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Digital Ownership: Comparing Tokenized and Traditional Financial Assets

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ABSTRACT:

The introduction of blockchain technology has enabled asset tokenization, the digital representation of physical or financial assets. The purpose of this thesis is to compare the theoretical benefits and practical limitations of tokenized financial assets, specifically bonds, real estate, and commodities with their traditional counterparts. The thesis uses a theoretical framework consisting of Efficient Market Hypothesis (EMH), Transaction Cost Economics (TCE), Modern Portfolio Theory (MPT), and Agency Theory to study these dynamics. The findings indicate that tokenization can successfully improve market accessibility through fractional ownership, and enhances liquidity with continuous trading, which is supported by the EMH and MPT theories. Furthermore, smart contracts demonstrate the technical capability to automate execution and lower traditional transaction costs. However, viewed through the lens of Agency Theory, it is found that traditional intermediaries are often replaced by new intermediary roles, such as oracle providers and governance networks. These new intermediaries introduce new technological vulnerabilities. Finally, the study concludes that widespread institutional adoption is currently slowed down by heavy regulatory uncertainty. Fragmented global jurisdictions and complex legal frameworks, such as the EU's Markets in Crypto-Assets Regulation (MiCAR), increases compliance costs, thereby offsetting many of the technological efficiencies gained through asset tokenization.

KEYWORDS: Blockchain, Cryptocurrencies, Tokenization, Transaction Cost Economics, Financial Technology

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1 Introduction

The development of blockchain technology, initially introduced as the underlying infrastructure for cryptocurrencies, has led to a fundamental structural change of the global financial system (Del Sarto et al., 2024; Tanveer et al., 2025). By introducing a decentralized, immutable, and cryptographically secured ledger, blockchain technology eliminates the need for traditional intermediaries that have historically governed financial transactions (Tanveer et al., 2025). This technological breakthrough has enabled asset tokenization, defined as the process of converting ownership rights of physical or financial assets into digital tokens that are stored on a distributed ledger (Jaouhari et al., 2025; Tanveer et al., 2025). Tokenization promises to reduce transaction costs, democratize access to investments, and enhance liquidity of various financial assets, such as real estate, bonds, and commodities (Cisar et al., 2025; Jaouhari et al., 2025; Kreppmeier et al., 2023).

Although tokenization remains at an early stage, recent evidence indicates that core financial institutions have begun to experiment with tokenized market infrastructure. Adoption has primarily taken the form of pilot projects and controlled issuances, rather than large scale deployment. According to the evidence summarized by Bank for International Settlements (BIS), several global banks and market infrastructures have participated in issuances of tokenized bonds with the overall market value of 8 billion USD. (Aldasoro et al., 2025). When it comes to real estate, the scale of adoption seems similarly limited. World Economic Forum (WEF) estimates that the value of tokenized real estate currently ranges between 4 billion and 20 billion USD (World Economic Forum, 2025). Relative to the size of traditional bond and real estate markets, these figures remain a fraction of the total market. The evidence suggests that tokenization is currently viewed as a complementary infrastructure innovation, rather than a substitute for existing systems.

Despite the potential of asset tokenization, the adoption and impact remain inconclusive due to significant gaps between theoretical promises and reality. While tokenization could offer opportunities for asset ownership in terms of accessibility, costs and liquidity, it also introduces new risks, including regulatory uncertainty, cybersecurity vulnerabilities, and new forms of intermediation (Castillo León & Lehar, 2026; Tanveer et al., 2025). This thesis conducts a structured literature review, that addresses the gap between the advantages and disadvantages of tokenized assets, focusing specifically on real estate, bonds, and commodities and their traditional counterparts.

1.1 Purpose of the study

The purpose of the thesis is to carry out a comprehensive literature review that compares tokenized financial assets with their traditional counterparts. Both the potential advantages and limitations are analyzed from investors perspective. The study follows a central research question:

RQ_1: What are the potential benefits and limitations of tokenized assets compared to traditional financial assets?

To answer this research question, the thesis is structured around three hypotheses based on relevant academic literature:

H_1: Tokenized financial assets improve market accessibility by enabling fractional ownership and continuous (24/7) trading.

H_2: Tokenization reduces transaction and settlement costs by reducing the number of intermediaries.

H_3: Investors and institutions remain hesitant to adopt tokenized assets due to regulatory uncertainty.

By examining these hypotheses, the goal is to contribute to a clearer understanding of how digital ownership models compare to traditional financial structures. The thesis helps to determine key differences between the technological potential and practical implementation of blockchain-based ownership models. Individual investors may benefit from a better understanding of the risks and opportunities associated with tokenized assets, as well as for other market participants evaluating the role of tokenization in the financial landscape.

1.2 Structure of the study

This thesis begins with an introduction to the key concepts of tokenization and presents the research question supported with three key hypotheses. Second chapter provides an overview of the technological foundations relevant to the thesis. It introduces blockchain technology and tokenization, clarifies the key concepts related to digital ownership, and outlines the traditional financial assets as a benchmark for the tokenized assets evaluated.

Chapter three presents the theoretical framework guiding the literature review. The analysis consists of Efficient Market Hypothesis, Transaction Cost Economics, and Modern Portfolio Theory to establish a theoretical foundation for assessing the potential benefits and limitations of tokenized assets relative to traditional financial assets.

Fourth chapter serves as the core of the study and offers a comparative review of tokenized and traditional assets across three asset classes: bonds, real estate, and commodities. Each subsection examines the respective asset class by comparing traditional market structures with their tokenized counterparts. Chapter five summarizes the main findings, reflecting implications, and highlighting limitations and directions for future research.

Large language models (Gemini and ChatGPT) were utilized during the preparation of this thesis for proofreading, translation, and refining academic language. All research, critical analysis, and original text are entirely the author's own work.

2 Blockchain and tokenization fundamentals

This chapter provides an overview of the technological foundations relevant to the analysis of tokenized financial assets. It outlines the core features of blockchain and distributed ledger technology that enable the tokenization of assets and the digital representation of ownership. The chapter further explains the tokenization process and reviews how traditional financial assets are structured to establish a clear benchmark for comparison. Overall, the chapter serves to provide the conceptual groundwork for the theoretical framework and comparative review presented in the following chapters.

2.1 Blockchain technology

Blockchain emerged as a new form of digital infrastructure with the publication of the Bitcoin whitepaper in 2008. The paper written by Satoshi Nakamoto introduced Bitcoin as a digital payment system, that functions independently of centralized institutions (Nakamoto, 2008). Instead of relying on trusted intermediaries, the system uses cryptographic techniques to verify transactions and maintain a ledger that is resistant to manipulation (Del Sarto et al., 2024; Feulner et al., 2025). Blockchain technology operates based on its decentralized and transparent architecture, working as a peer-to-peer distributed ledger. This means that no central authority or server maintains the entire database, instead all participants called "nodes" hold an identical copy of the ledger. With consensus mechanism, the blockchain makes sure all new data is correct before it's added to the chain. This structure enhances both data redundancy and system integrity, minimizing the risk of data manipulation or loss (Del Sarto et al., 2024). Figure 1 presents a simplified overview of how blockchain operates.

