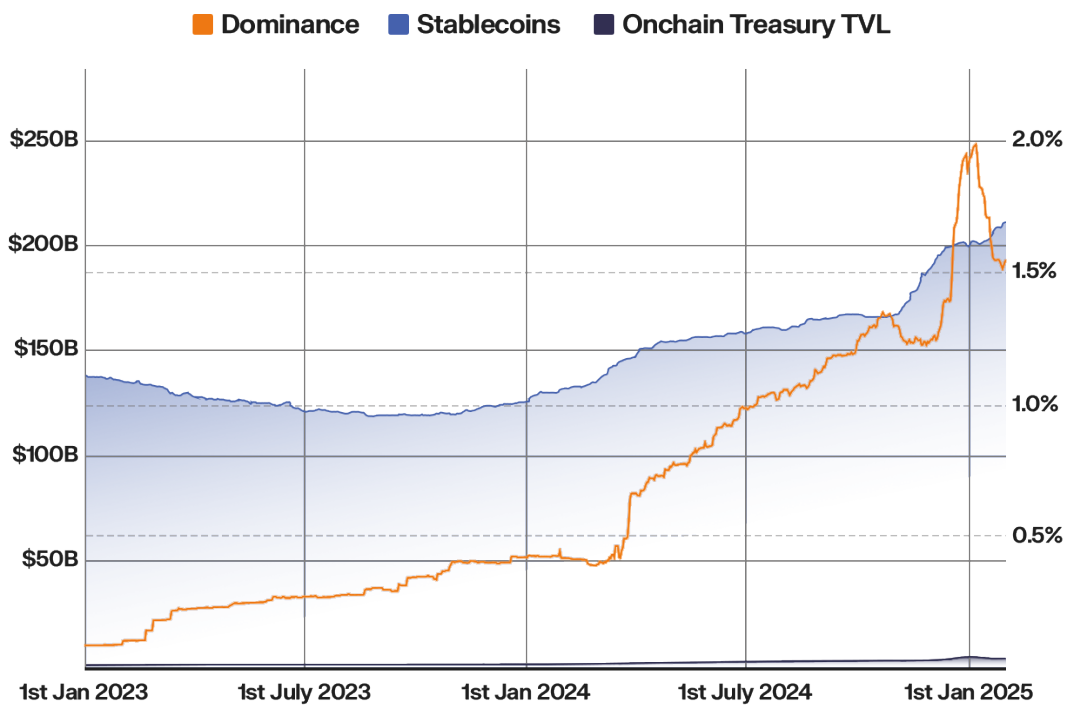
This dynamic creates a natural countercyclical hedge within DeFi ecosystems—as traditional rates rise, tokenized treasuries can absorb capital from pure stablecoins; when traditional rates fall, capital flows back to DeFi lending. This complementary relationship strengthens the overall resilience of onchain financial markets by creating multiple, interconnected yield paths rather than leaving the system dependent on a single yield source. For traders and liquidity providers, understanding these flows offers significant yield opportunities through strategic capital reallocation.

Yield comparisons—benchmarked against Aave's USDC rate—indicate that these products, though closely linked to treasury yields, provide relatively risk-free and competitive methods for users to earn yield on their stablecoins.

3.4 Market Outlook and Potential Adoption Scenarios

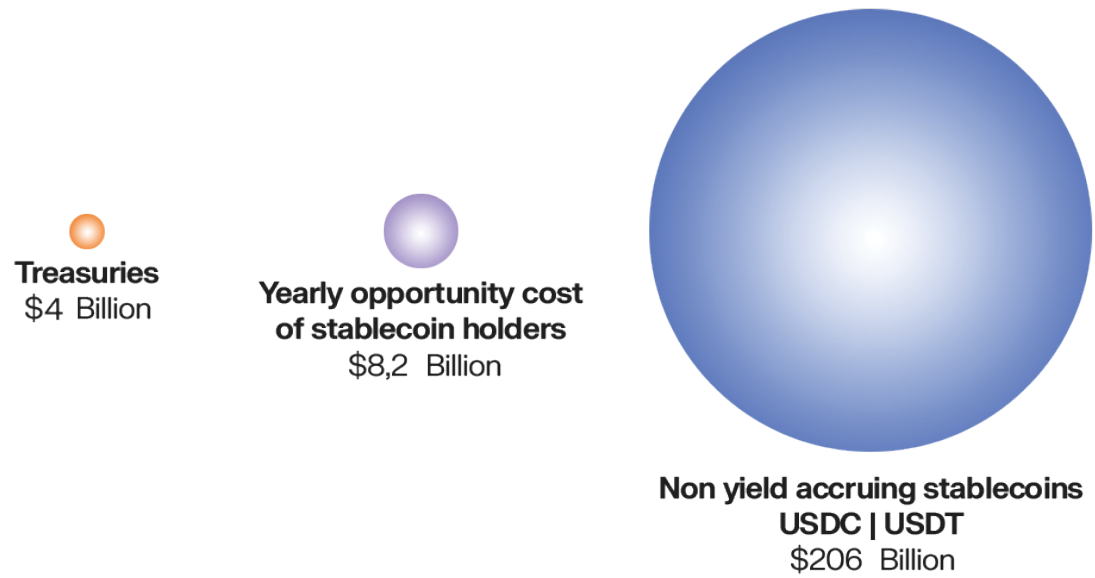
The current $4 billion in tokenized Treasury products represents just 2% of the stablecoin market—a penetration rate that reveals enormous growth potential. When compared to traditional finance, where money market funds holdings total over $7 trillion[17], the addressable market becomes even more compelling.

Onchain Treasury Assets vs. Stablecoin Market Size: A Comparative Analysis



With Treasury yields currently at approximately 4%, stablecoin holders[18] collectively sacrifice roughly $8 billion in annual interest by holding non-yield-bearing assets—creating a massive, immediate incentive for adoption.

Stablecoins vs. **Onchain Treasuries: Evaluating Unrealized Yield Potential**



Circle's acquisition of Hashnote in January 2025 represents the potential of the sector. By bringing USYC's Treasury yield capabilities under the same roof as the $55 billion USDC stablecoin, Circle has positioned itself to potentially offer seamless yield options to millions of existing stablecoin users. This strategic consolidation signals confidence from major financial infrastructure players and creates a pathway for rapid scaling through established distribution channels.

As Jeremy Allaire explained:

> *"We helped invent tokenized cash, and are now leading the way in tokenized money markets, both of which we believe will become essential to the future of the global financial system."* This consolidation of major players is likely to accelerate adoption and integration with traditional finance.
>
> – Jeremy Allaire, CEO, Circle[19]

Looking forward to 2025 and beyond, increased adoption appears inevitable as investors seek secure, yield-enhancing alternatives. The proven market viability of stablecoins suggests that incorporating Treasury-backed yield will resonate with evolving investor needs. While the adoption curve may be moderated by concerns over stability and regulatory clarity, broader participation by major asset managers is expected to bolster market confidence.

In parallel, traditional finance is likely to witness the emergence of structured products that blend stablecoins with tokenized Treasuries—unlocking new investment strategies for both retail and institutional players. Enhanced interoperability within DeFi will further enable these tokens to serve as robust collateral, key components in liquidity pools, and foundational elements in sophisticated yield optimization strategies.

> *"The demand for tokenized Treasuries is no longer theoretical - it's happening now. With institutions coming onchain, infrastructure maturing, and strong catalysts like the Sky $1B Tokenization Grand Prix, the foundation for widespread adoption is firmly in place. We've moved beyond proof-of-concept to building viable, long-term products that not only capture the opportunities of onchain capital markets today but also unlock the full transformative potential of blockchain for the future."* .
>
> – Bhaji Illuminati, CEO, Centrifuge

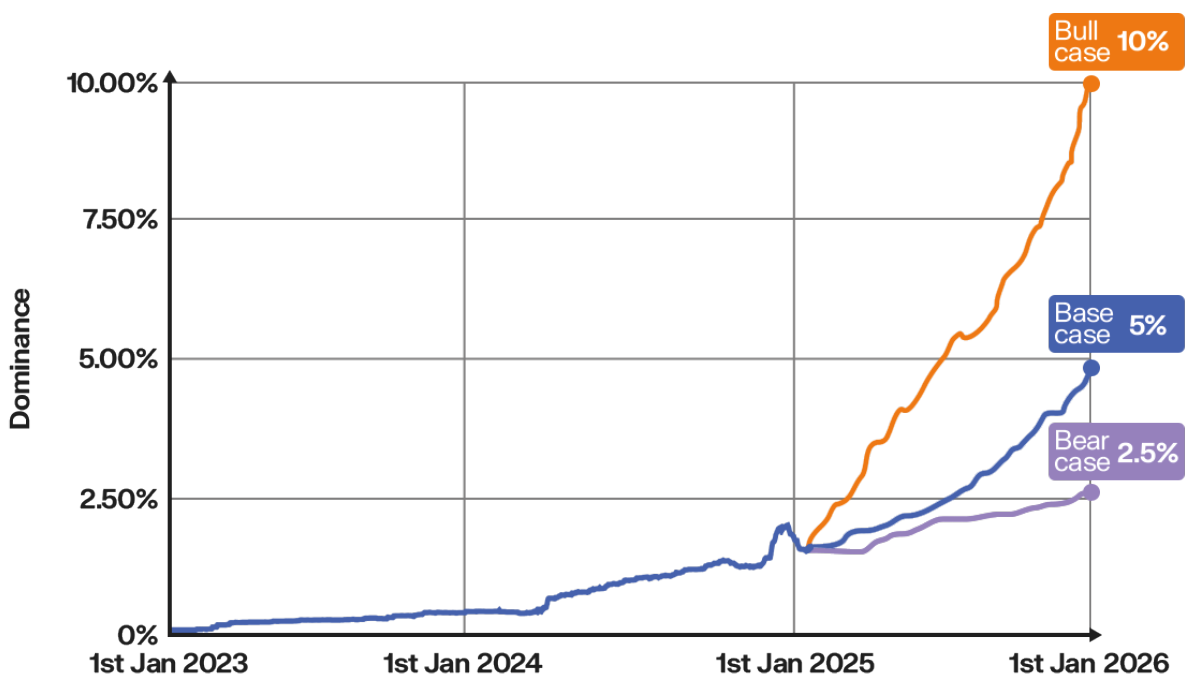
Our outlook for tokenized Treasuries remains very positive and we expect that treasuries have a breakout year in 2025:

- **Bull Case (10% of stablecoins, ~$28B):** This scenario assumes both supply-side and demand-side catalysts align—traditional asset managers accelerate tokenization of Treasury products, major DeFi protocols accept these tokens as top-tier collateral, and regulatory clarity enables broader institutional participation. In this scenario, we would expect to see both passive Treasury tracking tokens and more complex Treasury-backed derivatives gaining meaningful adoption. In our bull case, we also anticipate stablecoin adoption to continue its growth trajectory, further expanding the addressable market.

- **Base Case (5% of stablecoins, ~$14B) :** Our central projection envisions steady organic growth driven primarily by the inherent yield advantage of tokenized treasuries compared to zero-yield stablecoins. This growth would occur without requiring major external catalysts, instead following the natural market demand for yield from the existing $200+ billion stablecoin ecosystem.

- **Bear Case (2.5% of stablecoins, ~$7B) :** Even in a bearish scenario, where regulatory uncertainty or a significant smart contract exploit dampens enthusiasm, the fundamental value proposition of tokenized treasuries remains strong enough to support moderate growth. Under these conditions, we would expect to see consolidation around the largest, most secure issuers rather than continued product proliferation.

Forecasted Total Value Locked of **Tokenized Treasury Assets (2025)**



Following the widespread adoption of stablecoins and growing demand for native yield opportunities, U.S. Treasuries emerged as the natural first candidate for large-scale tokenization due to their uniform structure, established risk profile, and relative simplicity compared to more complex financial instruments. This successful implementation establishes critical infrastructure and market confidence that will serve as the foundation for tokenizing more complex asset classes, creating a blueprint for the broader transformation of traditional finance.

We expect tokenized Treasuries to evolve from a niche innovation into a core infrastructure component of global digital finance. Their impact will extend far beyond their direct market size by enhancing collateral efficiency, instant settlements, creating 24/7 access to government debt, and allowing for more integrated onchain yield strategies.

4.

Tokenized Equities

Extending Capital Market Access

4.1 Historical Context and Regulatory Considerations

Traditional equities markets have long been highly structured, operating through centralized exchanges (NYSE, NASDAQ, etc.), broker-dealers, custodians, and clearinghouses. Key features of the traditional system include:

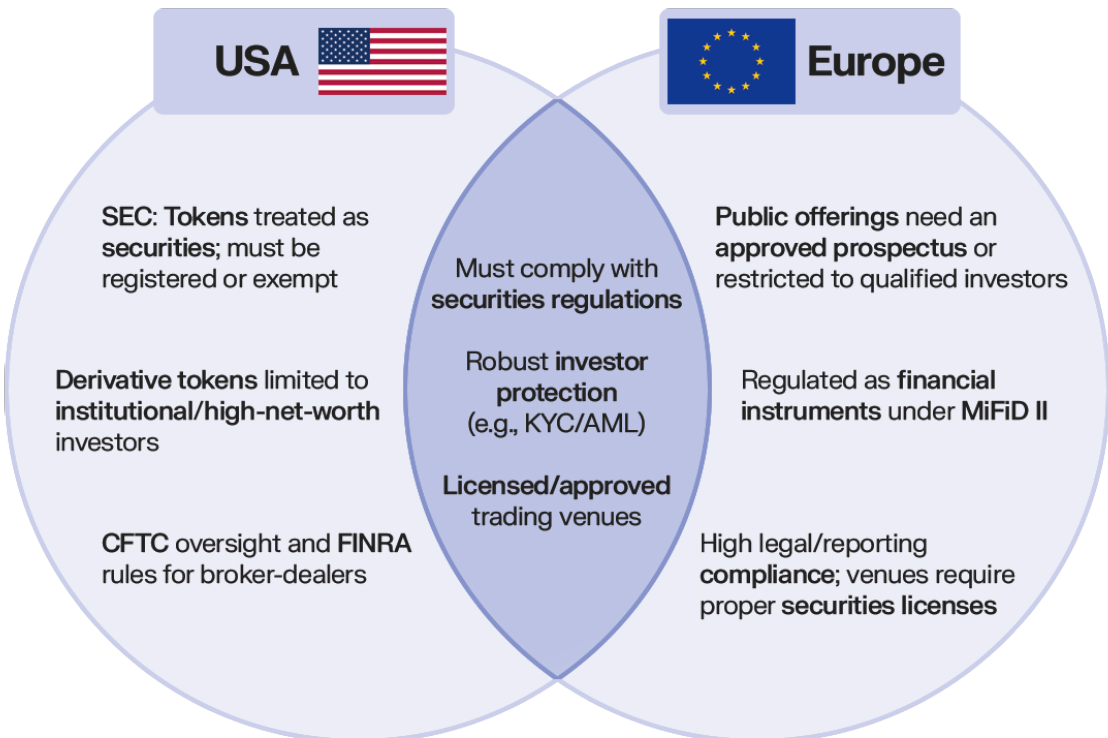
- **Centralized Clearing:** Trades must clear through a central counterparty (e.g., the DTCC in the U.S.), which introduces settlement delays.
- **T+2 Settlement:** Buyers and sellers typically wait two days for final ownership transfer—a lag highlighted during the 2021 GameStop frenzy, when brokerages halted buying due to heightened collateral requirements during the settlement window.
- **Layered Intermediation**: Shares are usually held in the name of brokers rather than as direct registered ownership, leading to potential transparency issues.

