Reinvesting the Bazaar ;

Explanatory notes of "SBI Research Review vol.5"

Yutaka Soejima, Principal Research Fellow of SBI Financial and Economic Research Institute

   Professor McMillan's book, "Reinventing the Bazaar" is a seminal work that offers an insightful analysis of how markets have emerged and contributed to the enrichment of socio-economics systems from an economic perspective. Market systems and mechanisms incorporate both elements that have arisen organically and those that have been intentionally designed and refined. In recent years, mechanism design, a branch of applied microeconomics, has gained attention in the design of various social systems and has also been actively applied to market design in conjunction with auction theory.

   This volume features four papers exploring the formation and ongoing re-creation of financial markets, financial systems, currency systems, and payment and settlement systems. In the realm of financial business, financial systems and infrastructure, and market structures are often regarded as fixed frameworks, within which business strategies and operational improvements are formulated under prevailing financial conventions. However, a historical perspective reveals that financial markets, financial products, financial systems, currency systems, and the infrastructure, spanning law, information technology, accounting, practices, and culture, have continuously evolved through recurring cycles of stability and transition.

   The accelerated digitalization of society is driving significant changes in financial services and the structure of the financial industry. As explained in the previous volume by Shizume Paper, during the Edo period — the early modern era characterized by samurai governance — a decentralized currency system emerged in which various currencies with different units of account were issued to support the development of individual product supply chains. This system underwent a profound transformation in the early Meiji period, a pivotal era marked by its centralization driven by the wave of modern nation-building. The current financial system, encompassing financial institutions, transaction and settlement institutions, central banks, and more, can be broadly seen as a continuation of this historical evolution.

   However, with the successive entry of non-financial institutions such as ecosystem players into the financial sector, and the activating creation of new financial services and financial infrastructure through the innovation of information and communication technology, the era of momentous transformation is approaching again. The papers in this volume provide insights

into the latest trends in this transformative era and offer valuable clues for envisioning the future of finance.

Soejima Paper, "The Challenges by Central Banks Exploring the Future of Financial Systems"

The discussion on Central Bank Digital Currency (CBDC) in Japan primarily focuses on its use in retail payments, whereas major developed countries are paying significant attention to the potential of wholesale CBDC. Particularly, private financial institutions and IT companies are anticipating the advent of wholesale CBDC, which has a significant synergy effect with emerging financial systems powered by distributed ledger technology. Central to this discourse are key considerations such as the design and functionality of new central bank money for securities settlement and cross-border payments, the new design of a financial system that integrates trading markets and payment and settlement systems, and the exploration of new frameworks where multiple blockchain infrastructures operate in an interconnected or integrated manner through cross-chain technology.

The entry of new players in exchanges such as ECNs/ATSs marked the beginning of transformation in the securities infrastructure industry in the late 1990s in the United States and Europe. This shift transcended borders, reshaping the industry structure of clearinghouses and central securities depositories (CSDs). In recent years, innovation has flowed in reverse, moving from downstream (settlement) to upstream (trading venues). Distributed ledger technology, that is, ledger management technology for money and securities has served as the catalyst for this wave of innovation. It has facilitated the application of a new trading market technology called DeFi and prompted a reconsideration of the role of clearinghouses.

However, in Japan, these global trends remain largely unfamiliar to all but a small group of practitioners and experts. The Soejima paper attempts to provide a comprehensive perspective by tracing the evolution of how central banks around the world are responding to the advancements in distributed ledger technology and continuing to challenge in exploring the future of financial systems. The paper also highlights that even consortia of private financial institutions and IT companies are attempting to create payment services that could compete with traditional central bank money, viewed from the perspective of currency competition (competition within the same currency unit) as discussed by Hayek in his theory of denationalization of money. Money is not only issued by nations but also by private companies in the form of deposits, electronic money, and stablecoins. This raises a fundamental question: who should issue money and for what purposes? It is a question in the design of economic and social infrastructure that underpins the stability of currency value as well as the efficiency and

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stability of the financial system.

As clues for considering these questions, the paper attempts to explain important elements in the system design of payment and settlement infrastructure. These include the decision of settlement periods, the choice between net settlement and gross settlement, and the distinction between real-time settlement and point-in-time settlement, emphasizing that these elements are independent and can be flexibly combined in various configurations. The paper explains, drawing on previous research, that considerations on tiering structures as well as network topology are important for both the efficiency and risk management of payment and settlement systems. When designing cross-border payments infrastructure, it underscores the significance to understand such topologies. It also introduces examples of experimental studies conducted by multiple central banks globally on the use of CBDCs in cross-border payments.