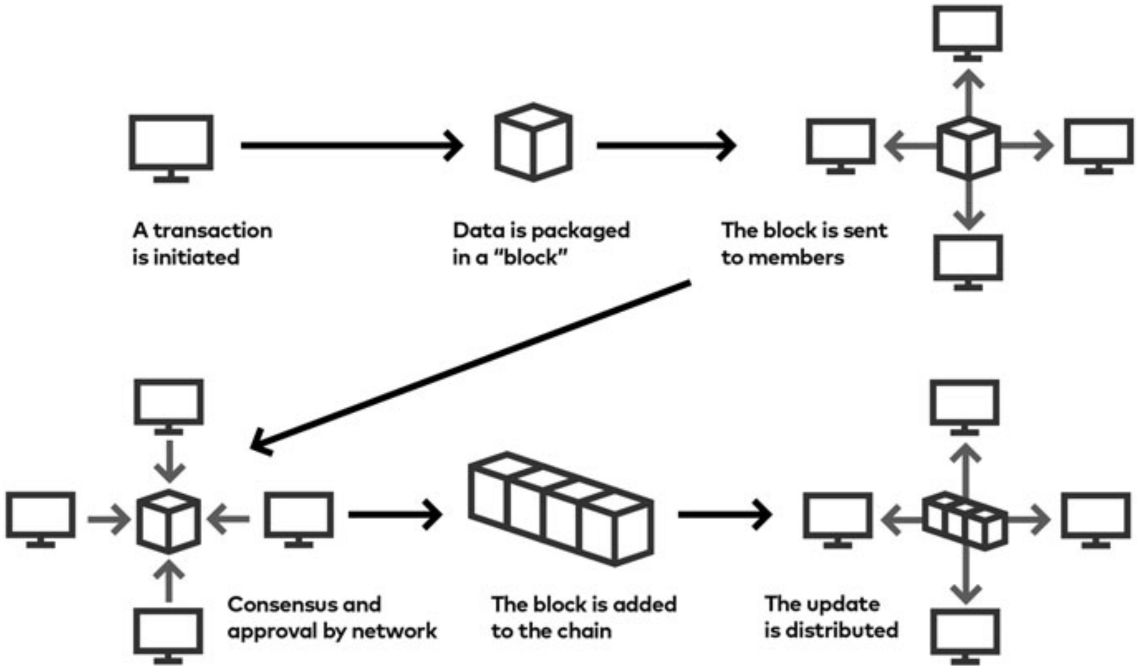

Figure 1. How Blockchain works (Al Goni et al., 2020).

Blockchain networks are commonly categorized into two types, public and private blockchains. Del Sarto et al. (2024) makes a distinction between these types of networks. Public or "permissionless" blockchains are open to everyone and participants can validate transactions, access data, and interact with smart contracts without authorization. These systems are a core component in cryptocurrencies and decentralized finance (DeFi) in general. Private or "permissioned" blockchains limit participation to only authorized actors. These are commonly used by financial institutions, since they suit better for their strict privacy and regulatory requirements.

2.1.1 Smart contracts

Smart contracts are self-executing scripts that operate on blockchain networks. These contracts have predefined terms and conditions and are automatically triggered by specific events. With automatic execution, smart contracts can reduce transaction costs, information asymmetry, and limit the amount of intermediaries for transactions (Grassi et al., 2022).

2.1.2 Oracles

Oracles serve as a critical extension of blockchain infrastructure, addressing the fundamental limitation of blockchains not being able to independently access external data. Oracles function as trusted intermediaries that bridge this gap by fetching, verifying, and transmitting data, for example asset prices, outside the blockchain to smart contracts (Nadler et al., 2026).

2.2 Asset tokenization and digital ownership

The transformation of a physical or traditional assets into digital tokens follows a structured roadmap. The process begins with the identification and assessment of the underlying asset, followed by the establishment of a legal framework and ownership structure that complies with regulatory requirements. The digital tokens are then created as a representation for the underlying assets, and the ownership rights and transfer are recorded on the blockchain. This process is governed by smart contracts to reduce the amount of intermediaries and increase security (Liu & Chen, 2025; Tanveer et al., 2025). Figure 2 visualizes the tokenization process; this process can also be applied to other assets like securities.

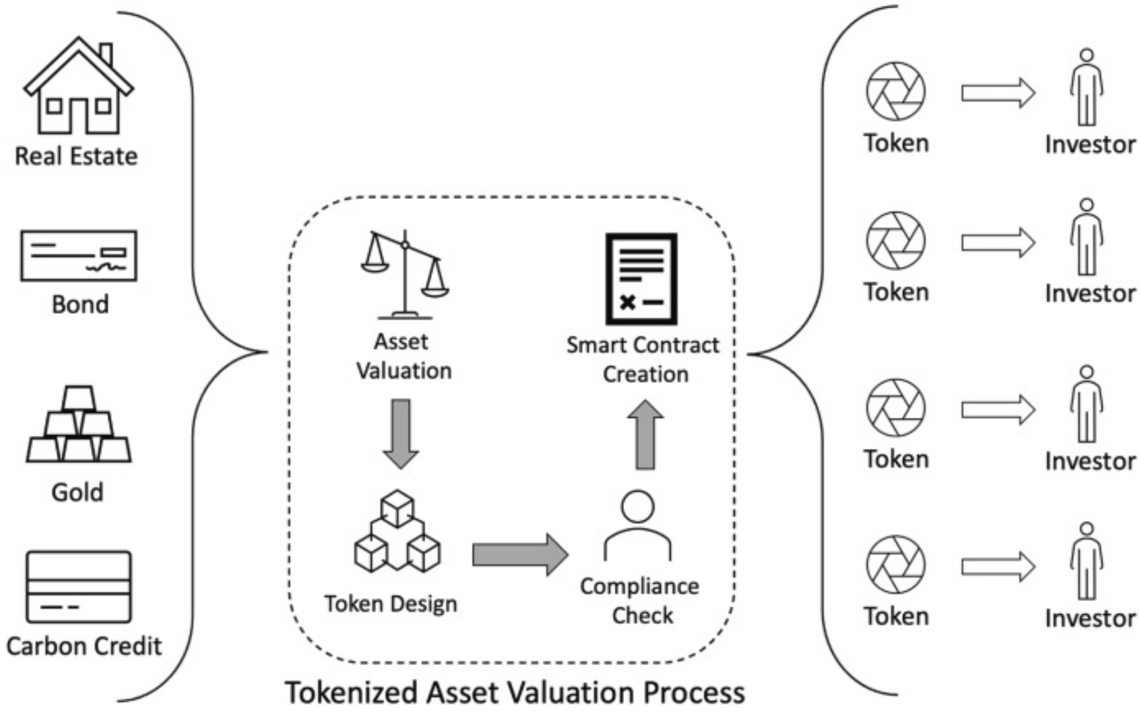

Figure 2. Asset tokenization process (Tanveer et al., 2025).