While equity markets are mature and liquid for major stocks, they are operationally constrained by business-hour trading, batch settlement, and access limitations for many global investors. Similar to tokenized treasuries, these inefficiencies create an opening for blockchain-based solutions that promise 24/7 trading, near-instant settlement, and direct ownership transfer without so many intermediaries.

However, despite the clear technological advantage, regulatory barriers have prevented traditional stocks from seamlessly integrating into blockchain markets. In the United States, tokenized stocks are rigorously regulated as securities or investment contracts under longstanding laws such as the 1933 Securities Act[20] and the 1934 Exchange Act. When a token replicates a share or delivers returns tied to a stock's performance, it is treated like any traditional equity, subject to full registration, detailed disclosures, and stringent trading requirements. Additionally, the requirement for trading platforms to register as national securities exchanges or alternative trading systems, coupled with FINRA's mandates on KYC/AML[21], makes the process complex.

In Europe and the United Kingdom, tokenized stocks are similarly integrated into existing securities frameworks, classified as financial instruments under MiFID II and the Prospectus Regulation rather than under the EU's newly enacted MiCA—which explicitly excludes crypto-assets that qualify as regulated financial instruments[22]. This means that public offerings require an approved prospectus unless specific exemptions apply[23], as illustrated by Germany's BaFin warning against Binance's 2021 token offerings that lacked the necessary disclosure documents, potentially exposing issuers to fines exceeding €5 million[24]. Moreover, trading venues must secure regulated licenses, such as operating as a Multilateral Trading Facility (MTF), and national legal nuances—like Liechtenstein's Blockchain Act and Germany's Electronic Securities Act (eWpG)—provide pathways for issuing and managing tokenized securities on blockchain registries.

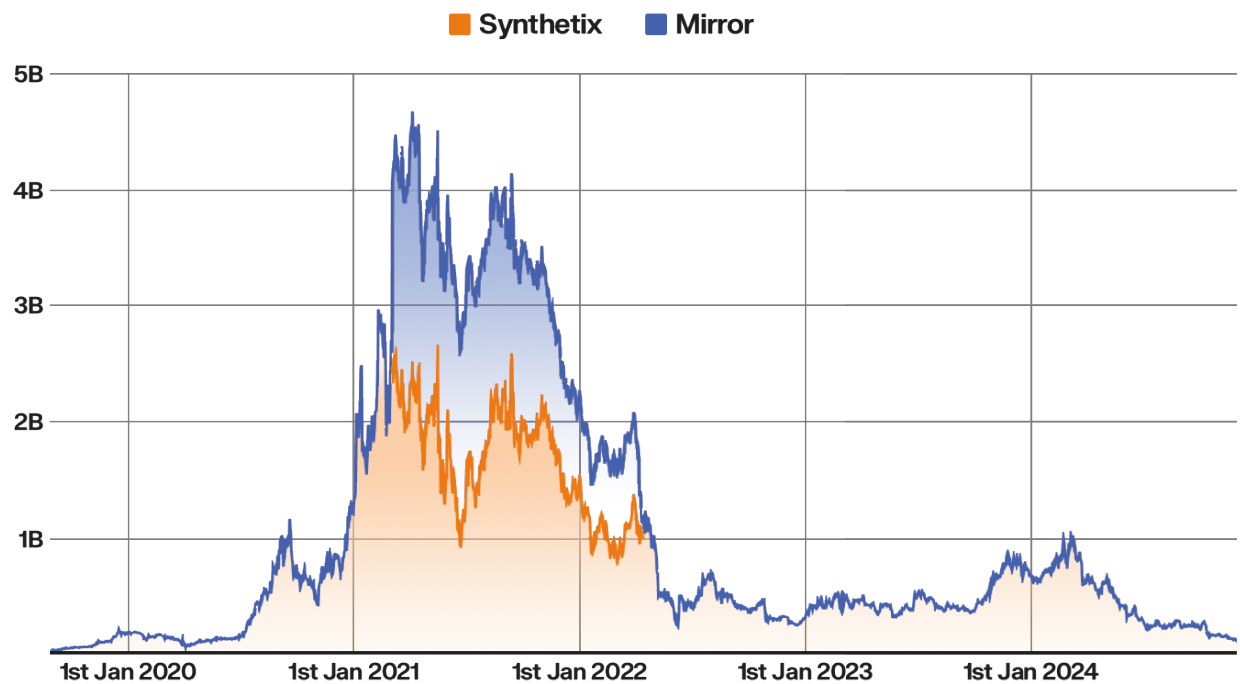
Tokenized Equities Regulation: United States and **European Union Compared**



4.2 History of Crypto Tokenization in Equities and Architectures

Despite the regulatory challenges, efforts to bring stocks onchain date back to the late 2010s. Early notions of "security tokens" envisioned digitizing shares with blockchain record-keeping, but adoption was slow due to regulatory hurdles. During the "DeFi Summer" of 2021, synthetic equities emerged in DeFi as a workaround: instead of representing an actual share, a synthetic token is created that tracks the price of a stock using an oracle. Users can buy and hold these synthetic positions to replicate the returns of their underlying stocks. Two protoc ols emerged as clear but temporary winners with this approach: Mirror Protocol and Synthetix.

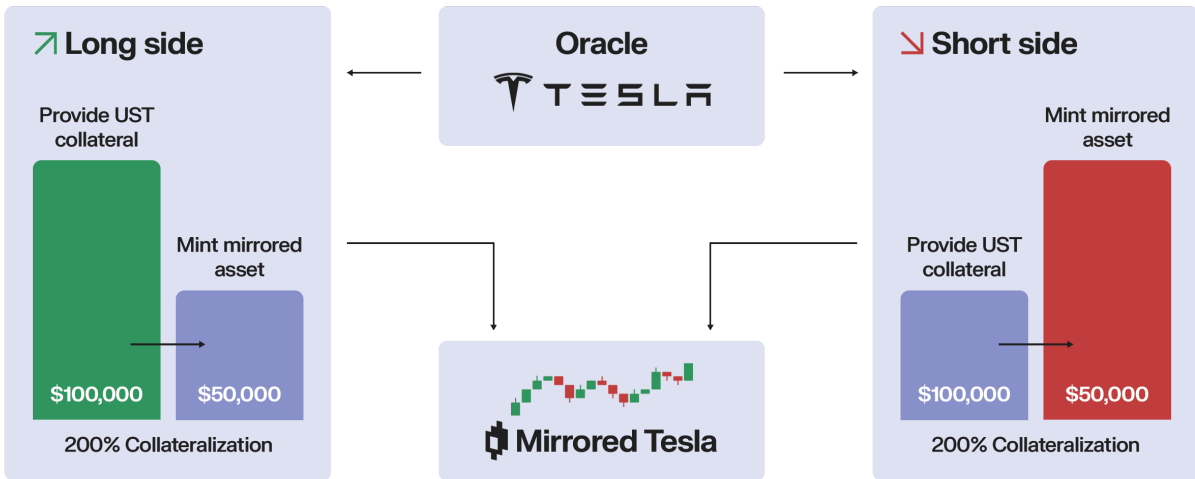
The fall of Synthetic Stocks



Mirror Protocol allowed users to create "mAssets" that synthetically mirrored the prices of real-world equities like Tesla or Apple. To mint these mAssets, a user would lock up UST in a collateralized debt position. Smart contracts from BAND protocol monitored the real stock price via oracles that updated roughly every 30 seconds. If the stock price rose and the CDP ratio fell below a set threshold, the user had to post more UST collateral or risk liquidation.

Arbitragers would keep the onchain price stable by minting and redeeming it with the current oracle price if the onchain price fell below its peg. While this approach provided immediate, global access to equities, it was inherently tied to UST's stability. When UST depegged in 2022, the entire system experienced cascading liquidations, demonstrating the fragility of synthetic structures backed by unstable collateral.

Minting Synthetic Assets on Mirror Protocol



Synthetix issues synthetic assets—"Synths"—using the protocol's native token, SNX, as collateral. The platform sets a high collateralization ratio (commonly 400–600%) to accommodate price volatility. For example, if a user mints a synthetic Tesla (sTSLA), that user effectively owes a "debt" denominated in Tesla's price, while holding a minted sTSLA token pegged to Tesla's real price. Oracles update Tesla's quote, causing the total debt to fluctuate. If Tesla's price climbs, the user's debt increases, compelling them to lock more SNX to stay above the liquidation threshold. This design offers leveraged exposure to equities without direct custodial requirements, but it is extremely capital-inefficient and demands active management of the collateral ratio.

4.2.1 Regulatory Challenges and Compliance Approaches

Unfortunately, these synthetic methods were not viable legal methods of creating securitized assets onchain. In the SEC's 2021 complaint against Terraform Labs' Mirror Protocol, mAssets were deemed security-based swaps[25]. While a December 2023 federal court ruling rejected this, finding mAssets lacked the bilateral risk transfer required for swaps, it left their broader status as securities unresolved.

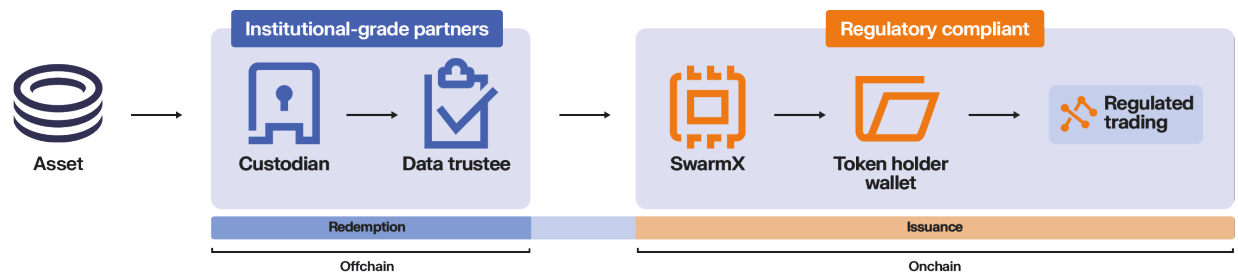
These products struggled not only from a technological perspective but also from a regulatory perspective. The table below summarizes historical approaches to tokenizing stocks:

Project/Platform	Model/Type	Failure Reasons
Mirror Protocol (Terraform)	Synthetic "mAssets" that tracked U.S. stock prices	- Depended on Terra's ecosystem (UST/LUNA), which collapsed - SEC action for unregistered security-based swaps
Synthetix (Stock Synths)	Over-collateralized synthetic stock tokens	- Low liquidity and user adoption - High collateral requirements for minted synthetic assets - Regulatory worries
Binance Stock Tokens	Fully-backed tokens for fractional shares	- Regulatory pressures from BaFin regarding an unapproved prospectus - Lacked full disclosures; forced to suspend product
FTX Stock Tokens	Fully-backed tokens via Swiss partner	- FTX's overall collapse destroyed trust in its tokenized product line - Bankruptcy overshadowed any specific regulatory confrontation

4.2.2 Evolving Legal Frameworks and Emerging Solutions

More recent ventures are focusing on compliance from the ground up. A proposed "Broker-Dealer Tokenization Act" in the U.S. aims to give broker-dealers explicit authority to issue and trade securities on distributed ledgers. By classifying "qualified tokenized securities" and allowing "approved broker or dealer" designations for those meeting custody, disclosure, and operations criteria, the bill could smooth the legal path for legitimate tokenized equity markets. This would allow custodians to tokenize a share held in an RWA vault that represents a claim to the underlying asset (similar to how tokenization of treasuries works)[26].

Tokenized Asset Minting Process



The momentum behind these legislative developments is further reinforced by political shifts, notably the start of the Trump presidency in 2025, which has opened new opportunities for tokenized securities. Industry sentiment reflects this optimism clearly:

> *"The macro situation has improved dramatically for Real-World Assets. With a crypto-friendly administration in the US, strong activity from Europe, Middle East, Africa, and Asia-Pacific regions, and the world's largest financial institutions like BlackRock making significant strides in tokenization, the time is finally right."*
>
> – Chris Yin, CEO and Co-founder, Plume Network

Plume Network is a Layer-1 blockchain dedicated to tokenizing RWAs, integrating them into the blockchain to enhance transparency and efficiency. It supports over 180 RWA finance projects, and has commitments for $4 billion in assets. Recent collaborations, such as with Ondo Finance, aim to expand its ecosystem by introducing tokenized U.S. Treasuries, offering investors access to Treasury-backed yields Plume's testnet saw over 18M wallets and 280M transactions in 2024.

Below is a comparison between asset-backed and synthetic securities:

Aspect	Synthetic	Asset-backed
Underlying Collateral	Backed by various forms of on-chain collateral (e.g., stablecoins or native tokens) rather than actual stock. No direct ownership of the real asset.	Fully backed by the actual security (e.g., real shares or bonds), often held in a regulated custodian or broker-dealer structure.
Regulatory Complexity	Elevated risk of being flagged as unregistered swaps if they replicate stock returns.	Must follow standard securities laws, but offer a clearer framework if properly disclosed/registered.
Capital Efficiency	Often over-collateralized (200–400%), resulting in high capital lock-up and inefficiency.	Typically 1:1 with real shares, so less excess collateral is needed, though reliant on share availability and demand.
Market Exposure & Accuracy	Fully-backed tokens via Swiss partner	Generally tracks the underlying asset accurately if custody and price feeds are robust.
Custody & Counterparty Risks	Dependent on protocol health and stablecoin reliability; collapses (like UST) can reverberate system-wide.	Regulated custodians mitigate certain failures, but remain subject to institutional risks (bankruptcy, fraud, etc.).
User Accessibility	Often permissionless or minimal KYC; easier for DeFi natives but carries higher risk of enforcement actions.	Historically requires KYC/AML; typically restricted to qualified or institutional investors, limiting broad retail access.

Several companies are pioneering the current market for tokenized equities with asset-backed securities, with two significant players emerging at the forefront:

Backed Finance:

Backed Finance is a pioneer in tokenized equities, issuing fully-compliant stock tokens via Swiss-regulated custodians. Founded around 2021, the company leverages Swiss DLT legislation and European regulatory frameworks through Liechtenstein's FMA to create permissionless access to tokenized securities. Their bCSPX (tokenized S&P 500 ETF) on Gnosis Chain, represents one of the first regulatory-compliant equity products with permissionless access.

Backed Finance has developed a regulatory-compliant yet permissionless approach to tokenized equities.

As Adam Levi explains:

> *"We started about four years ago with the idea to bring major assets onchain. After stable coins became the first kind of real-world assets onchain, we decided the next asset class would be public securities - S&P, Tesla, the big brands. For us, it was very important to have the tokens permissionless. Most security tokens have a whitelist with only 20 people on it, which isn't very interesting."*
>
> – Adam Levi, Co-Founder, Backed Finance

This emphasis on permissionless access represents a fundamental breakthrough in the tokenized securities market. By removing the traditional whitelist restrictions that have hampered security token adoption, Backed is targeting the massive untapped market of global investors who have been systematically excluded from equities markets.