While introducing the challenges surrounding the creation of payment and settlement systems, as well as money systems, the paper emphasizes that the essence of these system designs remain unchanged since the medieval and early modern periods, much like the three primary functions of money. Therefore, it suggests that studying the history of one's own country's payment and currency systems as well as learning from the current systems of other countries provide valuable insights for envisioning the future of financial systems.

Saito Paper, "The Future and Trajectory of Financial Systems Brought by Tokenization"

It deserves broader recognition that Japan is among the world leaders in the practical application and platform development of security tokens, also known as digital securities. This progress has been driven by several key factors: establishment of legal frameworks for security tokens through collaboration between the public and private sectors, the increasing issuance of tokens, particularly in real estate, the development of platforms such as Progmat, and the launch of the Osaka Digital Exchange aimed at creating a secondary market.

This paper, authored by Tatsuya Saito, the CEO of Progmat Inc., provides a comprehensive survey of the field. As a pivotal figure in this initiative, dating back to its inception within Mitsubishi UFJ Trust and Banking Corporation (MUFG's trust bank), Saito offers unique insights into the future vision of the financial system that Progmat seek to build. The paper details the latest developments in planning and technology, as well as a thorough explanation of tokenization concepts, regulatory frameworks, and IT infrastructure. For anyone looking to understand the tokenization business from a practical and interdisciplinary perspective, this paper stands out as an authoritative and indispensable resource.

The paper begins by explaining how the tokenization business is legalized in Japan through a comparison of security tokens, stablecoins, crypto assets, and utility tokens. It categorizes security tokens and stablecoins as a type of reals world assets (RWA) tokens, representing certain claims to real assets, such as securities or deposits. Furthermore, the paper emphasizes the importance of legally structuring two key aspects: (1) how to link RWA and tokens on the platform base, and (2) how to ensure that the transfer of token ownership on the same aligns consistently with the transfer of claims to RWA. It also introduces that the trust with certificates of beneficial interest based on Japan's Trust Law provide an effective means to address these requirements, and Progmat leverages this scheme in its platform.

The detailed explanation of the systems and infrastructures that enable securities ledger management and settlement across the three securities frameworks — physical securities issuance, the book-entry system, and security tokens — provides valuable insights for those studying the practical aspects of the tokenization business. Similarly, the in-depth comparative understanding of existing electronic money and stablecoins focusing on their legal structures and functions as money, is highly useful for structuring and clarifying information and concepts.

The highlight of this paper lies in its thorough explanation of the benefits of deliberately opting for security tokens and stablecoins instead of traditional securities or bank deposits, as well as its insight into their future development potential. It addresses the critical question of why distributed ledger technology, instead of traditional database technology, is necessary in financial infrastructures that typically operate under centralized governance, commonly referred to as the "Why blockchain?" question. The author, who has extensively explored practical use cases, offers his perspective and future strategy as answers to the questions "Why security tokens (ST)? / Why stablecoins (SC)?".

Based on this understanding, the paper envisions the leverage effect of utilizing security tokens and stablecoins on the common base of Progmat as the grand design of the near-future financial system, outlining its potential developmental trajectory. Additionally, it also describes the strategic process of spinning off Progmat from MUFG to establish a foundation for many financial institutions and alliance partners to co-create the near-future financial system. While acknowledging the presence of competitive areas, the paper argues that clearly distinguishing between zones of co-creation and competition is the key to the development of new financial infrastructures.

At the end of the paper, it introduces that real estate STs dominate STs issuance in the early stages of market growth. It is pointed out that the application of separate taxation and the use of specific accounts in a specified trust that issues beneficiary certificates, and the ability to invest in tangible, easily understood real estate assets such as apartments, hotels, and

commercial buildings, rather than portfolio types like REITs, are key factors to attract investor demand. The paper also identifies current challenges, including the need to ensure the continued smooth expansion of real estate STs as the market environment evolves, to consistently provide attractive investment products, and to cultivate a robust investor base to sustain growth. At the same time, the development of mechanisms to extend the tokenization market to other real assets and practical exploration of how ST and SC can effectively function on a common platform remain critical tasks for broader market expansion.