After the process is finished and tokens are created and distributed, owners can trade them on secondary markets like cryptocurrency exchanges. Centralized exchanges (CEXs), such as Coinbase and Binance are the most popular ways to trade tokens and cryptocurrencies. These exchanges operate as centralized intermediaries and maintain stricter compliance standards. Centralized exchanges operate on a custodial model where users must deposit their currencies into so called “hot wallets”, repositories managed by the exchange. CEXs rely on centralized ledger systems forcing users to depend on the exchanges security and regulatory compliance (Benedetti & Rodríguez-Garnica, 2025; Makridis et al., 2023).

In addition to centralized platforms, tokens may be exchanged on decentralized exchanges (DEXs) such as Uniswap. Utilizing smart contract-based protocols, DEXs offer peer-to-peer trading without central authority. These platforms are non-custodial, meaning assets remain in the user’s private wallet until traded. Decentralized exchanges offer lower fees compared to CEXs and face less jurisdiction since all transactions operate on a peer-to-peer network. For users this can be also seen as fewer know your customer (KYC) checks (Makridis et al., 2023).

When referring to “tokens”, a distinction must be made between different types of tokens. Fungible tokens are interchangeable units that can be divided into smaller fractions, like traditional currencies. Each token represents the same value and rights as any other token of the same type. There are also non-fungible tokens (NFTs), that are unique digital assets. Each token has its own metadata and is different from every other token. NFTs are best suitable, for example digital art and collectibles, where the specific identity is relevant (Castillo León & Lehar, 2026). In this thesis, the term “token” refers exclusively to fungible tokens, as non-fungible tokens are not as commonly used in the tokenization of bonds, real estate, or commodities.

Although blockchain technology was originally associated with the removal of intermediaries, recent research shows that it often leads to the creation of new intermediary roles that manage governance, technical coordination, and compliance within decentralized systems (Feulner et al., 2025).

2.3 Traditional financial assets as a benchmark

Traditional financial assets form the basis of the financial system and provide a well-established framework for the issuance, trading, and ownership of value. These assets are embedded in mature market structures supported by legal, regulatory, and institutional arrangements. This structure governs how ownership is defined, transferred, and protected. In traditional finance (TradFi), assets are traded through centralized market structures such as regulated exchanges or over-the-counter markets. Asset ownership is recorded and managed by financial institutions like custodians, clearinghouses, and central securities depositories (CSDs) (Cisar et al., 2025). These market participants monitor settlement processes, maintain official ownership records, and make sure that processes comply with regulatory standards. While this infrastructure has proven reliable over time, it also involves multiple intermediaries and operational difficulties. By outlining how conventional systems handle these processes, this study can assess whether blockchain-based solutions can offer significant improvements to the processes. Accordingly, traditional assets serve as the baseline against which the implications of digital ownership and tokenization are examined later in this thesis.

3 Theoretical framework

This chapter introduces four core financial and economic theories that provide the foundation for understating how tokenization could transform modern markets. These theories explain how information and transaction costs affect asset prices, how investors can manage risk through diversified portfolios, and how governance structures influence trust and operational efficiency.

3.1 Efficient Market Hypothesis

Efficient Market Hypothesis (EMH) is a fundamental theory in finance created by Fama (1970), that explores how information is reflected in asset prices. The theory presents, that in so called “efficient market”, prices at any given time are thought to completely reflect all available information. This means that asset prices are always fairly valued, and investors cannot expect excess returns using the same information (Fama, 1970).

Market efficiency is typically categorized into three levels (Fama, 1970):

1. Weak form: Prices only reflect the history of past prices.
2. Semi-strong form: Prices adjust to all publicly available information immediately.
3. Strong form: Prices reflect all information, including private or insider knowledge.

In case of asset tokenization, EMH is a vital theory since blockchain technology changes the way information flows through markets. With limiting the number of intermediaries and recording ownership and transactions on a public ledger, tokenization could potentially make markets more efficient (Zhang et al., 2024). EMH implies that blockchain can reduce the delay between public information and price adjustment. Tokenized assets can trade continuously on blockchain platforms, settle in minutes, and bypass traditional market hours and clearing delays. This could increase liquidity and the speed in which investors react to new information (Liu & Chen, 2025; Tanveer et al., 2025). Because transaction data is permanently recorded on the immutable ledger, on-chain data shows transaction volume, flow direction, deposit and withdrawal flows, and wallet activity in near real time (Benedetti & Rodríguez-Garnica, 2025). In this sense, tokenized markets may move closer to the semi-strong form of efficiency, where prices rapidly react to publicly available information rather than adjusting only after disclosure and settlement lags.

3.2 Transaction Cost Economics

Transaction Cost Economics (TCE) is a theory by Williamson (1981), which is based on the idea that buying and selling goods or services is never completely free. The theory states that there are always frictions or costs involved in the process. These transaction costs include the time, effort, and money spent searching for an investment, negotiating a contract, and monitoring the agreement to ensure every participant follows the rules (Williamson, 1981). These costs are often high in traditional markets, since they require several intermediaries, such as banks, brokers, lawyers, and clearing houses to signal trust and verify ownership (Tanveer et al., 2025).

Tokenization can automate several steps that used to require a middleman. This view helps explain why blockchain is often presented as a cost-reducing technology. Smart contracts can automate issuance, transfer, settlement, and parts of compliance that would otherwise require manual coordination across different parties. The literature also frequently links tokenization with faster settlement, lower intermediary fees, and more efficient processing in real estate, bonds, and carbon credits (Tanveer et al., 2025).

At the same time, tokenization does not completely eliminate transaction costs. Blockchain transaction fees, technical implementation costs, compliance design, and infrastructure maintenance still matter. The empirical literature shows that higher gas fees can slow funding progress in real estate security token offerings (STOs). TCE is therefore useful in this thesis not because tokenization removes costs altogether, but because it helps show how those costs are redistributed across the transaction chain (Kreppmeier et al., 2023; Tanveer et al., 2025).