Backed's model is distinct from many security token offerings through its regulatory approach:

> *"We were very bullish that it has to be permissionless, which makes it more difficult on the regulatory side. We were able to solve it mostly by relying on Swiss DLT legislation, which is probably the most advanced in the world today. We're a Swiss company actually issuing out of Jersey Island where the SPVs are located. We have a prospectus with the European Union through the FMA in Liechtenstein that we've passported throughout Europe. Our products are MiFID II retail-grade products throughout Europe with permissionless access."*
>
> – Adam Levi, Co-Founder, Backed Finance

By leveraging advanced Swiss DLT legislation and strategic European regulatory frameworks, Backed has created a model that maintains regulatory compliance while achieving truly permissionless access.

Ondo Global Markets:

Ondo Finance is a decentralized protocol specializing in tokenizing real-world financial assets, particularly U.S. Treasuries, for on-chain use. Ondo enhances investor access to institutional-grade yields by providing transparent, secure, and efficient exposure to Treasury-backed products.

The platform has rapidly expanded its ecosystem through strategic partnerships, including BlackRock's tokenized fund, BUIDL, enabling instant settlements for its U.S. Treasury-backed token, OUSG, and facilitating 24/7 subscriptions and redemptions. Further, in February 2025, Ondo partnered with Mastercard to integrate OUSG into Mastercard's Multi-Token Network (MTN), allowing businesses to earn daily yields via tokenized assets with continuous access, eliminating the need for stablecoin onramps or settlement windows.

Ondo has expanded into tokenized equities through their Ondo Global Markets (GM) platform and specialized Ondo Chain infrastructure. Ondo's approach prioritizes institutional compliance and addresses fundamental barriers to bringing securities onchain at scale.

Ondo Chain introduces specialized capabilities designed specifically for tokenized equities, addressing key limitations of general-purpose blockchains. It natively supports corporate actions such as stock splits and dividends, which are difficult to implement within traditional DeFi protocols. Its institutional validator network, operated by financial institutions, ensures regulatory compliance while mitigating risks like front-running and enabling best execution. It also features enshrined proof of reserves, where validators automatically verify with custodians that asset tokens are fully backed by underlying securities.

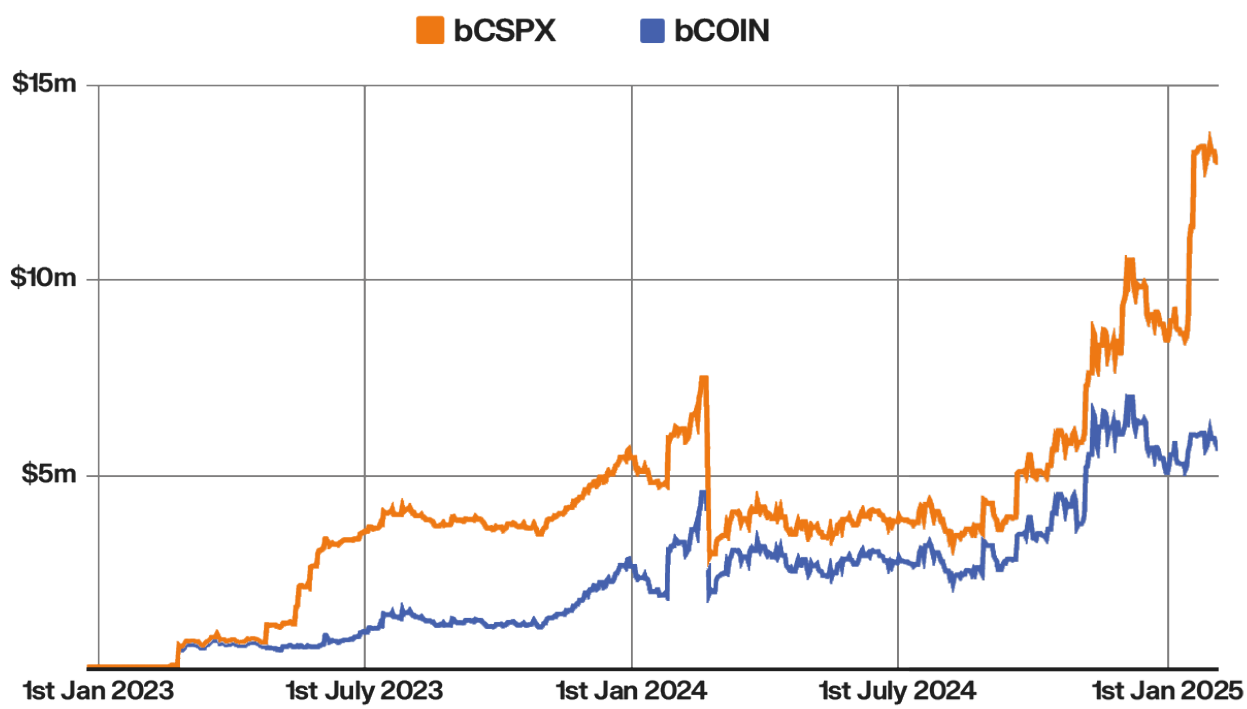
"Ondo Chain is a Layer 1 proof-of-stake blockchain purpose-built to accelerate the creation of institutional-grade financial markets onchain. By combining the openness of public blockchains with the compliance and security features of permissioned chains, Ondo Chain provides the infrastructure to enable tokenized real-world assets to be used at scale."

– Ondo Finance[27]

This public-permissioned approach creates a model where regulated institutions can participate in issuing and validating tokenized securities, while the broader ecosystem remains open for users and developers.

This interoperability with DeFi represents a paradigm shift in capital markets access. The combination of access and composability with DeFi protocols creates unprecedented opportunities for global participants previously excluded from traditional finance. The democratization of sophisticated financial tools through non-KYC, permissionless protocols promises to unlock trillions in untapped market potential from previously underserved regions and populations. While tokenized stocks have not seen large growth yet with small TVL, we expect this to change soon.

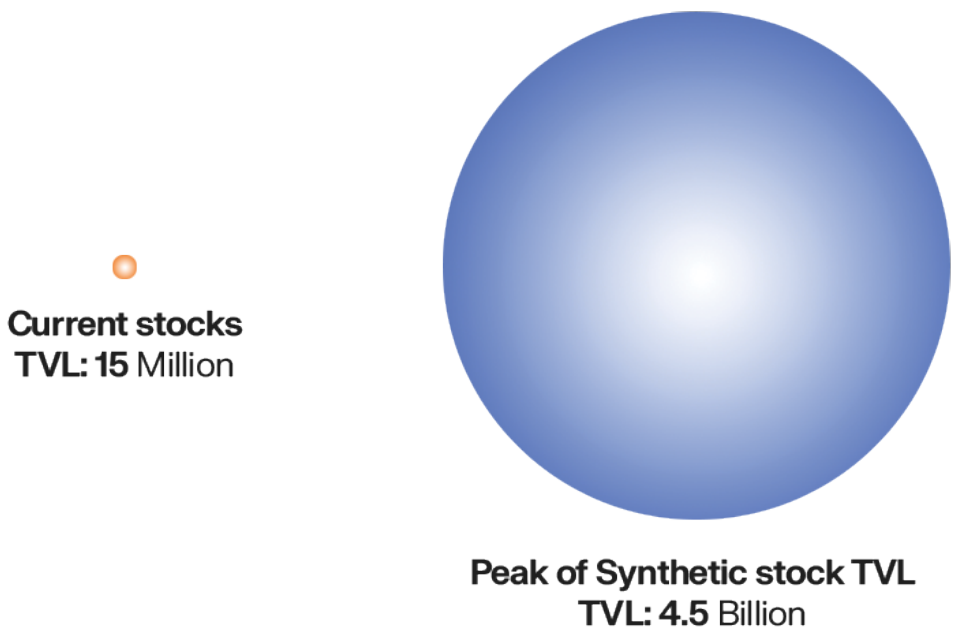
Growth of Onchain Equities | Total Value Locked



4.3 Market Prospects and Growth Trajectories

The evolution of tokenized stocks is at a pivotal juncture, underscored by the necessity for robust regulatory clarity and the establishment of a sound architectural framework. Despite advancements in regulation and infrastructure, adoption has lagged. **At their peak in 2021, synthetic stocks had a TVL approximately 300 times greater than that of current tokenized stocks**[28].

Comparison of Total Total Value Locked of Stocks vs. Synthetic Stocks at Peak Levels



Despite increased regulatory frameworks, Synthetic stocks had **300x more TVL** than backed stocks

For tokenized stocks, the primary challenge has shifted from regulatory concerns to demand dynamics. Unlike tokenized treasuries, which integrate seamlessly into crypto financial primitives and are accessible to a broad audience, tokenized stocks have traditionally faced significant bottlenecks due to KYC requirements. The models emerging from protocols like Backed and Ondo address the technical requirements of securities markets that general-purpose blockchains haven't been able to previously effectively handle.

Looking ahead, the future of tokenized equities appears promising as both regulatory frameworks and technical infrastructure mature. Backed envisions a future where tokenized equities become standard practice:

The addressable market for permissionless, non-KYC equity access is potentially orders of magnitude larger than the current KYC products. By removing geographical restrictions, minimum investment requirements, and cumbersome identity verification processes, tokenized equities could unleash unprecedented global retail participation.

Drawing parallels to the state of tokenized treasuries in 2023, tokenized stocks appear to be at a similar inflection point but with significantly greater upside potential due to the permissionless innovations. With the proper infrastructure development, enhanced composability within DeFi, and regulatory tailwinds, the growth trajectory could be exponential rather than linear.

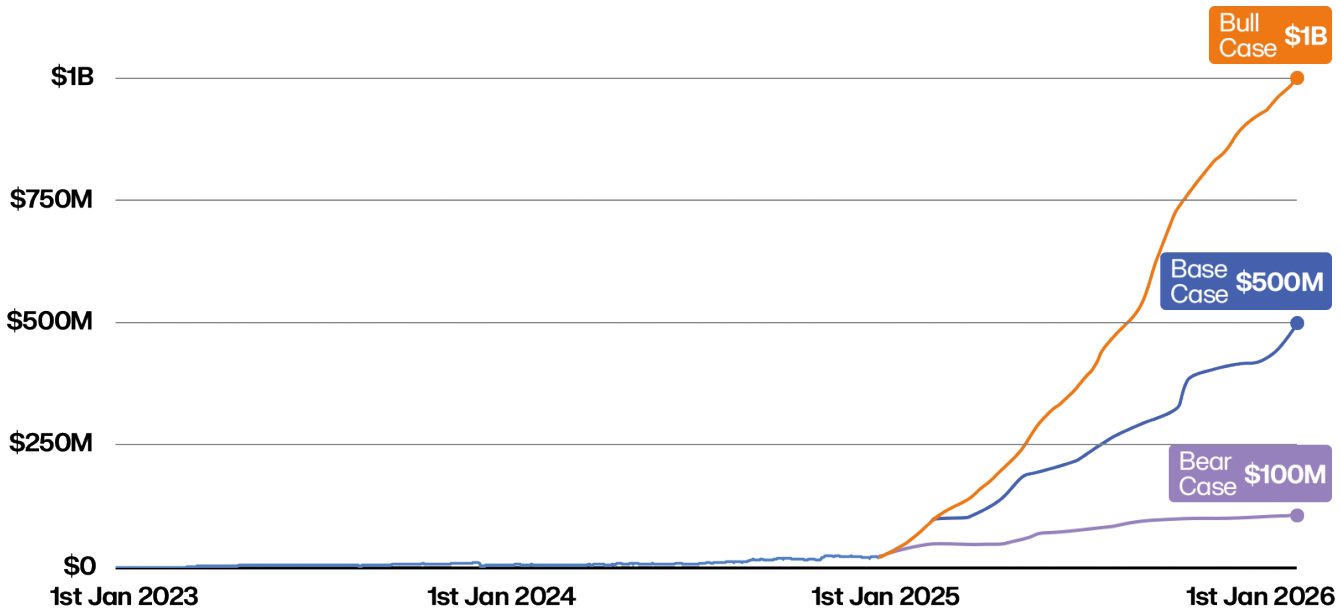
Our outlook for tokenized stocks for 2025 is:

- **Bull Case ($1 Billion):** This valuation becomes achievable through a combination of regulatory clarity and widespread permissionless access. If Trump-era regulations evolve to permit the tokenization and trading of stocks without strict KYC requirements as anticipated, we could see exponential market expansion driven by global retail participation and institutional adoption. The integration of tokenized stocks into major DeFi protocols would further accelerate this growth by enabling leverage, derivatives, and automated investment strategies.

- **Base Case ($500 Million):** This scenario anticipates robust growth facilitated by platforms like Backed and Ondo GM, which aim to create significant additional liquidity in the market. Permissionless access models gain traction in Europe while the U.S. regulatory framework continues to evolve favorably, though not as rapidly as in the bull case. Major exchanges list tokenized equities, and DeFi integration begins to show promise.

- **Bear Case ($100 Million):** Even in a conservative scenario, the permissionless innovation represents a substantial improvement over current models. While regulatory progress might be slower than anticipated, the inherent efficiencies and global access benefits would still drive modest growth compared to traditional securities tokenization approaches.

Forecasted Total Value Locked of **Tokenized Equities (2025)**



Overall, while the foundational infrastructure for tokenized stocks is rapidly developing, substantial market adoption is likely to accelerate dramatically through 2025 and beyond. The combination of permissionless access, DeFi composability, and an improved regulatory landscape creates the conditions for tokenized equities to become one of the most transformative applications of blockchain technology in traditional finance.

5.

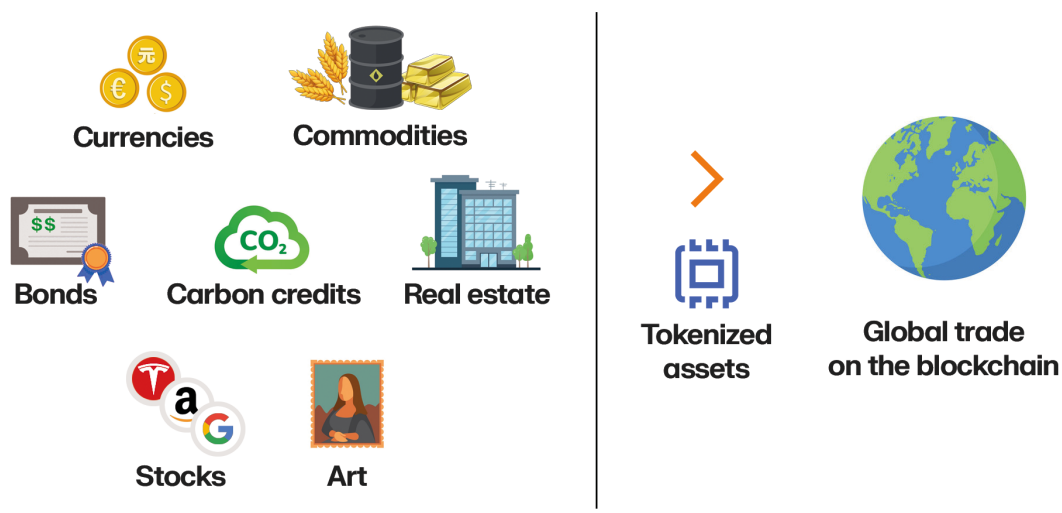
Tokenized Commodities

Progress and Limitations

5.1 Overview of Commodity Markets and Key Drivers

The commodities market encompasses physical goods such as precious metals (gold, silver), energy (oil, natural gas), and agricultural products (wheat, coffee), among others[29]. These markets operate through a mix of spot trading (for immediate delivery) and derivatives trading (futures, options, and forwards on exchanges like CME or ICE, or via OTC deals). The infrastructure is complex: while major commodity exchanges list standardized contracts, physical trade requires networks of warehouses, inspectors, shipping logistics, and trade finance banks. Key participants include producers (miners, farmers), consumers (manufacturers, utilities), trading firms, financial speculators, brokers, and clearinghouses for futures.

