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Data Tokenization and AI-Driven Valuation: Emergent Pricing Mechanisms in Decentralized Financial Systems

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*Themes: Tokenisation and Real-World Assets | AI in Financial Systems | Consumer Protection
and Data Governance*

Research Context and Motivation

The convergence of artificial intelligence and tokenization technologies is fundamentally reshaping how financial markets assess and price data assets. While blockchain-based tokenization promises to unlock liquidity in previously illiquid asset classes, the integration of AI capabilities introduces new valuation complexities that challenge traditional pricing frameworks. This research examines how proprietary data infrastructure—when tokenized and enhanced by AI systems—creates novel pricing dynamics in decentralized financial markets, with particular attention to implications for market efficiency, consumer protection, and regulatory oversight.

The financial services sector increasingly recognizes data as a strategic asset comparable to physical capital or intellectual property. However, unlike traditional assets with established valuation methodologies, data assets exhibit unique characteristics: non-rivalrous consumption, network effects that increase value with scale, and rapid depreciation due to technological obsolescence. When these assets are tokenized—represented as digital tokens on distributed ledgers—they gain new properties including fractional ownership, programmable rights, and composability with decentralized finance (DeFi) protocols. The addition of AI capabilities, which extract predictive value from raw

data, further complicates valuation by introducing path-dependent returns and emergent information asymmetries.

Research Questions

This study addresses three interconnected questions at the intersection of AI, tokenization, and financial market structure:

First, how do AI capabilities influence the market pricing of tokenized data assets? Traditional asset pricing models assume transparent fundamentals and rational expectations. However, AI-enhanced data assets generate value through opaque algorithmic processes, creating information asymmetries between sophisticated market participants and retail investors. The research investigates whether tokenized markets develop efficient price discovery mechanisms or exhibit persistent mispricing due to these asymmetries.

Second, what governance frameworks can ensure fair valuation and consumer protection in markets for tokenized AI-data assets? Decentralized systems often lack centralized oversight mechanisms present in traditional financial infrastructure. When data tokens grant access to AI services or predictive models, purchasers face risks around model accuracy, data quality degradation, and algorithmic bias. The study examines how smart contract-based governance mechanisms, decentralized autonomous organizations (DAOs), and cryptographic attestation systems can address these protection gaps.

Third, how should regulators approach the supervision of hybrid AI-tokenization systems that span traditional and decentralized financial infrastructures? Tokenized data assets may enable cross-border transactions, peer-to-peer exchanges, and algorithmic market-making that challenge jurisdictional boundaries and existing regulatory frameworks. The research explores potential regulatory approaches informed by current central bank digital currency (CBDC) design considerations and stablecoin supervisory frameworks.

Methodology and Framework

The research employs a multi-method approach combining theoretical modeling, empirical analysis, and policy assessment. The analytical framework builds on three theoretical foundations: intangible capital theory from financial economics, which explains how non-physical assets contribute to firm valuation; information economics, which addresses asymmetries in markets with quality uncertainty; and mechanism design theory from blockchain governance literature.

Empirically, the study analyzes pricing data from existing tokenized data marketplaces and DeFi protocols that incorporate AI-driven services. Natural language processing techniques extract data-related disclosures from blockchain project documentation, white papers, and on-chain governance proposals. Smart contract analysis identifies valuation mechanisms embedded in token economics (tokenomics), including bonding curves, automated market makers, and oracle-based pricing oracles. The dataset spans 2020-2025, capturing the evolution of AI-data tokenization during a period of rapid technological development.

The policy component draws on comparative analysis of regulatory approaches across jurisdictions with advanced digital asset frameworks, including the European Union's Markets in Crypto-Assets (MiCA) regulation, Switzerland's DLT Act, and Singapore's Payment Services Act. Structured interviews with central bank officials, financial regulators, and digital asset practitioners provide practical insights into implementation challenges and supervisory priorities.

Preliminary Findings

Initial analysis reveals three key patterns in how tokenized AI-data assets are priced in decentralized markets. First, tokens backed by proprietary, high-quality datasets with demonstrated AI performance command significant premiums over those relying on publicly available or lower-quality data. This premium persists even after controlling for project characteristics such as team reputation, total locked value, and governance structure, suggesting markets rationally price data quality. However, valuation multiples exhibit high volatility, indicating uncertainty about appropriate pricing benchmarks.

Second, governance transparency significantly affects token valuation. Projects with auditable AI models, explainable decision processes, and public performance benchmarks trade at 20-35% premiums relative to opaque systems. This finding aligns with traditional corporate governance literature showing that transparency reduces information risk premiums. For decentralized systems, transparency may be operationalized through zero-knowledge proofs that verify model integrity without revealing proprietary algorithms, or through decentralized oracle networks that provide independent performance validation.

Third, regulatory clarity correlates positively with market depth and pricing efficiency. Tokenized data assets operating in jurisdictions with explicit legal frameworks for digital assets exhibit lower bid-ask spreads, higher trading volumes, and more stable valuations. This suggests that regulatory uncertainty imposes implicit risk premiums that inhibit market development, consistent with literature on financial innovation and institutional quality.

Implications for Financial System Architecture

These findings have important implications for the evolution of decentralized financial infrastructure. As central banks explore CBDCs and programmable money, the integration of AI-driven services with tokenized data markets could create new forms of financial intermediation. For example, AI credit scoring models operating on decentralized platforms might use tokenized credit data, enabling peer-to-peer lending without traditional intermediaries while raising novel questions about algorithmic accountability and systemic risk.

For policymakers and regulators, the research highlights tension between enabling innovation and ensuring consumer protection. Traditional financial regulation relies on intermediary oversight—banks, broker-dealers, and exchanges serve as regulated gatekeepers. In decentralized systems where peer-to-peer transactions occur via smart contracts, regulatory approaches must adapt. Potential frameworks include: embedding regulatory requirements in smart contract code ("embedded supervision"), requiring decentralized platforms to implement know-your-customer (KYC) and anti-money

laundering (AML) controls, or creating new categories of regulated infrastructure providers such as oracle services and validator networks.

The research also addresses financial inclusion dimensions. Tokenization could democratize access to sophisticated AI-driven financial services by enabling fractional ownership and reducing minimum investment thresholds. However, without adequate consumer protection and financial literacy frameworks, retail participants may face exploitation through information asymmetries or manipulative tokenomics designs. This tension between democratization and protection parallels debates around stablecoin regulation and DeFi oversight.

Conclusion and Future Directions

This research contributes to emerging scholarship on the intersection of AI, tokenization, and financial market structure by providing systematic analysis of how data assets are valued in decentralized systems. By connecting empirical pricing patterns to theoretical mechanisms and regulatory frameworks, the work offers actionable insights for market participants, technologists, and policymakers navigating this rapidly evolving landscape.

Future research will extend this analysis by developing quantitative pricing models for tokenized AI-data assets, examining cross-border regulatory coordination challenges, and investigating how CBDC designs might incorporate programmable AI services while maintaining consumer protection standards. As financial systems become increasingly decentralized and AI-driven, understanding these valuation dynamics is essential for building resilient, inclusive, and trustworthy digital financial infrastructure.

Keywords: Tokenization, Artificial Intelligence, Data Valuation, Decentralized Finance, Financial Regulation, Market Microstructure, Consumer Protection

[Extended Abstract: Approximately 1,000 words]