3.3 Modern Portfolio Theory

Modern Portfolio Theory (MPT) by Markowitz (1952) provides a mathematical framework for investors to build a portfolio that enables best possible return for a specific risk level. The central lesson of MPT is to spread money across different types of investments, such as stocks, bonds, and real estate. Diversifying investments can reduce their overall risks, since assets returns aren't always correlated with each other. According to the theory, in diversified portfolio individual risks of different assets cancel each other out. According to the theory, simply increasing the quantity of holdings is insufficient. The crucial factor is their covariance. Consequently, spreading investments across various sectors and economic profiles mitigates portfolio volatility far more effectively than maintaining concentrated positions (Markowitz, 1952). In other words, the quality of diversification matters more than the simple number of positions. However, in traditional finance it is often difficult for the average person to diversify properly (Kreppmeier et al., 2023).

Building a diversified portfolio can have high entry barriers and require significant amounts of capital. Tokenization solves this problem through fractional ownership. By breaking a high-value asset into millions of less valuable digital tokens, a diversified portfolio becomes much more accessible. This democratization of ownership makes a great difference considering that even small retail investors could build highly diversified and efficient portfolios that have been only available for wealthier investors (Tanveer et al., 2025). Historical market evidence shows that for example government bonds and commodities have relatively low correlation with the broad market portfolio, which is exactly why they are often used to improve diversification across asset classes. Tokenized versions of these assets may therefore support portfolio construction by lowering barriers to entry and making cross asset allocation more practical (Doeswijk et al., 2020; Jaouhari et al., 2025).

3.4 Agency Theory

Theory by Jensen & Meckling (1976) explains situations where a party called the principal delegates decision-making authority to another party called the agent. This is especially important in finance, because ownership and control are often separated. Investors provide capital and managers, intermediaries, or platform operators make decisions on their behalf. This separation can create conflicts of interest, because agents may pursue their own goals, use information advantages, or make choices that do not fully maximize the principal's value (Jensen & Meckling, 1976).

Agency Theory is useful for understanding tokenized assets because it focuses on the separation between the parties who supply capital and parties who make decisions on their behalf. In traditional finance structures, this separation is common in Real Estate Investment Trusts (REITs). Management and board oversight is strong, and investors have limited direct influence over day-to-day decisions. This arrangement can reduce some agency costs through formal governance and distribution rules. These rules also leave ownership and control partly disconnected, which is a problem the theory is designed to explain (Liu & Chen, 2025).

In tokenized markets, some of these frictions can be eliminated. Steps of issuance, settlement, and compliance can be automated using smart contracts. Immutable transaction records on-chain also improve transparency and real-time monitoring (Tanveer et al., 2025). Token holders may also gain more direct participation through decentralized governance mechanisms, which can distribute control more widely than in traditional structures (Liu & Chen, 2025).

At the same time, tokenization does not remove all agency problems. It transfers them to new actors like oracle providers, validators, and governance token holders, whose incentives do not always align with investors (Cong et al., 2025; Feulner et al., 2025). Governance tokens can concentrate decision-making power, as oracle networks require staking, penalties, and reward systems to keep participants honest. This shows that trust still depends on human-designed incentive structures rather than the software alone (Castillo León & Lehar, 2026). Agency Theory explains whether tokenized assets really improve accountability and incentive alignment or just relocate principal-agent problems into a new technological situation. From the theory's perspective, information asymmetry remains a core issue despite decentralization. Grassi et al. note that intermediation can reduce asymmetry by giving a clearer view of counterparties' risk profiles and by monitoring how information is distributed. Blockchain may also reduce the borrowers' incentives to provide false information. At the same time, DeFi still depends on algorithmic or consensus-based risk assessment (Grassi et al., 2022).

4 Comparative review of tokenized and traditional assets

This chapter provides a comparative analysis of tokenized and traditional financial assets, focusing on bonds, real estate, and commodities. The objective is to evaluate whether blockchain-based tokenization impacts the market structure, economics, and risks of these asset classes.

4.1 Bonds

The bond market represents the largest securities market globally, with the total value of approximately 133 trillion USD in 2022. The United States alone accounts for over USD 51 trillion of the global bond market as of the same year. China has the second largest bond market in the world, with 16 % share of the total market (Cisar et al., 2025; Wong et al., 2025). Within this landscape, traditional corporate bonds play a vital role in funding companies while providing portfolio diversification opportunities for institutional and retail investors. The U.S. corporate bond market was valued at approximately 10 trillion USD in 2020 (Cisar et al., 2025). However, the existing infrastructure for issuing and trading these instruments is characterized by significant inefficiencies that tokenization aims to address.

According to Cisar et al. (2025) the traditional bond market relies on a highly centralized infrastructure, involving a complex chain of international intermediaries such as investment banks, underwriters, rating agencies, and clearing and settlement houses. Issuance and trading processes have time consuming procedures such as bond raising, promissory bills, and compliance that increase operational costs. These structural frictions can lead to higher costs and bid-ask spreads. As a result, large-volume transactions may face execution challenges, while smaller investors may encounter barriers to participate (Cisar et al., 2025).

Cisar et al. (2025) find that transaction costs in bond markets can be reduced by minimizing intermediary involvement and streamlining transaction processes. Blockchain-based bond models are proposed as a potential solution to these inefficiencies. According to the study, a blockchain-based solution could reduce uncertainty, information asymmetry, and asset specificity, a principle from Transaction Cost Economics theory by Williamson (1981). In this context, asset specificity refers to structural features of traditional bond markets that tie issuance, settlement, and trading processes to intermediaries and infrastructures, thereby limiting standardization and increasing coordination costs. According to a study by Tanveer et al. (2025), liquidity is also increased by continuous trading, which is allowed by blockchain-based trading platforms.

The solution uses smart contracts that make the complex bond infrastructure simpler, faster, and more customizable. In theory, the concept could make secondary markets more accessible for bonds, and lower entry barriers (Cisar et al., 2025). By integrating issuance and settlement procedures on-chain, the model aims to enhance efficiency while simultaneously increasing market activity. A recent report from BIS shows concrete evidence from tokenized government bonds, backing the theoretical promises. Entry barrier for minimum investment is shown to be lowered from 185,000 USD down to 110,000 USD with tokenized bonds. Figure 3 shows that tokenized bonds have increased liquidity and similar issuance costs compared to conventional ones (Aldasoro et al., 2025).