Unlike securities, many commodities are generally not subject to securities regulations. Owning a bar of gold or a barrel of oil is typically a commercial transaction rather than an investment contract. As a result, tokenizing a commodity—such as issuing a token representing one ounce of gold stored in a regulated vault in London—often avoids the regulatory pitfalls that complicate the tokenization of stocks or bonds. In this context, tokenized commodities function similarly to digital warehouse receipts[30]. They benefit from regulatory frameworks that emphasize custodianship and physical asset transparency (for example, under the U.S. Commodity Exchange Act and the EU's MiCA), rather than the complex investor protections required for securities. This regulatory distinction allows tokenized commodities to represent direct ownership of standardized, audited assets (as seen with PAX Gold's Brink's storage) while sidestepping issues such as corporate voting rights or the need for integration with centralized depositories like the DTCC.

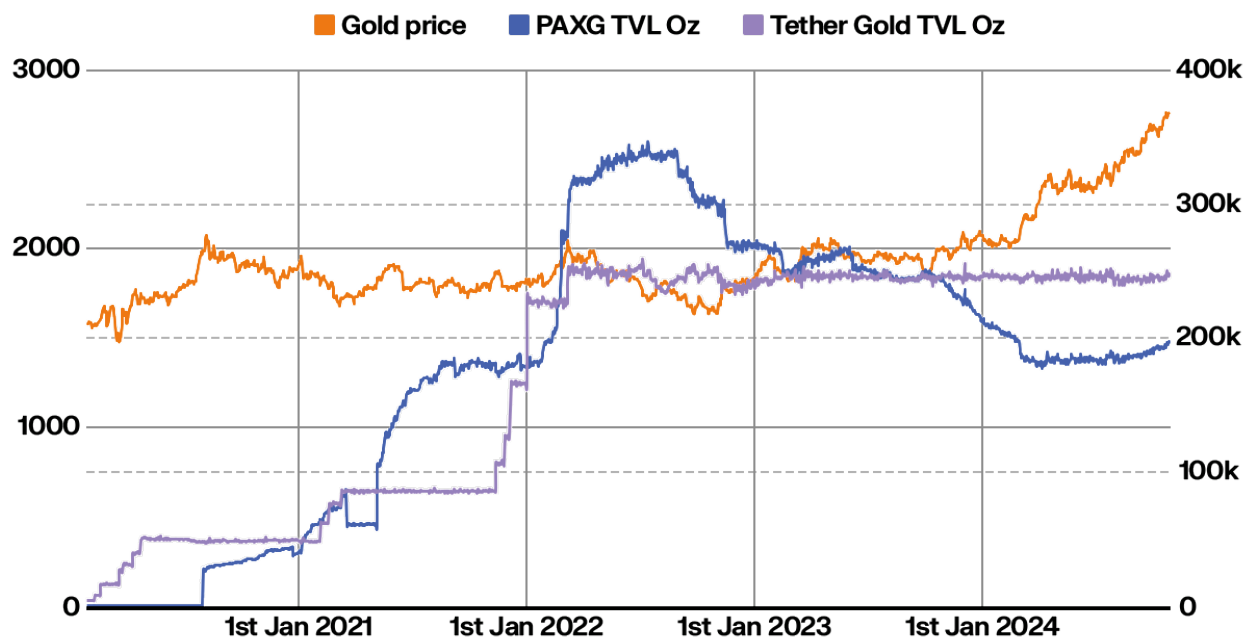


5.2 Leading Tokenized Products and Their Market Impact

Among tokenized commodities, Gold has emerged as the clear leader, with Pax Gold (PAXG) and Tether Gold (XAUT) as the notable frontrunners. In an interview with Keyrock, Paxos representatives have highlighted the key differences between these two offerings, stating:

> *"The key differences between PAXG and XAUt is regulatory status as well as transparency. … Each PAXG token represents ownership of a specific gold bar. Token holders can view details such as the bar's serial number, weight, and purity, ensuring clear accountability."*
>
> – Charles Cascarilla, Paxos Interview

Gold Onchain: Total Tokenized Supply (Ounces)



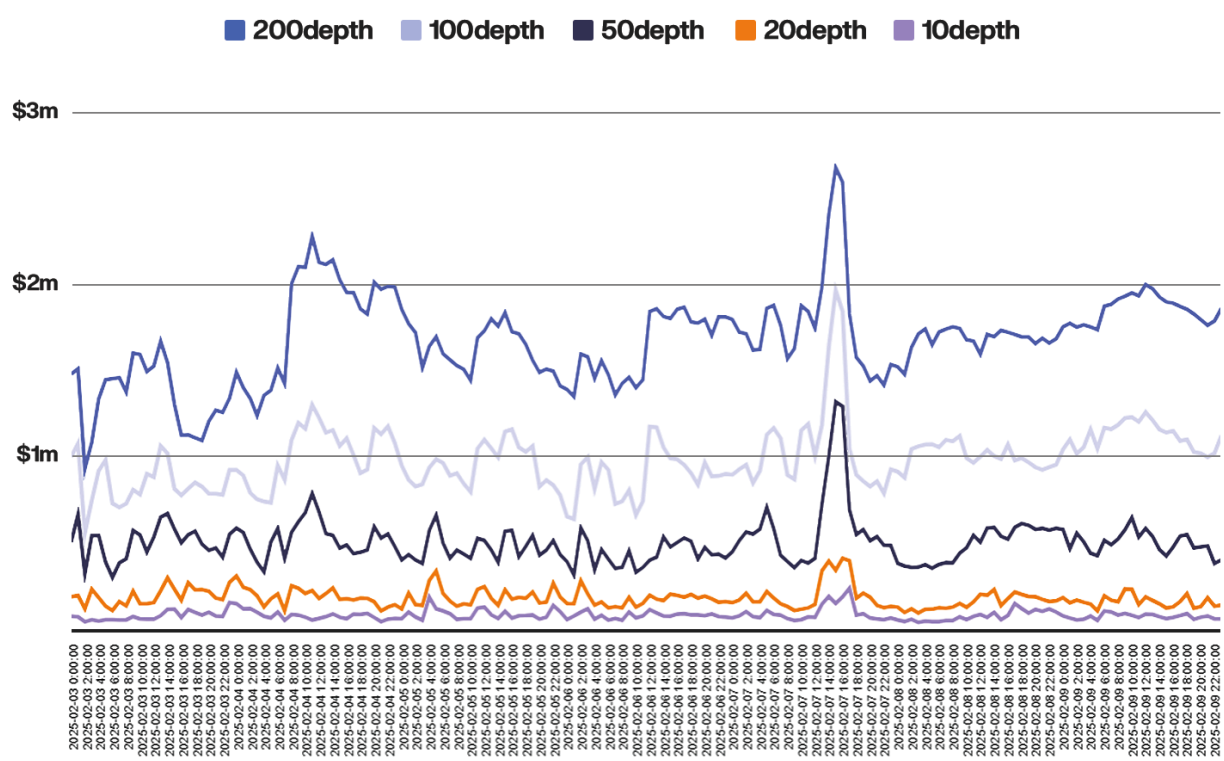
While gold is one of the most heavily traded assets globally—often surpassing major fiat currencies in daily volume—tokenized gold derivatives like PAXG and XAUT experience markedly lower volume and depth on digital exchanges. Price premiums above spot can emerge, especially during periods of market volatility. For instance, Binance at times has seen up to a 5% premium (500 basis points) on PAXG or XAUT, underscoring the mismatch between global gold markets and onchain liquidity.

Paxos is a regulated blockchain infrastructure company that specializes in issuing, and custodying digital assets. Known for its fully-backed stablecoins like Pax Dollar (USDP) and Pax Gold (PAXG), Paxos bridges traditional finance and crypto with a strong emphasis on compliance. The company is regulated by the New York Department of Financial Services (NYDFS) and provides blockchain solutions for global leaders in financial services.

Paxos ensures that its digital assets are backed by 1:1 redemption and held in accounts protected from bankruptcy, offering a secure and reliable platform for digital asset management. **Paxos issued PayPal's USD-backed stablecoin, PYUSD, in August 2023, marking a rare instance where a major fintech giant (PayPal) fully embraced blockchain via a regulated partner.**

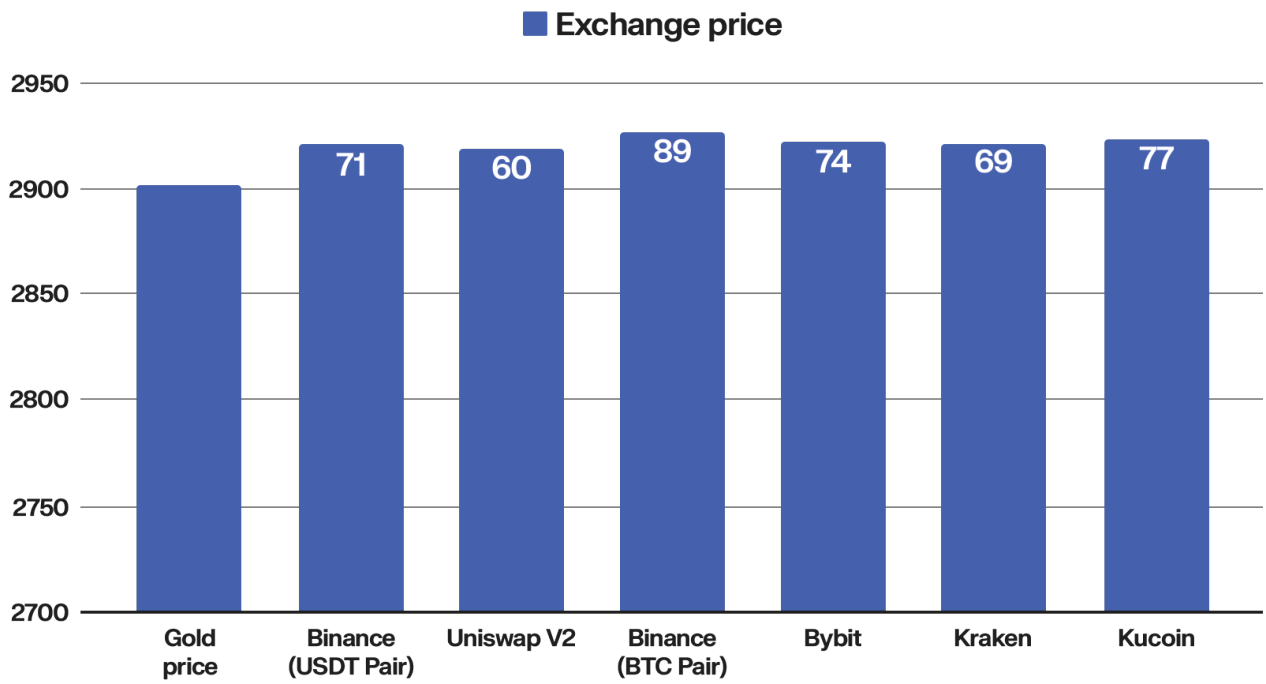
Additionally, onchain analysis indicates that PAXG has seen limited uptake in DeFi, with only around $3 million deployed across various protocols[31]. This modest DeFi usage is partly due to the reliance on arbitrage rather than a robust order book. When tokenized gold trades above its real-world spot price, specialized arbitrageurs are incentivized to mint new tokens and sell them at a premium.

PAXG Aggregate Liquidity Depth

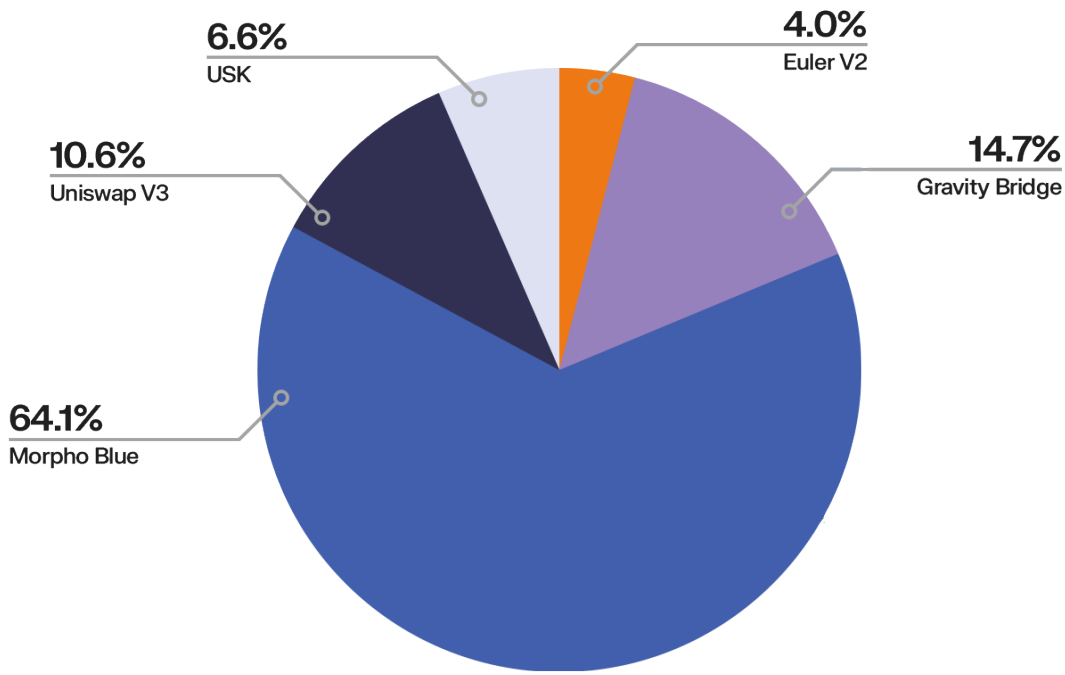


However, during periods of high volatility, the spread may widen beyond what short-term capital can immediately correct. Market makers balance the incentive to let the price drift above peg to capture higher premiums against the operational frictions involved.

PAXG Price Deviations on **Centralized Exchanges**



PAXOS Gold Utilization in DeFi protocols



Two additional concerns arise from oracle design. First, if DeFi platforms depend on exchange-based PAXG prices, sudden dips in onchain liquidity or rapid premium fluctuations can trigger liquidations even when the real-world gold price remains stable. Alternatively, if a protocol uses a spot gold price oracle, a custodian or redemption failure might allow an attacker to purchase PAXG at a discount while the oracle still reflects a higher market value, potentially draining protocol treasuries.

While these challenges are significant, the current landscape also offers important positives that lay the groundwork for future growth. The successful tokenization of gold demonstrates that blockchain technology can provide transparent, verifiable proof of ownership and enable 24/7 global trading of physical assets. Platforms like PAXG have built trust through detailed tracking of each gold bar, enhancing investor confidence. Moreover, the regulatory framework for commodities is comparatively more adaptable than that for securities, offering a smoother path for tokenization. These factors—combined with the inherent efficiencies of blockchain-based trading—suggest that with improvements in liquidity, oracle design, and redemption mechanisms, onchain commodity markets have the potential to evolve significantly.

An alternative direction is also emerging: purely synthetic commodity exposure that forgoes physical redemption. Protocols like Ostium let users go long or short on gold (or other commodities and RWAs) with margin, referencing off-chain spot prices oracle. This approach addresses the demand gap among traders who find physically redeemable tokens cumbersome.

"If you ask a typical retail trader whether they want to store a tokenized bar of gold in their wallet, they usually say no. They want to go long or short with leverage and pocket the price difference, that's why we built a decentralized CFD model—so people can trade commodity volatility the same way they do crypto, but still lean on DeFi's transparency."

– Kaledora Kiernan-Linn, Co-Founder, Ostium Labs

Ostium is an emerging decentralized finance platform that has developed a decentralized perpetuals exchange for trading real-world assets, including commodities like gold and oil, as well as indices. The platform offers leveraged trading with up to 200x leverage, ensuring full self-custody and transparency. Ostium aims to make commodity and forex trading more accessible by eliminating traditional restrictions and providing a seamless on-chain trading experience.

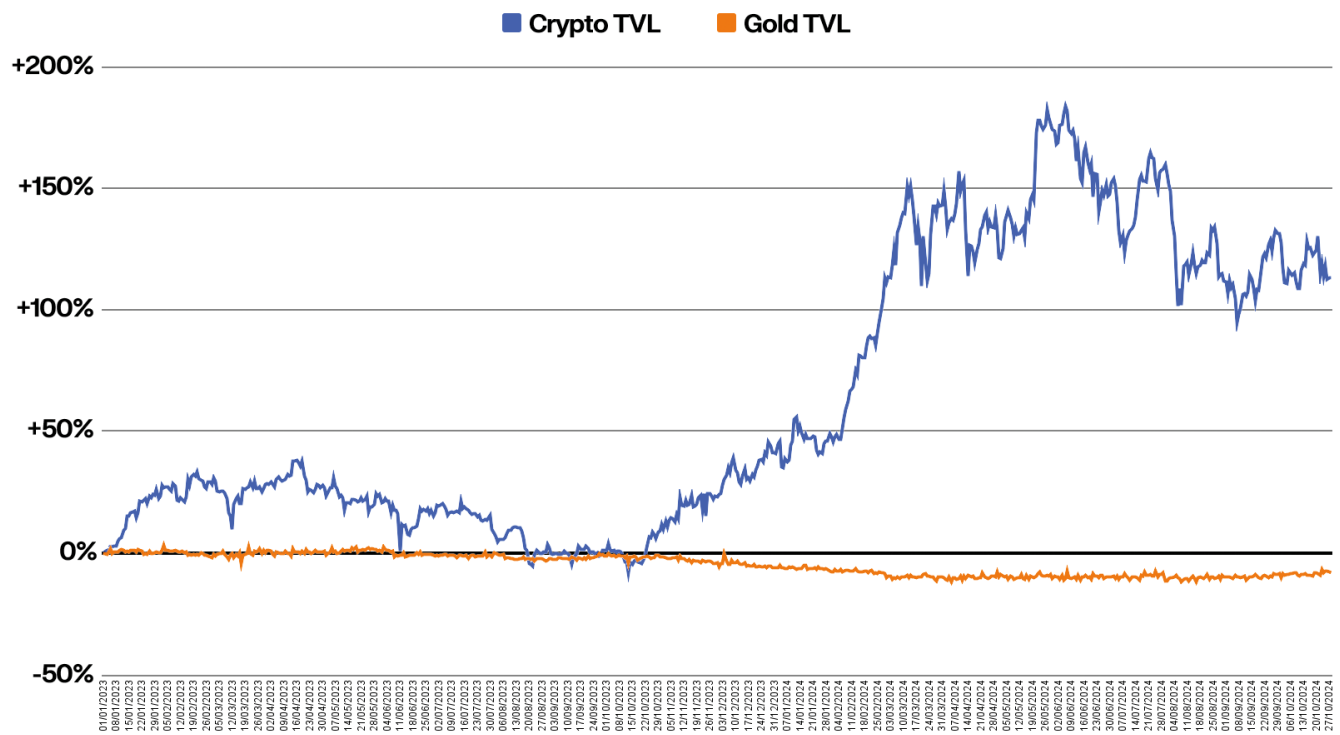
By issuing purely synthetic positions, Ostium ensures its prices match real-time oracles for the underlying commodity rather than relying on redemption-based arbitrage. Unlike PAXG or XAUT, there is no right to receive physical gold; instead, traders trade against a stablecoin pool, and get their PNL from the pool.

This architecture allows the protocol to list nearly any commodity or real-world asset with a reliable feed—so far including gold, silver, and copper—reflecting the view that **"most traders just want short-term speculative exposure, not physical delivery."** Ostium's approach thus highlights the trade-off: for many retail traders, leveraged speculation is more appealing than storing a physically redeemable token, yet institutions seeking guaranteed settlement may be less inclined to adopt purely synthetic models. By allowing high leverage and a more diverse range of RWA, this approach might solve the demand side of commodities trading.

5.3 Future Outlook: Adoption Catalysts and Potential Market Growth

Tokenized commodities have so far struggled to gain significant traction in the digital asset space. **Despite the relative success of gold-backed tokens like PAXG and XAUT, the overall market remains small—around $1.2 billion—with concerning trends such as PAXG's 28.5% decline from 588,000 oz to 420,000 oz during the broader crypto market recovery**[32].

Diverging Trends: Onchain Gold TVL Decrease vs. Overall Crypto TVL Increase

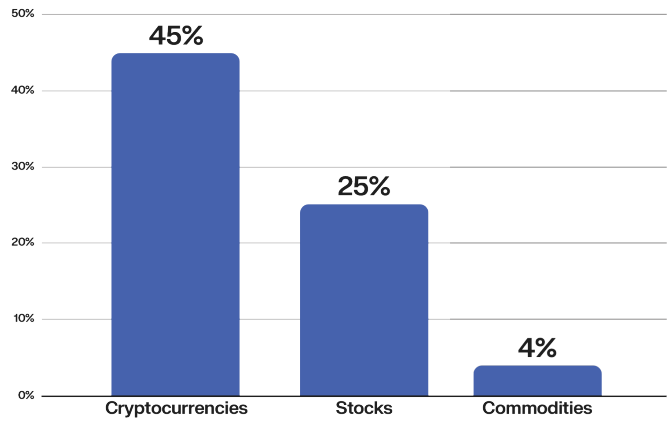


Looking ahead to 2025 and beyond, our view is one of cautious modesty.

We see potential only for limited growth or stagnation in tokenized commodities unless a major catalyst emerges or a broader array of commodities—beyond gold—is successfully tokenized. Institutional players dominate traditional commodities markets with access to sophisticated trading infrastructures. Retail crypto investors have shown limited interest in holding tokenized commodities, preferring Bitcoin as their store of value. There appears to be a mismatch between the risk appetite of institutional investors, who already benefit from deep liquidity systems, and the current state of tokenization. Similarly, early retail adopters for tokenized treasuries and stocks have yet to show strong interest in commodity tokens.

Commodities Trading

Retail Investor Participation by Asset Class



> *"The real-world asset commodities market is experiencing slower adoption … Minting is primarily driven by retail customer demand. Those same customers are digitally native and have also chosen Bitcoin as their store of value."*
>
> – Charles Cascarilla, Paxos Interview

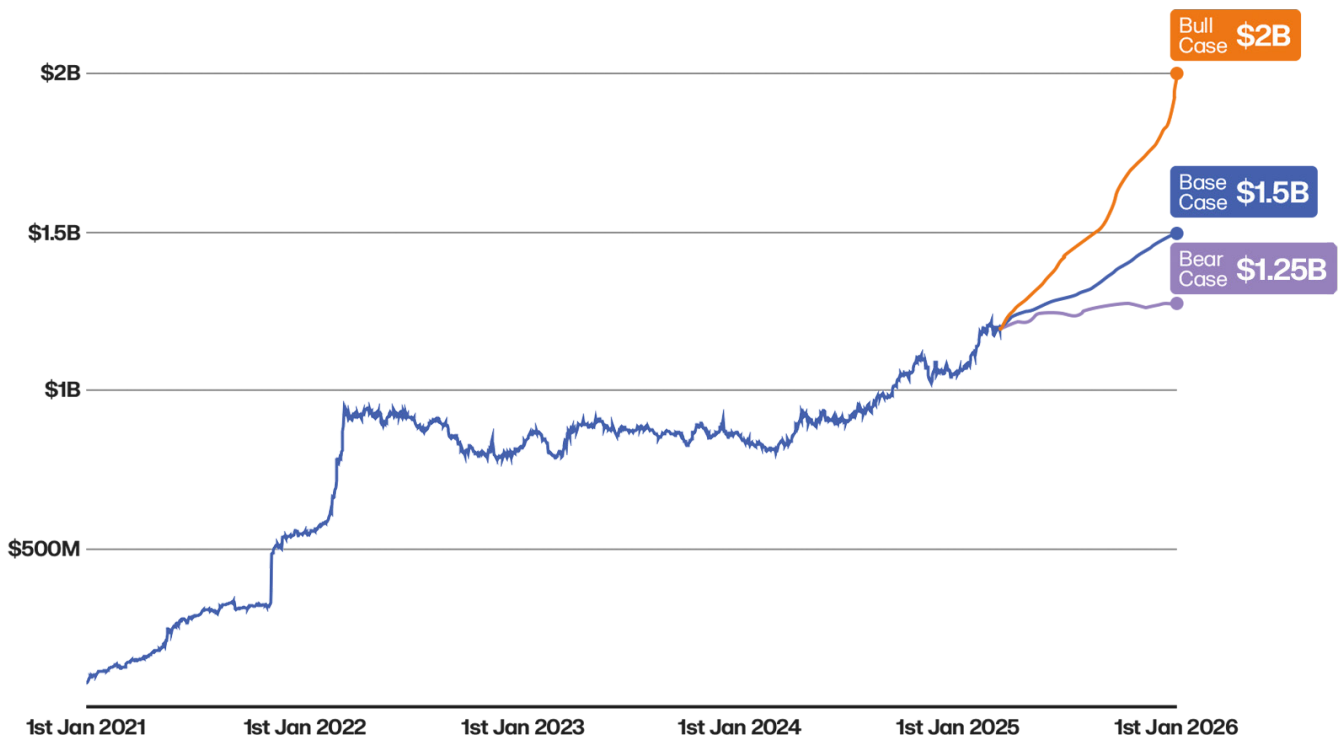
Nonetheless, two parallel paths could support future growth. First, more mature redemption options—potentially with lower fees, integrated insurance, or streamlined logistics—could make physically tokenized metals like PAXG more attractive for users seeking a stable, non-fiat store of value. Second, synthetic derivatives such as Ostium may capture the short-term speculative demand that has largely overlooked physically redeemable tokens. By offering a CFD-like trading experience and broadening the range of commodities to include everything from oil to copper, these protocols might shift onchain commodity trading from a slow-moving physical-ownership model to a dynamic, leveraged market.

- **Bull Case ($2 Billion TVL):** With new offerings on PAXG and enhanced DeFi applications, combined with effective incentive programs, substantial growth could occur. Although $2 billion is still relatively low, this target is achievable with the right catalysts and the potential creation of new on-chain commodities.

- **Base Case ($1.5 Billion TVL):** The market remains roughly at its current size, with existing products continuing to operate but facing challenges in attracting new users without major innovations.

- **Bear Case ($1.25 Billion TVL):** The market contracts further if institutional investors continue to favor traditional platforms and retail interest remains tepid, potentially leading to reduced support from major issuers.

Forecasted Total Value Locked of Tokenized Commodities (2025)



In any case, demand-side inertia remains the key obstacle. So far, neither physically redeemable nor synthetic offerings have unlocked robust retail interest comparable to other tokenized real-world assets. Still, the emergence of protocols like Ostium suggests a gradual evolution, where commodities may eventually carve out a niche by aligning DeFi's use cases for leverage and 24/7 markets with traditional commodity exposures—regardless if they are physically settled or purely synthetic.

6.

Tokenized Private Credit

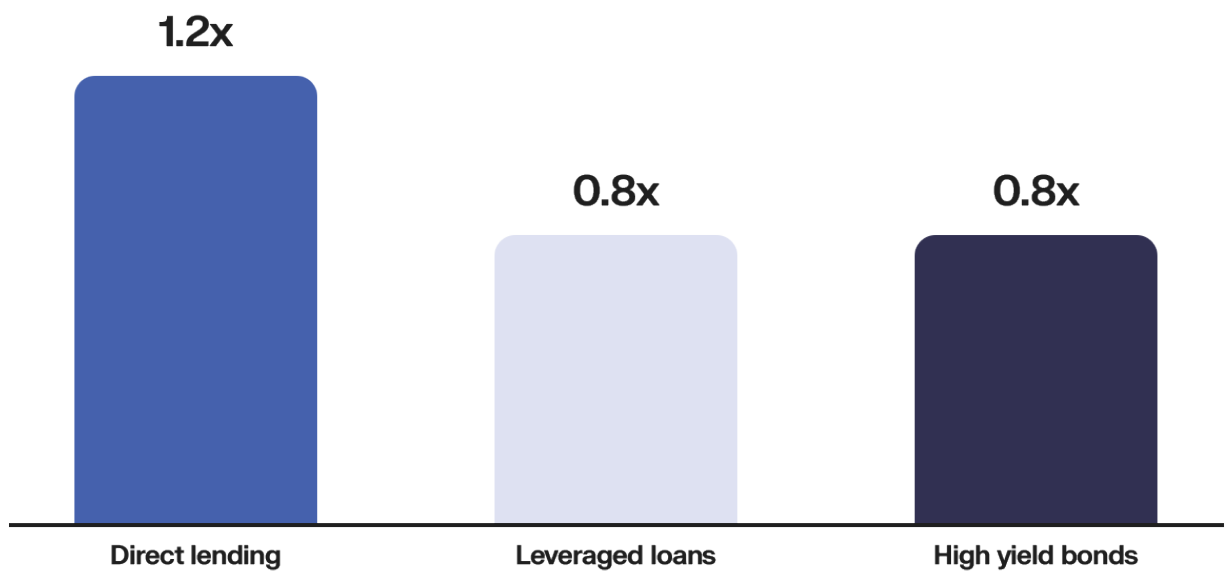
Opportunities in Alternative Lending

6.1 Historical Development and Traditional Constraints

Private credit refers to debt financing provided by non-bank lenders—such as direct loans to mid-sized companies, real estate loans, or consumer loans—that are not issued as tradable bonds on public markets. Over the past decade, private credit has boomed into an asset class exceeding $2 trillion globally[33], largely driven by investment funds (private equity firms, credit funds) stepping in where banks retreated after 2008. These loans are typically illiquid; once a fund makes the loan, it holds it to maturity since there isn't an established exchange where a fraction of a private loan can be easily sold (aside from bespoke secondary sales, which are slow and require buyer due diligence).

Private credit deals typically involve a lead arranger and the borrower, with terms negotiated on a case-by-case basis and documentation kept private. Interest rates are usually higher than those in public markets—compensating for increased risk and illiquidity—making private credit attractive to yield-seeking investors. However, due to the lack of public trading, transparency is low, and only institutional or accredited investors (with high minimums often exceeding $5 million) typically participate . This structure has resulted in private credit offering better rates than leveraged loans and high-yield bonds for depositors.

Private Credit Returns



Traditional private credit faces several challenges:

- **Illiquidity:** Being a hold-to-maturity investment, if a lender wants to exit early, there isn't a deep market of buyers readily quoting prices. Sales are often executed at a discount and require borrower or agent approval, taking weeks to months. Investors demand an "illiquidity premium"—a higher yield to compensate for being locked in.