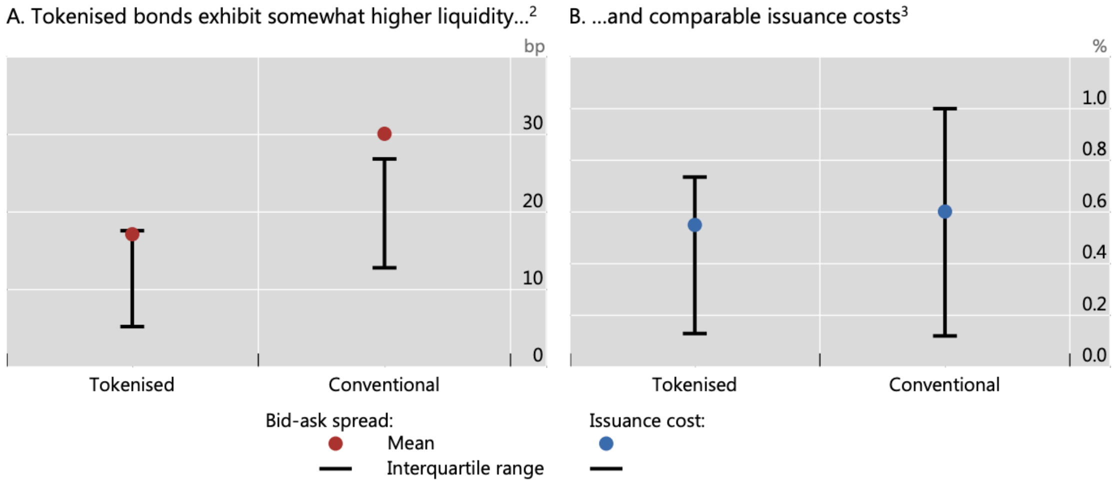

Figure 3. Comparison of liquidity and issuance costs (Aldasoro et al., 2025).

However, this data reveals that the theoretical promises of tokenization are only partially realized in current market applications. While the reduction of the minimum investment barrier supports the accessibility claims of MPT, the expectation of significantly reduced transaction costs is challenged by market realities. As shown by the figure, tokenized bonds currently shows issuance costs that are highly comparable to conventional bonds (Aldasoro et al., 2025). From a TCE perspective, the anticipated savings from bypassing traditional clearinghouses are limited by the high legal, technological, and compliance costs required to map on-chain execution to off-chain regulatory frameworks. While tokenization successfully enhances secondary market liquidity, its capacity to lower primary issuance costs remains more theoretical.

While the findings seem promising, tokenized bond issuances remain small relative to the total market size. Unlike traditional bonds, which operate on a well-established and mature legal framework, tokenized bonds must bridge on-chain settlement with off-chain legal recognition (Zhang et al., 2024). From Agency Theory perspective, the traditional bond market requires multiple agents, such as credit rating agencies, trustees, and clearinghouses to bridge the trust gap between the issuer and the investor. While tokenization mathematically guarantees coupon payments through smart contracts and cuts the agency costs of administrative middlemen, it cannot eliminate the fundamental principal-agent risk of borrower default. Specifically, the blockchain's transparent ledger does not resolve the off-chain information asymmetry regarding the borrowing company's actual financial situation. If a tokenized corporate bond defaults, the blockchain cannot seize physical collateral. Investors and legal frameworks must still rely on traditional legal agents, custodians, and off-chain courts to enforce their rights. Regulatory uncertainty, particularly in cross-border offerings may further increase compliance complexity and limit efficiency gains. Therefore, while bond tokenization may reduce operational frictions, its long-term impact depends heavily on regulatory standardization and the integration of these off-chain agents.

4.2 Real estate

The global real estate market is valued at over 217 trillion USD and represents around 60 % of global wealth. Currently, this sector is shifting from traditional financial infrastructure towards decentralized structures and ownership (Manahov & Li, 2025). Real estate plays a large role in traditional investment strategies but is less accessible compared to assets like stocks and bonds. Properties are illiquid and capital-intensive, often requiring significant investments and transaction fees (Kreppmeier et al., 2023; Liu & Chen, 2025).

To address these limitations, in 1960s the real estate industry developed Real Estate Investment trusts (REITs). A recent study by Liu & Chen (2025) compares traditional real estate ownership structures to blockchain-based tokenization. The paper introduces REITs as the current primary vehicle for democratizing access to property equity. REITs enable individual investors to gain exposure to large property investments by allowing them to purchase fractional ownership rights in diversified real estate portfolios. These fractions function like securities and increase accessibility and liquidity. Despite REITs benefits, they remain heavily dependent on centralized oversight. Decision-making power is centered to the REITs management team and shareholders, resulting in a lack of direct investor involvement over the assets (Liu & Chen, 2025).

Blockchain-based tokenization introduces a shift from this model by enabling the direct fractionalization of property rights into digital tokens. These tokens directly represent ownership and grant investors voting rights as well as greater autonomy over the underlying property assets. The difference is significant compared to REITs, where investors only own shares of the company that is managing the portfolio (Liu & Chen, 2025). From the standpoint of Agency Theory, this structural shift attempts to remove the traditional principal-agent problems inherent in REITs. In REITs centralized management teams may often prioritize corporate growth or fee generation over maximizing shareholder returns. By utilizing smart contracts to automatically apply property rules and distribute rental income, tokenized real estate removes these traditional agency costs. However, as established in the theoretical framework, this only relocates the agency problem. Governance protocols often grant voting power in the same ratio as token holdings, creating a new dynamic where large token holders act as new agents. Large token holders could then potentially make property management decisions that disadvantage minority retail investors.

The paper by Liu & Chen (2025) focuses on Ethereum blockchain-based solutions in real estate tokenization. It is found in the study that smart contracts working on the blockchain reduce the need for traditional centralized intermediaries like lawyers, brokers, and management companies. These smart contracts automate important functions like transactions, rent collection, distribution of profits, and compliance. Empirical evidence in the paper suggests that the automation can reduce transaction costs by 30% to 50% compared to traditional methods (Liu & Chen, 2025). It aligns well with Transaction Cost Economics theory and gives a practical example of the benefits of removing intermediaries. In addition, studies by Manahov & Li (2025) and Tanveer et al. (2025) indicate that tokenization can significantly accelerate settlement processes. Traditional real estate transactions often require several days or longer to complete due to extensive documentation, verification procedures, and intermediary involvement. Blockchain-based systems enable much faster digital settlement, with ownership transfers potentially occurring within minutes on globally accessible, continuous trading platforms.

To further illustrate the nature of real estate tokens, a study by Kreppmeier et al. (2023) examines real estate token platform RealToken (RealT). The USA based company offers investors a vehicle to invest in rented residential buildings through security token offerings (STOs), where a smart contract automatically distributes tokens to investors. These security tokens represent ownership of a specific property. Because the protocol is utilizing Ethereum blockchain, investors must pay a so called "gas fee", representing the costs required to execute on-chain transactions. Due to high gas fees and longer execution times of Ethereum blockchain, the company also enabled transactions on Gnosis blockchain. In addition to gas fees, RealT applies a 10% fee at the time of the STO. In return, investors are issued RealT governance tokens, that work as voting rights for the company. RealToken properties are managed by local service providers and the net profits are distributed to token holders weekly using a smart contract. However, this reliance on off-chain property managers creates a significant information asymmetry. While token holders can track dividend payouts on the blockchain, they have very limited visibility into the actual physical condition and maintenance of the property. The value of a RealT token is calculated by deducting maintenance and repair reserve from the property value and dividing it by the circulating token supply. Property values are calculated annually, which then affects the token prices (Kreppmeier et al., 2023).

This empirical data from active platforms reveals a clear paradox between the theoretical cost savings and practical implementation. While Liu & Chen (2025) estimate theoretical transaction cost reductions of 30% to 50% through the elimination of traditional real estate brokers and management companies, real-world applications show that these costs are often replaced rather than completely removed. Investors on the RealT platform face a significant 10% upfront fee during the STO, alongside highly variable network gas fees required to execute the smart contracts. When factoring in the additional compliance costs required to navigate fragmented legal frameworks, the true economic efficiency of tokenized real estate remains unclear. From the perspective of TCE, tokenization currently redistributes execution costs to blockchain networks and platform operators, rather than eliminating the frictions of traditional real estate investing.

While tokenization brings theoretical liquidity benefits in associated with fractionalized ownership and continuous trading, the depth of secondary markets for tokenized real estate remains limited. Liquidity does not only depend on the technological infrastructure, but also on investor participation and market trust. As a result, while the structural entry barriers are lowered, it does not automatically eliminate inherent liquidity associated with real estate as an asset class. It is important to note, that from portfolio perspective, tokenized real estate remains economically exposed to the same market risks as traditional property management. Kreppmeier et al. (2023) study analyzing 173 real estate tokens and over 200,000 blockchain transactions found that investors do not hold well-diversified portfolios.

Tokenized real estate face significant challenges from a legislative perspective. Traditional regulation systems have not yet globally adapted to blockchain-based real estate models and legal uncertainties with AML compliance and token offerings can lead to major delays in DeFi projects. For further adaptation of tokenized real estate, a clear and consistent regulatory framework should be developed (Liu & Chen, 2025). Furthermore, tokenized ownership must be aligned with existing property law frameworks. Although on-chain records represent digital claims to real estate assets, legal ownership remains tied to standard juridical land registries. This distinction highlights that tokenization changes the transfer mechanism but does not replace the underlying legal structure that monitors the property rights.

4.3 Commodities

The commodity market represents a fundamental part of the global financial system, offering exposure to physical assets, such as agricultural goods, energy products, and precious metals. Among these, gold holds a unique position due to its historical role as a store of value and safe-haven asset. Major currencies have historically been linked to gold under monetary systems such as the gold standard, and central banks have continued to hold gold reserves as a hedge against macroeconomic instability. The global gold market consists of physical bullion, futures contracts, and exchange-traded funds (ETFs) (Baur & McDermott, 2010). In this section, gold is presented as the primary example because it currently dominates the tokenized commodity market. According to a recent report by the World Economic Forum (2025), Tether Gold (XAUt) and Paxos Gold (PAXG) account for approximately 99% of the total market share.

Tokenized gold represents a digital extension of the traditional structure. In tokenized models, physical gold reserves are held in custody by an issuer, while blockchain-based tokens represent ownership of a specified quantity of gold. These tokens can then be transferred on-chain, enabling fractional ownership, and continuous trading. Similarly to other tokenized assets, this approach may streamline certain processes using smart contracts, lower entry barriers, and increase liquidity (Tanveer et al., 2025).

Preliminary insights from a recent working paper by Harvey et al. (2026) examining tokenized gold markets suggest that blockchain-based gold tokens may reduce certain operational frictions and increase accessibility compared to traditional gold markets. However, as the study has not yet undergone peer review, its conclusions should be interpreted as early-stage evidence, rather than definitive empirical findings. The study focuses on the two predominant gold tokens, XAUt and PAXG by analyzing on-chain and off-chain data from various sources. The findings indicate that even during high volatility events, tokenized gold prices stay in line with gold ETFs, futures, and spot prices. Reported price deviations are generally small and corrected by arbitrage, while bid-ask spreads remain relatively low. Figure 4 demonstrates the strong alignment between gold futures, spot prices, and the tokenized gold assets XAUt and PAXG, indicating tight price tracking across traditional and blockchain-based markets during 2022–2025.

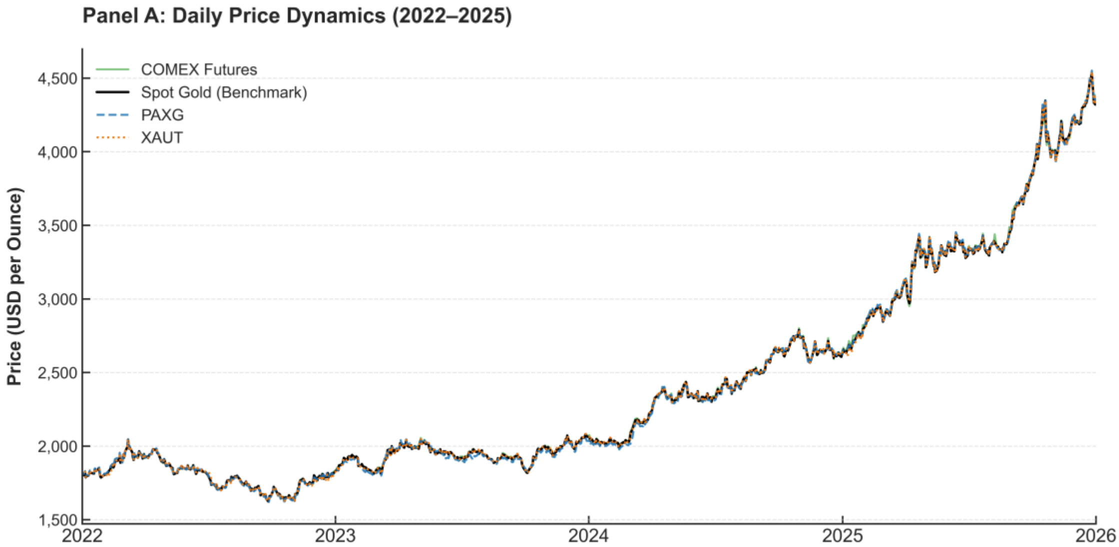

Figure 4. Gold price dynamics 2022-2025 (Harvey et al., 2026).