- **High Minimums / Limited Access:** Private loans generally require large minimum investments, meaning that many funds only accept commitments of $5–10 million or more.

- **Lack of Transparency and Price Discovery:** Without a public market, loan valuations are updated infrequently (often quarterly), relying on subjective models or broker quotes, making it hard to determine a loan's fair value until an event (like a default or acquisition) occurs.

Traditional private credit markets have historically operated under strict securities laws designed for private placements. In the U.S., private credit funds and direct lending deals were typically offered under exemptions like Regulation D[34], limiting the investor pool to accredited investors or institutions based on the premise that such investors could fend for themselves without full registration protections. These investments were highly illiquid with multi-year lock-ups and minimal disclosure requirements compared to public offerings. Similar frameworks existed in the EU, where offerings to the public generally required a prospectus.

This regulatory landscape creates significant barriers to democratizing access to private credit. Traditional securities regulations in the U.S. restrict non-accredited investors from most private credit opportunities, while EU regulations like MiFID II impose similar restrictions designed to protect retail investors. These regulations, while protective, effectively limit participation to wealthy or institutional players. Additionally, cross-border offerings face jurisdictional complexities, often requiring separate compliance in each market where investments are offered.

6.2 Onchain Credit Structures and Platforms

For DeFi private credit, an offchain originator provides loans to real-world borrowers and then issues tokens that represent claims on those loan assets or their income streams. Unlike treasury products, these loans are individually structured, allowing any user to create a bespoke financial instrument with its own parameters and sell it. For example, a trade finance platform might originate dozens of short-term inventory loans, package them into a pool, and mint ERC-20 tokens that confer pro-rata rights to the pool's interest and principal payments. The token may be structured as a debt security (note) or a fund share. It is important to note that since these tokens represent investment contracts in a pool of loans, they may be considered securities—meaning private credit platforms must either register or use regulatory exemptions.

The emergence of blockchain-based private credit solutions has introduced both opportunities and significant regulatory challenges. As digital tokens representing financial assets gained popularity from 2017 onward, regulators worldwide clarified that tokenization doesn't exempt issuers from securities regulations[35]. In practice, a token representing a loan asset or revenue stream is treated as a security regardless of being on a blockchain. Similarly, the European Securities and Markets Authority (ESMA) affirmed that using distributed ledger technology does not make it a crypto-asset by default – a tokenized note is regulated as a note[36].

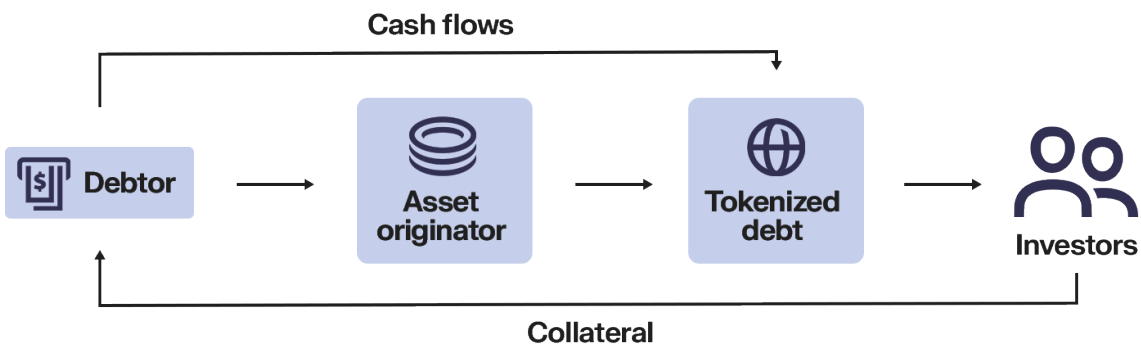
These regulatory constraints have profoundly shaped how private credit protocols operate. Legal barriers meant most tokenized credit offerings used private placement exemptions (like Reg D in the U.S.) limited to accredited investors, contradicting the ideal of democratizing financial access. Even under these exemptions, tokens carried transfer restrictions, requiring mechanisms to prevent secondary trading to ineligible investors. This created significant operational challenges: platforms needed to implement KYC verification, track investor accreditation, and maintain whitelists of approved addresses.

The legal complexity is further compounded by custody requirements and jurisdictional questions. In the U.S., SEC Rule 15c3-3[37] (the Customer Protection Rule) created uncertainty about how broker-dealers could legally custody digital securities while proving "possession or control." And while the legal issues for purely crypto-based lending might be somewhat contained, involving real-world assets introduces additional layers of contract law, property rights, and enforcement mechanisms.

Currently, there are two main approaches to structuring tokenized private credit, each with different regulatory implications:

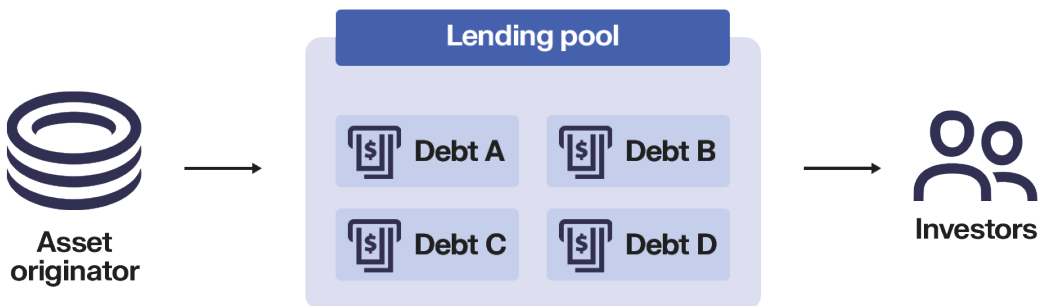
- **Loan-Specific Tokens:** Each loan is tokenized into one or more ERC-20 tokens that represent claims on that asset's cash flows. For example, a real estate lender might originate a mortgage and then mint tokens entitling holders to the repayment stream of that mortgage.

  Regulatory challenge: These tokens typically constitute securities and must be offered under exemptions like Reg D (for accredited investors) or potentially Reg A+ (for broader but still limited retail access).



- **Lending Pool Model:** Maple Finance uses a pooled model where lenders contribute to a general lending pool and a Pool Delegate allocates loans to borrowers. In this model, loans are represented onchain as debt obligations associated with an NFT (not tradeable tokens), while lenders receive tokens representing their share of the pool. As borrowers make payments, the smart contract passes these funds to the lenders. Maple's smart contracts enforce the loan terms—if a borrower fails to pay by maturity, the loan enters default, triggering predetermined remedies (although off-chain legal enforcement remains essential).

Regulatory challenge: Pool tokens may be classified as investment company interests under the 1940 Act, potentially requiring fund registration in addition to securities compliance[38].



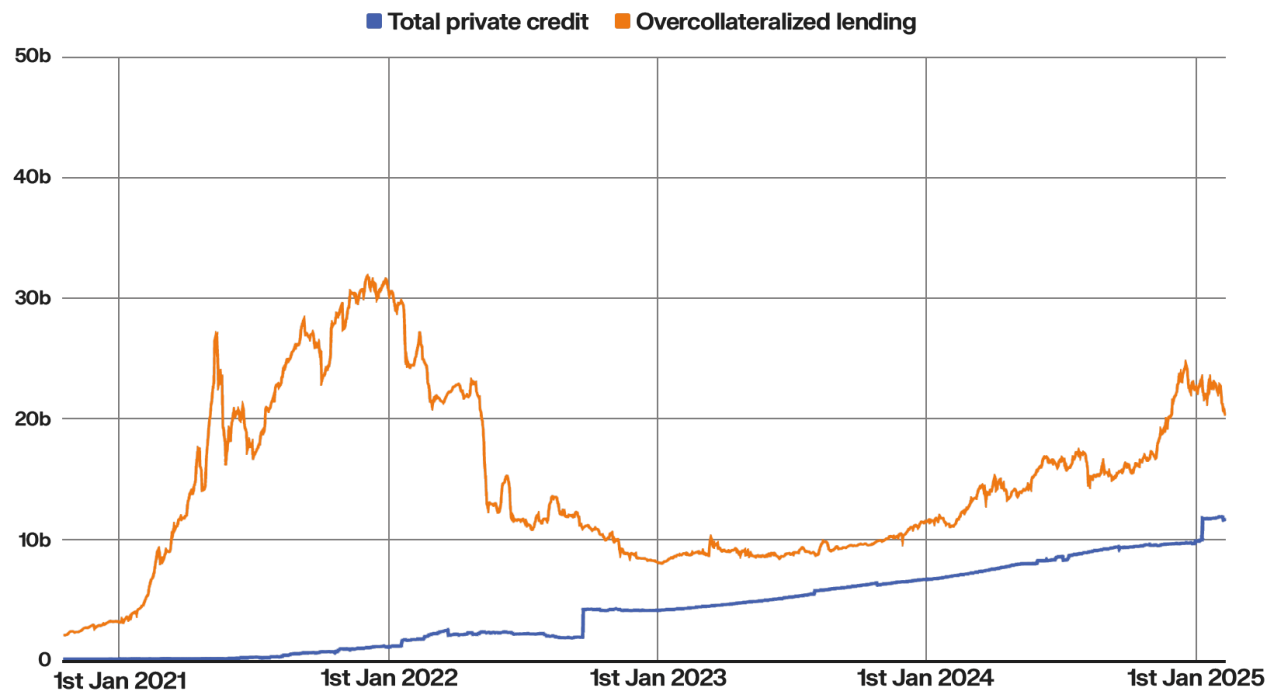
Maple Finance is a decentralized institutional capital marketplace that provides lending solutions for institutional borrowers and fixed-income opportunities for lenders, all transparently on-chain. Since its inception in 2021, Maple has facilitated over $2.5 billion in loans, positioning itself as a leading private credit platform in the Lending sector.

The platform operates through lending pools managed by Pool Delegates, who assess creditworthiness and set loan terms for borrowers. In July 2024, Maple introduced "Syrup," an upgrade that enhances its lending infrastructure, offering depositors permissionless access to institutional-grade lending products with consistent, competitive yields.

6.3 Sector Overview: Major Participants and Strategies

Due to the bespoke nature of private credit, several distinct projects have emerged in the crypto space rather than a single dominant platform:

Outstanding Loans: Tokenized Private Credit vs. Traditional Overcollateralized DeFi



Centrifuge: Centrifuge pioneered onchain private credit, proving that institutional credit markets could move to blockchain with lower costs, greater transparency, and improved efficiency. A defining moment came in 2022 with BlockTower Credit, a $220M structured credit fund tokenized on Centrifuge and integrated into MakerDAO (now Sky).

This fund was one of the first institutional-grade private credit pools to leverage blockchain for both financing and risk management, demonstrating real-world impact:

- 97% reduction in securitization costs compared to traditional credit structuring.
- Faster capital deployment, reducing time-to-liquidity for borrowers and investors.
- Transparent risk assessment, as all transactions and pool performance were verifiable onchain.

> *"The real-world asset commodities market is experiencing slower adoption … Minting is primarily driven by retail customer demand. Those same customers are digitally native and have also chosen Bitcoin as their store of value."*
>
> – Bhaji Illuminati, CEO, Centrifuge

Centrifuge started with private credit but has expanded since into multi-asset tokenization. This evolution unfolded in three key phases:

- **V1 (2020): Private Credit & DeFi Integration**
  Proved tokenized private credit could serve as collateral, notably in MakerDAO.
- **V2 (2023): Multi-Chain Expansion & Fund Management**
  Introduced multi-chain investor management and institutional-grade fund structuring tools.
- **V3 (2024-Present): Interoperability, Standards & Composability**
  Scaled customizable, battle-tested fund modules, seamless chain integration, and onchain settlement using ERC-7540, the leading DeFi standard for RWAs, all within a white-label, open-source SDK for easy deployment.

A key part of this evolution was the development of ERC-7540, extending ERC-4626 to standardize asynchronous investments and redemptions—a critical feature for RWAs.

Maple Finance: Focused on institutional lending pools, it created smart contract pools where experienced credit managers (Pool Delegates) bring in borrowers (often crypto trading firms or later real-world companies) and underwrite loans. Lenders deposit USDC (or other assets) into the pool and receive tokens representing their share. Loans can be unsecured or undercollateralized, based on borrower reputation and delegate due diligence. Maple rapidly grew by serving the credit needs of crypto firms (such as market makers and exchanges) requiring working capital. Similar to other Private credit platforms Maple also requires KYC, but they also offer a retail product called Syrup. With Syrup USDC can be lent to institutions that overcollateralize their Loan with BTC/ETH without requiring strict KYC.

Tradable: Tradable has emerged as a significant player in the private credit space by tokenizing institutional private credit assets. Built using Matter Labs technology, Tradable deploys its own dedicated zk-rollup "Hyperchain" via the ZK Stack, which runs on a Layer-2 environment that inherits Ethereum's security while allowing customizations. As of late 2024, Tradable has tokenized an impressive $1.7 billion of private credit positions, making it one of the largest platforms in the space. The platform emphasizes modularity and privacy: the ZK-rollup enables bespoke privacy controls and compliance features so transaction details can be shielded while still securing proofs on Ethereum. Tradable works with established asset managers like VPC to bring "institutional grade" assets onchain, focusing on high-quality conventional loans rather than crypto-native lending, which has helped it achieve substantial scale quickly.

Figure: Figure's marketplace lists loans such as home equity lines of credit (HELOCs) (secured by residential property), mortgages, consumer loans, and other private credit deals. The collateral for these loans is off-chain: for a HELOC, it's the borrower's home; for a consumer loan, it might be unsecured or secured by personal assets.

A brief summary of platforms and accepted collateral/asset types follows:

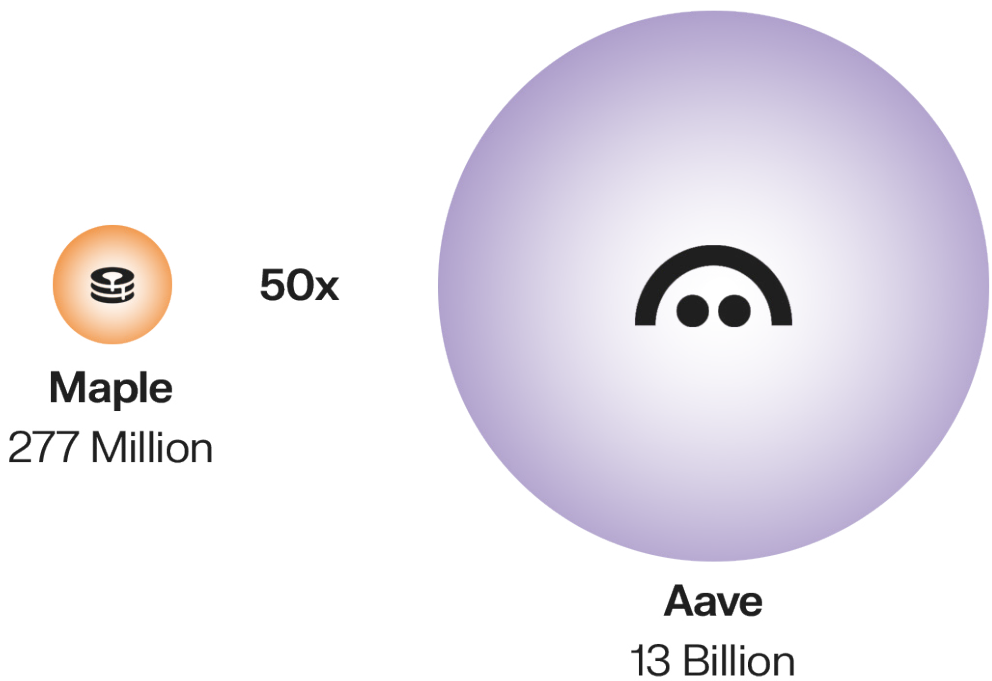
Platform	Accepted Collateral / Asset Types	Regulatory Approach and Impact
Centrifuge	Tokenized real-world assets, from private credit (invoices, receivables, real estate loans, royalties) to Treasuries.	Compliance-first approach with KYC for all investors. Uses SPVs that issue tokens under securities exemptions (Reg D/S).
Maple Finance	Liquid crypto assets (BTC, ETH, SOL, etc.) vetted for liquidity and volatility.	Initially more open but evolved to require KYC/AML for all users. Uses Reg D exemptions for U.S. investors. Geofences certain jurisdictions. Global Permissioning system implemented to satisfy regulators, limiting initial accessibility but enabling institutional adoption.
Tradable	Institutional credit assets (corporate loans, asset-backed securities, fund interests) with off-chain legal backing.	Operates as a permissioned platform with KYC/AML. ZK-rollup technology enables privacy while maintaining compliance. Focuses on the institutional market to avoid retail regulatory complications, allowing larger scale but limiting broader access.
Figure	Real-world loans (HELOCs, mortgages, consumer credit) with traditional collateral.	Maintains traditional lending licenses across U.S. states. Fully regulated as a lender and broker. High compliance overhead limits participation but ensures regulatory certainty for both borrowers and investors.