Continuous trading allows for price adjustments outside traditional market hours, enabling earlier incorporation of new information. This observation is consistent with the Efficient Market Hypothesis, which suggests that asset prices reflect available information as it becomes public (Fama, 1970). Unlike traditional gold products, tokenized gold tokens can also be used as collateral in various DeFi protocols, demonstrating expanded financial functionality (Harvey et al., 2026). The findings reported provide preliminary empirical support for the arguments proposed by Tanveer et al. (2025) about the efficiency and accessibility gains associated with asset tokenization.

While this data validates the theoretical potential of smart contracts to allow efficient continuous trading, a critical assessment of the market structure reveals a paradox regarding decentralization, since the two companies (Paxos and Tether) control almost the entire tokenized gold market (WEF, 2025). Furthermore, the tight price tracking observed by Harvey et al. (2026) is highly reliant on centralized oracle networks and traditional custodial vaults holding the physical reserves. Under the Agency Theory, this indicates that the tokenized commodities market has not eliminated traditional financial intermediaries but has simply concentrated them into a massive technological duopoly. Therefore, the practical reality of tokenized gold currently functions less as a decentralized revolution, and more as a technologically advanced wrapper for traditional, highly centralized asset management.

Building on these structural limitations, the stability of tokenized gold depends entirely on the credibility of these custodial arrangements. Unlike decentralized cryptocurrencies, tokenized gold relies on centralized vault providers, which introduces severe centralization risks. Investors face total information asymmetry regarding the true state of the physical gold reserves, because the physical asset remains completely off-chain. This forces them to trust centralized proof-of-reserve audits rather than algorithmic verification. The effectiveness of arbitrage mechanisms in maintaining price alignment may also depend on sufficient market liquidity and institutional participation, which remains limited compared to traditional gold ETFs and futures markets. Furthermore, regulatory oversight and proof-of-reserve transparency are critical for building investor trust. In addition, while tokenization may increase transferability, it does not eliminate traditional risks associated with gold ownership.

4.4 Smart contract risks

Tokenized solutions provide several security enhancements over traditional systems in theory while also introducing new types of security risks across all asset classes. For instance, the automated settlement of tokenized corporate bonds (Section 4.1) and the automatic distribution of rental yields in tokenized real estate (Section 4.2) depend heavily on immutable smart contracts. Because blockchain-based solutions depend heavily on these contracts, vulnerabilities such as programming errors, logical flaws, and malicious design can result in significant losses. The DeFi ecosystem has witnessed multiple high-profile incidents, where smart contract vulnerabilities led to the theft of millions of dollars in digital assets. In addition to capital losses, these incidents also weaken trust on decentralized autonomous organizations (DAOs) (Liu & Chen, 2025; Tanveer et al., 2025). The study by Liu & Chen (2025) highlights a 2016 hack on a DAO that resulted in 60 million USD losses in Ethereum as a warning example for DeFi security.

To strengthen investor trust, DeFi protocols typically undergo third-party smart contract audits. A paper by Castillo León & Lehar (2026) shows that DeFi projects are more inclined to undergo smart contract audits when they operate on major blockchain networks, provide standardized financial services such as lending or exchange, or rely on technically complex data inputs. Research indicates that audited projects tend to experience stronger user adoption and demonstrate more stable performance during adverse market events. It is also shown that projects that undergo audits often attract significantly higher levels of capital. This evidence shows that while auditing can mitigate some risks, it does not fully eliminate the risk of future security breaches. In some cases, DeFi projects change auditing firms after incidents, which may limit the long term preventive impacts of audits (Castillo León & Lehar, 2026).

4.5 Oracle vulnerabilities

DeFi applications depend heavily on price oracles to fetch off-chain data into the blockchain. This function is especially critical for tokenized commodities (Section 4.3) like gold that require continuous alignment with traditional spot markets. Since smart contracts execute independently based on oracle data inputs, inaccuracies in oracle feeds can directly affect the stability of the protocol and user outcomes. Even relatively small pricing errors can result in misaligned collateral valuations, inefficient liquidations, and increased uncertainty within trading and lending platforms (Nadler et al., 2026). In recent study, researchers Cong et al. (2025) divide oracle vulnerabilities into intentional and unintentional issues. Intentional failure is described as economic manipulation, where participants try to exploit oracle mechanisms for financial gain. These risks materialize when economic incentives and oversight arrangements do not effectively compel malicious actions. Unintentional failures are usually technical, such as network outages, data feed issues, or system malfunctions. Since oracles depend on external data, such as APIs, weaknesses in any connected component can compromise data accuracy and disrupt the oracles operations. This also creates a point of centralization to the otherwise decentralized systems (Cong et al., 2025).

A recent study by Nadler et al. (2026) reviewed Chainlink Price Feeds (CPFs) to gain insight of the risks in oracle infrastructures. The study analyzed major oracle provider Chainlink, and the findings indicate that price deviations are generally limited but seem to increase during periods of increased market volatility. Oracle accuracy is influenced by configuration parameters such as deviation thresholds and update frequency. While most deviations are corrected within a short time period, larger variance may last longer and require active updates to restore alignment with reference market prices (Nadler et al., 2026). The challenge of maintaining secure and accurate oracle systems is particularly relevant for asset tokenization, since the gap between on-chain tokens and off-chain data must be continuously bridged through trusted feeds.

4.6 Custodial and counterparty risk

This risk is mostly relevant for tokenized commodities (Section 4.3) like gold, where the physical bullion must be stored in a vault, and tokenized real estate (Section 4.2), which requires property management companies. Tokenized assets still depend on many off-chain participants, like custodians, trustees, issuers, servicers, and others to verify that the underlying asset exists and is properly backed. This means that failures, fraud, or reputational damage can still weaken trust in the token itself. In conclusion, blockchain does not remove counterparty exposure entirely (Ciriello, 2021; Tanveer et al., 2025).

4.7 Liquidity risk

Tokenization can improve liquidity by creating secondary markets and enabling fractional ownership, but the liquidity is not guaranteed. Fractionalization lowers barriers for capital intensive assets like corporate bonds (Section 4.1) and commercial properties. In several tokenized real estate settings (Section 4.2), secondary-market activity remains limited and low trading volume can contribute to price instability. This means the liquidity benefit should be presented as conditional rather than automatic (Kreppmeier et al., 2023; Liu & Chen, 2025).

4.8 Technology transfer and implementation risk

The institutional adoption of tokenized corporate and government bonds (Section 4.1) faces significant difficulties. Technical expertise, standards, interfaces, secure infrastructure, and legal coordination is required when switching from traditional systems to tokenized infrastructure. The literature notes that tokenization is complex to implement, and interoperability remains incomplete. Weak technical preparation can slow adoption of tokenized solutions or limit the ability of issuers and investors to use the system effectively (Jaouhari et al., 2025; Zhang et al., 2024).

4.9 Valuation and pricing risk

Valuation and pricing dynamics create certain challenges across different asset classes. Tokenized commodities (Section 4.3) rely on fast oracle updates to track spot prices, and tokenized real estate (Section 4.2) often suffers from a delay between continuous trading prices and the manual assessment of the physical property. Token prices do not always align with the value of the underlying asset. Pricing can be distorted by inaccurate or delayed oracle inputs, gaps between token prices and net asset values, and market manipulation. These factors can affect the valuation of the collateral, liquidations, and investor returns (Jaouhari et al., 2025; Nadler et al., 2026).

4.10 Scam and market manipulation risk

Scams and market manipulation are one of the most significant concerns in tokenized markets. The same features that make tokenization attractive, such as fast trading, global access, and the lack of oversight, can also make it easier to inflate prices and defraud investors. The literature notes that fraud, hacking, and poorly designed token projects can weaken trust, while weak regulation and pseudonymous trading can increase the risk of insider trading and price manipulation. The risk is higher particularly in smaller or less liquid markets (Manahov & Li, 2025; Tanveer et al., 2025). Common threats also include phishing scams, fake crypto projects, pyramid and Ponzi schemes, pump-anddump scams, and many other fraudulent activities (Sapkota, 2022). Because investors in tokenized real estate (Section 4.2) and commodities (Section 4.3) must often navigate multiple different cryptocurrency exchanges to trade their assets, they face a higher risk of interacting with fraudulent actors compared to investors in traditional financial markets.

4.11 Regulatory concerns

While the technological infrastructure underlying blockchain-enabled systems has developed rapidly, the corresponding legal and regulatory frameworks governing tokenized bonds (Section 4.1), real estate (Section 4.2), and commodities (Section 4.3) remain uncertain and fragmented. Regulating tokenized assets is essential to limit cybersecurity and governance risks as well as protect investors and maintain market trust. DeFi protocols operate in multiple jurisdictions and rely on identity preserving user participation, which further complicates regulatory oversight. Participants often interact across multiple platforms and exchanges, making effective enforcement of KYC and AML measures more challenging (Castillo León & Lehar, 2026; Tanveer et al., 2025). Because of the inherent global nature of tokenized assets, effective regulation requires coordination across jurisdictions. Tanveer et al. (2025) found, that for example market manipulation is a major concern in tokenized markets and could be mitigated by establishing a well-functioning legal framework and increasing transparency.

A study by Zhang et al. (2024) reviews the environments for tokenization in major economies. The findings indicate that the regulatory bodies in the United States, France, and Germany have a more skeptical approach for blockchain-based solutions, compared to South Korea, Japan, Australia, Switzerland and the United Kingdom. The regulation varies inside the European Union as some countries are implementing a more restrictive legal framework than others. For example, Malta and Gibraltar are said to have a more flexible approach to attract blockchain-based companies.

In the European Union crypto-assets and related services are regulated by the Markets in Crypto-Assets Regulation (MiCAR). This framework targets crypto-assets, that cannot be classified as traditional financial instruments under Markets in Financial Instruments Directive II (MiFID II), thereby aiming to create a more uniform stance across the EU (Del Sarto et al., 2024; Zhang et al., 2024). The framework divides crypto-assets into asset-referenced tokens (ARTs), e-money tokens (EMTs) and other crypto-assets. EMTs are tokens pegged to an official fiat currency, essentially acting as digital equivalents of traditional e-money. Conversely, asset-referenced tokens (ARTs) maintain their peg through a wider variety of assets, like a combination of different fiat currencies, commodities, or other crypto-assets (Regulation (EU) 2023/1114, 2023). Tokenized assets like bonds, real estate, and commodities can operate within both MiFID II and MiCAR, which can further complicate operations. For instance, tokenized corporate bonds (Section 4.1) typically qualify as traditional securities under MiFID II, whereas tokenized commodities (Section 4.3) like gold are regulated as ARTs under MiCAR, requiring 100% asset reserves. From the perspective of Transaction Cost Economics (TCE), this complicated environment significantly increases compliance and legal costs. Therefore, while tokenization theoretically reduces traditional intermediary fees, the lack of a unified legal framework introduces new and higher transaction costs.

5 Conclusions

The purpose of this thesis was to study the benefits and limitation of tokenized financial assets compared to their traditional counterparts, focusing specifically on bonds, real estate, and commodities. The comparative study shows how blockchain-based tokenization introduces significant technological efficiencies, particularly in fractionalizing high-value assets and automating settlement processes using smart contracts. However, these benefits remain mostly theoretical. Emergence of new intermediary roles, technological vulnerabilities, and highly fragmented global regulatory frameworks are eliminating most the advantages.

The findings from the analysis provide clear outcomes for the three hypotheses guiding this thesis. Hypothesis one (H_1) is well supported by the literature, which is indicating that tokenization improves market accessibility. Tokenized real estate allows direct fractional ownership that bypasses traditional REIT structures, while tokenized commodities like gold enable continuous 24/7 trading outside of traditional market hours. Continuous trading activity and fractional ownership is available on all three asset classes. Hypothesis two (H_2) is only partially supported. While smart contracts technically execute automatically and reduce traditional intermediary fees in theory, these savings are frequently offset by new practical costs, such as high platform STO fees, gas fees, and heavy compliance costs. Hypothesis three (H_3) is well supported by the research. Institutional hesitation is largely driven by regulatory uncertainty. The necessity of bridging on-chain digital ledgers with off-chain legal property registries, custodies, fragmented jurisdictional frameworks and KYC/AML requirements, continues to limit wider institutional adoption.

This thesis applied four core financial theories to analyze the impact of tokenized assets. The continuous trading capabilities of tokenized assets align with the Efficient Market Hypothesis (EMH) by allowing the faster incorporation of public information into asset prices. From the perspective of Transaction Cost Economics (TCE) the analysis reveals, that while technical transaction costs decrease, regulatory and compliance costs increase due to legal fragmentation and asset specificity. Under Modern Portfolio Theory

(MPT), tokenization theoretically democratizes portfolio diversification by lowering entry barriers. Finally, using Agency Theory it is found that tokenization does not eliminate the principal-agent problem. Instead, the trust is shifted from traditional financial institutions to protocol developers, decentralized governance networks, oracle providers, and the centralized custodians holding the physical asset reserves.

The primary limitation of this study is the reliance on early-stage market data, as most institutional tokenization efforts currently remain in limited pilot phases. Because long-term empirical data is limited, future research should investigate the actual liquidity of tokenized assets on secondary markets as they mature. Additionally, further legal and economic studies are recommended to examine the impact of unified global regulatory frameworks, such as the full implementation of MiCAR, on transaction costs and institutional adoption.

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