6.4 Projections and Key Considerations for Expansion

Private credit represents a natural convergence of crypto's core value proposition with traditional finance. This sector democratizes fundraising and credit access, creating permissionless, 24/7 markets that address traditional liquidity constraints. Historical concerns about enforcement mechanisms for defaults and liquidations are gradually being resolved through increased regulatory clarity, providing a more robust framework for institutional participation. With approximately $12.2 billion in current TVL and demonstrated product-market fit, private credit protocols have validated both the technical and operational viability of this model.

Unlike previous sectors targeting crypto-native tokens, private credit on-chain has largely attracted traditional finance participants. For example, non-crypto natives have adopted platforms such as Tradable, and the majority of TVL in this space derives from integrating Tradfi data on-chain. **On-chain markets like Maple—the largest platform with on-chain lenders—remain about 50x smaller than Aave's markets, despite offering higher yields for lenders.**

Aave vs **Maple Finance: Total Loans Oustanding**



"Unlike a lot of real-world lenders, we're focusing on crypto-native. There's a ton of demand from funds or trading desks that need working capital … We think real-world assets will come eventually, but first we're serving the bigger need in crypto itself."

– Martin de Rijke, Head of Growth, Maple Finance

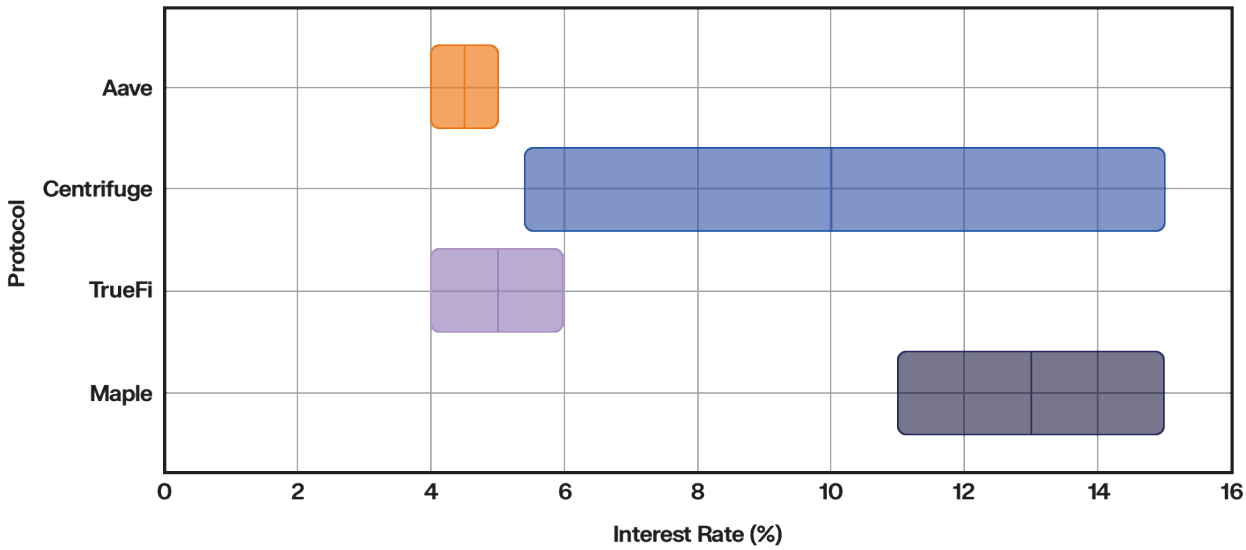
Furthermore, these higher interest rates—while reflecting increased risk—are expected to become attractive sources of yield on pooled lending platforms and can be considered in a similar vein to treasury products with their unique yield flow.

"Investors are moving up the yield curve onchain, seeking higher yields beyond Treasuries while staying uncorrelated to crypto markets. The BlockTower Credit fund on Centrifuge, integrated into Maker, demonstrated this shift—bringing institutional capital into tokenized private credit with transparent risk management and efficient onchain settlement."

– Bhaji Illuminati, CEO, Centrifuge

As regulations crystallize, institutional players have grown more comfortable entering the space. Major asset managers like Hamilton Lane and KKR have launched tokenized funds on blockchain within compliant structures. Hamilton Lane's tokenized Senior Credit Opportunities Fund (SCOPE) used a feeder vehicle to issue security tokens under SEC's Reg D and Reg S, limiting investors to accredited/institutional and non-US persons. Such projects were enabled by clearer guidance on encoding transfer restrictions and platforms like Securitize operating as registered transfer agents and broker-dealers to maintain compliance.

Interest Rate Comparison Across Private Credit Platforms



Going forward, regulators seem to be converging on common approaches: technology-neutral laws (treating tokens the same as underlying assets legally), allowances for DLT infrastructure in trading/settlement, requirements for identity and compliance layers on security tokens, and leveraging tokenization to improve efficiency provided risk controls remain. The trajectory is toward a cautiously enabling regulatory environment, with jurisdictions creating legal pathways for tokenized private credit to exist within the regulatory perimeter rather than outside it.

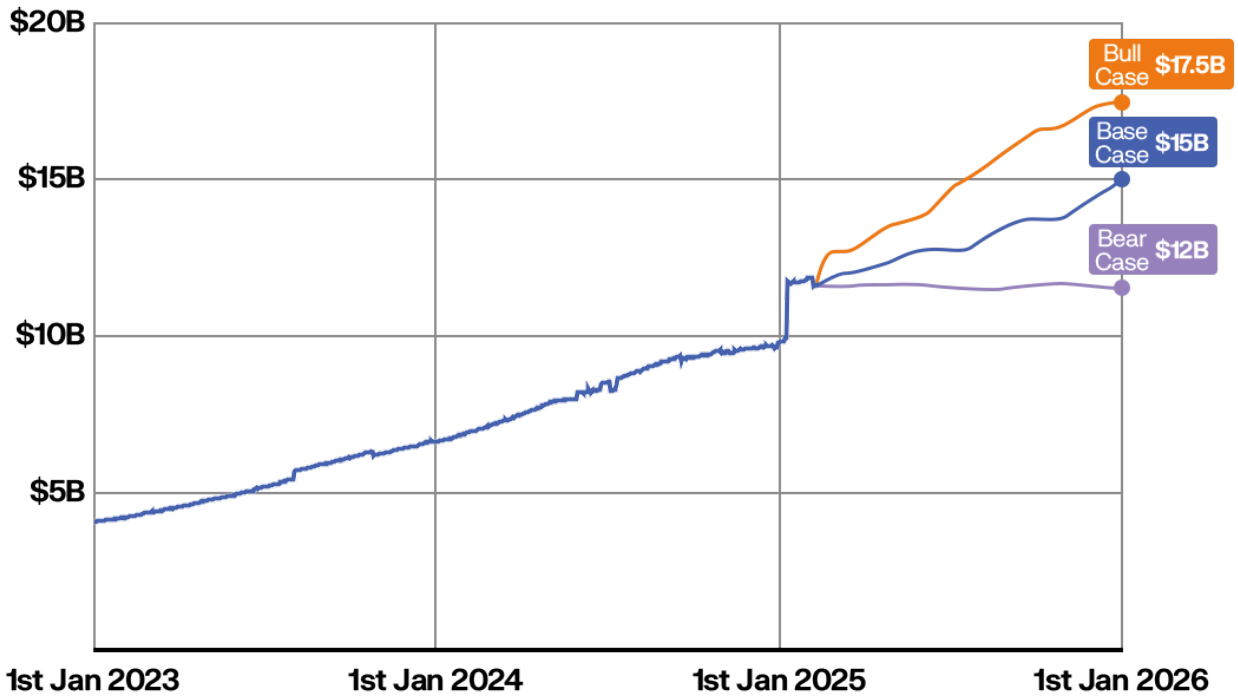
Our growth predictions for the private credit sector in 2025 are as follows:

- **Bull Case ($17.5 Billion TVL):** Driven by increased participation from both traditional finance (with traditional loans stored on-chain) and enhanced integration into DeFi, including the growth of platforms like Maple.

- **Base Case ($15 Billion TVL):** Continued strong growth as observed in previous years, this is continuation of the trend created by institutions leveraging blockchain to account for loans.

- **Bear Case ($12 Billion TVL):** A downturn in overall crypto market conditions could lead to higher default risks and a reduced demand for loans, as seen in previous years where Private credit platforms suffered from defaults.

Forecasted Total Value Locked in Private Credit (2025)



Overall, while the private credit sector has experienced solid growth, its current focus on non crypto-native participants and modest on-chain presence suggest that further expansion will depend on improved market conditions and continued regulatory evolution.

7.

Conclusion

Assessing the Trajectory of Tokenized Markets

7 Conclusion: Assessing the Trajectory of Tokenized Markets

The tokenization of RWA stands as a transformative force, positioned to reshape global finance by leveraging blockchain technology to integrate traditional markets with decentralized ecosystems. Across the sectors analyzed in this report—Treasuries, Tokenized Stocks, Commodities, and Private Credit—tokenization is addressing inefficiencies, broadening access, and creating new opportunities for investors, borrowers, and market participants.

Synthesizing the insights from these domains reveals a compelling trend: the convergence of DeFi and TradFi is not a speculative future but a present development with significant implications.

> *All assets will eventually be tokenized. This is not a matter of philosophy, simply an economically superior way of representing value. Our positioning will continue to be to support our clients through our industry-leading pricing and execution, across all digital assets."*
>
> – Kevin de Patoul, CEO, Keyrock

Key highlights:

- **United States Treasury Securities**: The $28 trillion Treasury market, long constrained by settlement delays and intermediary dependencies, is undergoing a renaissance on blockchain networks. Currently valued at $4 billion dollars, tokenized Treasuries represent just 2 percent of the $210 billion dollar stablecoin market, yet their ability to deliver yield offers a robust alternative for stablecoin holders seeking returns. The sector is positioned for substantial growth, making its rapid evolution a particularly compelling development to observe as demand for secure, onchain yield accelerates.

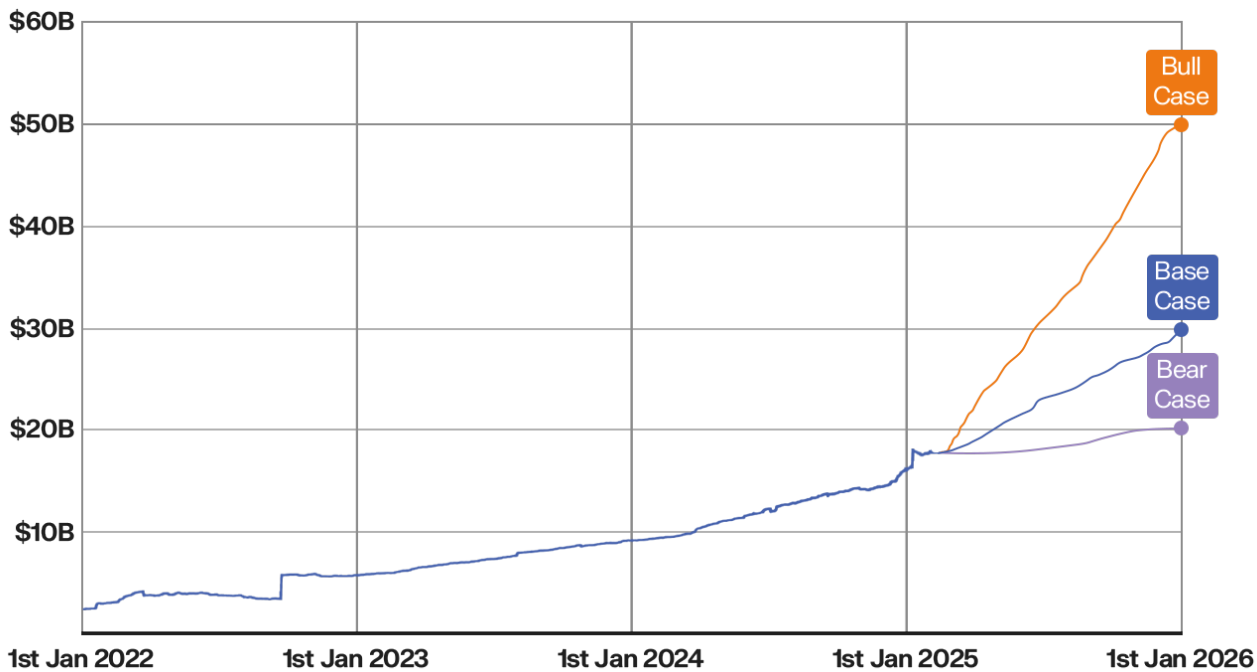
- **Tokenized Equities**: Tokenized equities, currently at ~$15 million market size, remain significantly smaller than synthetic stocks at their 2021 peak (approximately 300x larger), largely due to historical regulatory constraints (SEC Acts, MiFID II). With clearer legal frameworks emerging, such as the proposed U.S. Broker-Dealer Tokenization Act and favorable European legislation (Germany's eWpG, Liechtenstein Blockchain Act), regulatory pathways are opening. Looking ahead, Asset-backed protocols have pioneered permissionless yet compliant models, facilitating broader retail participation and institutional adoption, further accelerated by political shifts beginning with the Trump administration in 2025. As infrastructural and regulatory obstacles diminish, tokenized equities are poised for rapid adoption.

- **Commodities**: Tokenized commodities, currently valued around $1.2 billion, have gained modest traction primarily via gold-backed tokens but face persistent liquidity constraints, price premiums up to 5%, and limited retail engagement. Regulatory simplicity compared to securities has facilitated initial growth; however, retail investors have shown stronger preference toward Bitcoin and speculative exposure rather than physically redeemable assets. Emerging synthetic commodity models offering decentralized leveraged exposure without physical delivery may better align with this investor demand, potentially broadening adoption. The market's trajectory depends on improved liquidity, redemption processes, regulatory clarity, and expanding institutional engagement, while overcoming persistent inertia in investor preferences remains a significant barrier.

- **Private Credit**: Tokenized private credit, currently valued around $12.2 billion, presents substantial opportunities for growth by overcoming traditional barriers like illiquidity, high minimum investments, and limited transparency. Recent institutional success and regulatory developments indicate increasing acceptance, making private credit uniquely suited to blockchain's strengths, such as fractional ownership, improved liquidity, and enhanced transparency. With clearer regulatory frameworks emerging and growing institutional comfort, tokenized private credit is positioned to expand significantly.

Looking to 2025, We believe the tokenization of RWA is expected to gain momentum, driven by institutional uptake, regulatory clarity, and technological advancements. This period represents a critical phase in which early adopters and cryptocurrency-native participants are testing and refining these systems, establishing the infrastructure necessary for broader institutional engagement. **Aggregating our predictions for the various industries we see significant growth potential. In the bull case, driven by regulatory tailwinds we expect 2025 to be a breakout year with tokenized RWA increasing to around $50b, this requires both the increasing composability from the DeFi side and appetite from institutions to tokenize existing offerings. Even in a base case our outlook is extremely positive predicting $30b due to existing improvements in regulation and architecture.**

Forecasted Total Value Locked in Tokenized Assets (2025)



The broader impact of this transition transcends market size.
Tokenization offers:

- Reduced reliance on intermediaries through blockchain-enabled real-time settlement and transparent ledgers, lowering costs and risks.
- Fractional ownership of high-value assets—spanning Treasuries, stocks, gold, and private loans—widening access and enhancing liquidity.
- New avenues for innovation, such as yield farming with tokenized Treasuries or staking real estate tokens, blending traditional finance and decentralized finance principles.

"All other things being equal, a digital asset is superior to a traditional one because it is a lot easier and a lot more efficient to exchange. This promise is however only realized if there is a counterparty at the other end of the trade providing liquidity, the tech upgrade only is not sufficient. Superior liquidity is the very promise of digitizing assets and market makers are the ones providing it."

– Kevin de Patoul, CEO, Keyrock

Keyrock and Centrifuge stand at the forefront of this transformative shift, actively shaping the evolution of tokenized markets by providing cutting-edge solutions that bridge traditional and decentralized financial systems. Tokenization will become a foundational element of a restructured global market, echoing the evolution of exchange-traded funds, where initial skepticism yielded to widespread adoption through strategic implementation. As early adopters refine these systems and institutions built upon their efforts, the path forward offers substantial potential. The tokenization movement is in its early stages, and 2025 will mark a significant step in its progression from an exploratory phase to a core component of financial infrastructure.

Appendix

Bibliography

Allaire, Jeremy. *"Blockchain is in from the Cold—And Stablecoins Are Set to Change the Financial System Forever."* World Economic Forum, January 15, 2024.

Boston Consulting Group, Visa. *"Stablecoins in Digital Payments Ecosystem."* Accessed March 2025.

BlackRock. *"Larry Fink on ESG Investing."* Panel at the DealBook Summit, December 1, 2022.

Centrifuge. *"Anemoy Launches Liquidity Network to Power Institutional Grade Liquidity Provision in RWAs."* November 8, 2024.

Centrifuge. *"The Real-World Asset Revolution."*

Chainlink. *"Chainlink's Leading Position in Capital Markets, Tokenized Assets, and DeFi | 2024 Highlights."* Chainlink Blog, December 30, 2024.

Circle. *"Circle Announces Acquisition of Hashnote."*

Cohen, Charles, Caio Ferreira, Fabio Natalucci, and Nobuyasu Sugimoto. *"Fast-Growing $2 Trillion Private Credit Market Warrants Closer Watch."* IMF Blog, April 8, 2024.

Commodity Exchange Act. 7 U.S.C. § 1a(9) (2018).

Davidson, Warren. *"Rep. Warren Davidson Introduces the Broker-Dealer Tokenization Act."* U.S. Congressman Warren Davidson, December 19, 2024.

DefiLlama. *"Paxos Gold."* Accessed March 13, 2025.

DefiLlama. *"Token Usage: PAXG."* Accessed March 10, 2025.

European Parliament and Council. Regulation (EU) 2017/1129 of 14 June 2017 on the prospectus to be published when securities are offered to the public, Official Journal of the European Union L 168/12 (2017).

European Parliament and Council. Regulation (EU) 2023/1119 of 14 June 2023 on markets in crypto-assets (MiCA), Official Journal of the European Union L 150/40 (2023).

European Securities and Markets Authority (ESMA). *"Report on Distributed Ledger Technology Applied to Securities Markets."*

Fink, Larry. *"BlackRock C.E.O. Larry Fink on ESG Investing."* Panel at the DealBook Summit, December 1, 2022.

Investment Company Institute. *"Money Market Fund Assets,"* March 6, 2025.

Paxos. *"PAX Gold Whitepaper."* Accessed March 10, 2025.

Reuters. *"Germany's financial watchdog warns crypto exchange Binance over 'stock tokens'."* April 29, 2021.

RWA.xyz. *"Analytics on Tokenized Real-World Assets."* Accessed March 4, 2025.

RWA.xyz. *"Tokenized Stocks."*

Securities Industry and Financial Markets Association (SIFMA). *"RSN Technical Report."* December 2024.

Securities Industry and Financial Markets Association (SIFMA). *"US Treasury Securities Statistics."* March 3, 2025.

U.S. Department of the Treasury. *"Daily Treasury Bill Rates,"* March 5, 2025.

U.S. Securities and Exchange Commission. *"Framework for 'Investment Contract' Analysis of Digital Assets,"* April 3, 2019.

U.S. Securities and Exchange Commission. "*Joint Staff Statement on Broker-Dealer Custody of Digital Asset Securities,"* July 8, 2019.

U.S. Securities and Exchange Commission. *"Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO."*

U.S. Securities and Exchange Commission. *"SEC Files Subpoena Enforcement Action Against Terraform Labs PTE, Ltd. and Do Kwon."* Press Release 2021-234, November 12, 2021.

U.S. Securities and Exchange Commission. *"Statement on Digital Asset Securities Issuance and Trading."* November 16, 2018.

Visa. *"Stablecoin Supply."* Visa Onchain Analytics Dashboard. Accessed March 4, 2025.

Footnotes

[1]J.P. Morgan, *"ETF Market Guide: Trends and Themes to Watch,"* October 22, 2024.

[2]Larry Fink, *"BlackRock C.E.O. Larry Fink on ESG Investing,"* Panel at the DealBook Summit, December 1, 2022.

[3]Jeremy Allaire, *"Blockchain is in from the cold — and stablecoins are set to change the financial system forever,"* World Economic Forum, January 15, 2024.

[4]Rajaram Suresh, Sumit Kumar, Darius Liu, Bernhard Kronfellner, and Aaditya Kaul, *"Relevance of onchain Asset Tokenization in 'Crypto Winter',"* Boston Consulting Group, September 12, 2022.

[5]Visa, *"Stablecoin Supply,"* Visa Onchain Analytics Dashboard, accessed March 4, 2025.

[6]RWA.xyz, *"Analytics on Tokenized Real-World Assets,"* accessed March 4, 2025.

[7]Securities Industry and Financial Markets Association (SIFMA). *"US Treasury Securities Statistics."* March 3, 2025.

[8]Securities Industry and Financial Markets Association (SIFMA). *"RSN Technical Report."* December 2024.

[9]Centrifuge, *"Anemoy Launches Liquidity Network to Power Institutional Grade Liquidity Provision in RWAs,"* November 8, 2024.

[10]Visa, *"Stablecoin Supply."*

[11]RWA.xyz, *"Analytics on Tokenized Real-World Assets."*

[12]Circle, *"Circle Announces Acquisition of Hashnote."*

[13]Centrifuge, *"The Real-World Asset Revolution."*

[14]Ibid

[15]Zihao Li et al., "*Demystifying DeFi MEV Activities in Flashbots Bundle,"* Cryptology ePrint Archive, Report 2023/1855, 2023.

[16]Chainlink, *"Chainlink's Leading Position in Capital Markets, Tokenized Assets, and DeFi | 2024 Highlights,"* Chainlink Blog, December 30, 2024

[17]Investment Company Institute, *"Money Market Fund Assets,"* March 6, 2025,

[18]U.S. Department of the Treasury, *"Daily Treasury Bill Rates,"* March 5, 2025.

[19]Circle, *"Circle Announces Acquisition of Hashnote."*

[20]U.S. Securities and Exchange Commission, *"Framework for 'Investment Contract' Analysis of Digital Assets,"* April 3, 2019.

[21]Financial Industry Regulatory Authority (FINRA), *"Rule 2090: Know Your Customer."*

[22]European Parliament and Council, Regulation (EU) 2023/1114 of 31 May 2023 on markets in crypto-assets (MiCA), Official Journal of the European Union L 150/40 (2023), Article 2(2a).

[23]European Parliament and Council, Regulation (EU) 2017/1129 of 14 June 2017 on the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market, Official Journal of the European Union L 168/12 (2017), Art. 3(1).

[24]Reuters. *"Germany's financial watchdog warns crypto exchange Binance over 'stock tokens'."* April 29, 2021.

[25]U.S. Securities and Exchange Commission. *"SEC Files Subpoena Enforcement Action Against Terraform Labs PTE, Ltd. and Do Kwon."* Press Release 2021-234, November 12, 2021.

[26]Davidson, Warren. *"Rep. Warren Davidson Introduces the Broker-Dealer Tokenization Act."* U.S. Congressman Warren Davidson, December 19, 2024

[27]Ondo Finance, *"Introducing Ondo Chain."*

[28]RWA.xyz, *"Tokenized Stocks"*

[29]Commodity Exchange Act, 7 U.S.C. § 1a(9) (2018).

[30]Paxos Trust Company, *"PAX Gold Whitepaper,"* accessed March 10, 2025,

[31]DefiLlama, *"Token Usage: PAXG,"* accessed March 10, 2025,

[32]DefiLlama, *"Token Usage: PAXG,"* accessed March 10, 2025,

[33]Cohen, Charles, Caio Ferreira, Fabio Natalucci, and Nobuyasu Sugimoto. *"Fast-Growing $2 Trillion Private Credit Market Warrants Closer Watch."* IMF Blog, April 8, 2024.

[34]U.S. Securities and Exchange Commission, *"Private Funds,"* accessed March 12, 2025

[35]U.S. Securities and Exchange Commission (SEC) *"Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO"*

[36]European Securities and Markets Authority (ESMA) *"Report on Distributed Ledger Technology Applied to Securities Markets"*

[37]U.S. Securities and Exchange Commission, "*Joint Staff Statement on Broker-Dealer Custody of Digital Asset Securities,"* July 8, 2019

[38]U.S. Securities and Exchange Commission. *"Statement on Digital Asset Securities Issuance and Trading."* November 16, 2018.

Data Sources

Growth of Real-World Asset Tokenization | Total Value Locked
Data source: RWA.xyz (accessed February 2025).

USDC Cash Reserves Breakdown
Data Source: Circle Internet Group, Inc., "USDC Examination Report," January 25, 2025,

Growth of Onchain Treasury Products | Total Value Locked
Data source: RWA.xyz (accessed February 2025).

Flow of Tokenized Treasury Stablecoins: Permissioned vs. Permissionless Systems
Figure created by authors to illustrate the structure of permissioned and permissionless systems in tokenized treasury assets.

Interest Rate Comparison Across Treasury Investment Products
Data sourced from RWA.xyz and Aavescan (accessed February 2025)

Accruing Model: Inefficiencies in Liquidity Pool Design
Figure created by authors to illustrate effects of MEV on Treasury liquidity pairs

Rebasing Model: Inefficiencies in Liquidity Pool Design
Figure created by authors to illustrate effects of MEV on Treasury liquidity pairs

Interest Rate Comparison: EFFR Rates vs Aave USDC
Data sourced from the Federal Reserve Bank of New York and Aavescan (accessed February 2025)

Onchain Treasury Assets vs. Stablecoin Market Size: A Comparative Analysis
Data sourced from Visa's Onchain Analytics Dashboard and RWA.xyz (accessed February 2025)

Stablecoins vs. Onchain Treasuries: Evaluating Unrealized Yield Potential
Data sourced from Visa's Onchain Analytics Dashboard and RWA.xyz (accessed February 2025)

Forecasted Total Value Locked of Tokenized Treasury Assets (2025)
Figure created by the authors to illustrate TVL projections derived from the study's research

Tokenized Stocks Regulation: United States and European Union Compared
Figure created by authors to illustrate regulations on tokenized stocks

The Fall of Synthetic Stocks
Data sourced from DefiLlama's Synthetix and Mirror Protocol pages (accessed February 2025)

Minting Synthetic Assets on Mirror Protocol
This figure illustrates the step-by-step process that was used for minting synthetic assets using Mirror Protocol.

Tokenized Asset Minting Process
This figure illustrates the tokenization process from a RWA to Onchain asset

Growth of Onchain Equities | Total Value Locked
Data source: RWA.xyz (accessed February 2025).

Comparison of Total Total Value Locked of Stocks vs. Synthetic Stocks at Peak Levels
Data sourced from RWA.xyz and DefiLlama ("Synthetix" and "Mirror"), accessed February 2025.

Forecasted Total Value Locked of Tokenized Equities (2025)
Figure created by the authors to illustrate TVL projections derived from the study's research

Tokenizing Real World Assets
This figure illustrates the general process needed to tokenize any RWA

Gold Onchain: Total Tokenized Supply (Ounces)
Data sourced from DefiLlama's "Paxos Gold" and "Tether Gold" pages, accessed February 2025.

PAXG Aggregate Llquidity Depth
Data sourced from Keyrocks internal research team

PAXG Price Deviations on Centralized Exchanges
Data sourced from Keyrocks internal research team. Data represents a snapshot in time and is subject to continuous fluctuations.

PAXOS Gold Utilization in DeFi protocols
DefiLlama. "Token Usage: PAXG." Accessed February 2025

Diverging Trends: Onchain Gold Total Value Locked Decrease vs. Overall Crypto Total Value Locked Increase
Data sourced from DefiLlama's "Paxos Gold" page and overall DeFi TVL metrics, accessed February 2025.

Commodities Trading: Retail Investor Participation by Asset Class
Data estimated by authors based on Keyrocks internal research

Forecasted Total Value Locked of Tokenized Commodities (2025)
Figure created by the authors to illustrate TVL projections derived from the study's research

Private Credit Returns
Data sourced from Morgan Stanley's "Private Credit Market: 2024 Outlook & Opportunities" report.

Tokenized Private Credit: Loan-Specific Model
Illustration created by authors to demonstrate the direct tokenization process of individual loans, highlighting cash flows from debtor to investors and collateral arrangements

Tokenized Private Credit: Lending Pool Model
Illustration created by authors to depict the lending pool structure, illustrating how multiple loans are aggregated and offered collectively to investors.

Outstanding Loans: Tokenized Private Credit vs. Traditional Overcollateralized DeFi
Data sourced from RWA.xyz and DefiLlama's lending protocols page, accessed February 2025.

Aave vs Maple Finance : Total Loans Oustanding
Data sourced from RWA.xyz and DefiLlama's lending protocols page, accessed February 2025.

Interest Rate Comparison Across Private Credit Platforms
Data sourced from RWA.xyz and Aavescan (accessed February 2025)

Forecasted Total Value Locked in Tokenized Assets (2025)
Data estimated by authors based on Keyrocks internal research