Mizuta Paper, "Artificial Market: Computer Simulation for Financial Market"

Market microstructure is a specialized research field within financial theory and analysis. When designing market systems for exchange trading or over-the-counter trading, a vast number of rules need to be established. These include:

- The methods of matching buy and sell orders and the mechanisms of price determination.

- The presence or absence of intermediary dealers acting as counterparties (whether it is order-driven or quote-driven by dealers).

- The increments of price and trading units, whether it is a continuous auction or a call auction for opening/closing.

- The design and operation of circuit breakers, the disclosure and distribution method of trading information.

- The management of order flow information.

- The information processing speed of systems.

- Transaction fees and other trading costs.

- The relationship between market liquidity and transaction costs.

- The number and size distribution of market participants.

- The composition, qualifications and corporate attributes of both direct and indirect participants.

Market microstructure research examines how these system design elements and differences affect various market functions such as participant behavior, price formation and fluctuation, market liquidity, and efficient price discovery.

Exploring better market trading systems is not a simple challenge. Since analysis relies on data obtained under existing systems, it is often difficult to predict how changes to these systems will impact the market or whether they will achieve the intended outcomes. Even if supported by theoretical reasoning, there remains uncertainty about whether the expected effects will materialize and, if they do, the extent of their quantitative impact. Approaches such as A/B testing used in marketing or randomized controlled trials (RCT), where different systems, environments, or products are implemented and compared, offer potential methods to gather insights. However, these methods are not always applicable in financial markets. Occasionally, natural experiments, where unintended changes in the environment produce observational data that can be treated as experimental results, may take place by accident, but they lack planning and reproducibility.

To address these challenges, a promising alternative is the use of artificial markets, computer-simulated financial markets where different system designs can be tested and their impacts analyzed. The Mizuta Paper reviews a wide range of studies leveraging artificial markets as computer simulations of financial markets, providing various examples and analytical motivations. Specifically, it covers the mechanisms of bubble and financial crisis occurrences and the non-normality of market returns, the impact of tick size on price volatility, the effects of circuit breakers, the relationship between order matching rules and price fluctuations, the impact of algorithmic trading on markets, the risk of unintended market manipulation by artificial intelligence, and applications to macroeconomic models.

The paper first examines why traditional economics and finance theories fail to adequately address the complex behaviors of financial markets and systems. It highlights their shortcomings in understanding phenomena such as market spikes and crashes and the amplification of sectoral shocks through various propagation channels that lead to a financial system crisis. The paper attributes these inadequacies to the inherent simplifications in traditional approaches, which aim to make complex phenomena more manageable. It further criticizes the overreliance on these models, which, while effective under normal conditions, fail to capture the dynamics of extreme market events.

The theoretical models in economics simplify reality to enhance analytical clarity and mathematical tractability, such as solving for equilibrium. For instance, these models limit the number of economic entities e.g., households, firms and government, simplify behavioral principles like utility maximization and profit or firm value maximization, and assume homogeneity of economic agents under the framework of a representative agent. Finance theory, particularly financial engineering, identifies stochastic processes that fit well with the price developments and volatility, and assumes that future price fluctuations will follow these processes. These approaches often abstract away key aspects that are difficult to handle in

models, such as the heterogeneity and bounded rationality of economic agents, the network structure of transactions and claims and debts, and the specific roles of market systems and infrastructures. When attempting to analyze market microstructure with theoretical models, it inevitably becomes a partial equilibrium model with many exogenous environments as given. In such cases, general equilibrium and dynamic perspectives, such as interactions among market participants, have to be ignored.

The author advocates for agent-based models as an effective method to overcome these limitations of traditional economics and finance theories. This approach involves preparing a simulation environment where numerous agents interact in an artificial market that replicates the characteristics of the market to be analyzed, and experimentally verifying factors that affect price fluctuations and trading volume, market liquidity, and more. Despite individual agents operating under relatively simple behavioral principles, their interaction can reproduce the complex behaviors observed in real-world financial markets as complex systems, thereby the paper evaluates the agent-based models as a method to overcome the limitations of traditional economics and finance theories.

Furthermore, the paper emphasizes the importance of tailoring agent-based models for specific analysis purposes, dividing their use into three categories:

1) Understanding mechanisms: Developing models to clarify the underlying mechanisms driving observed phenomena.

2) Quantitative predictions: Creating detailed models calibrated with real-world data to support accurate forecasting.

3) Hybrid purposes: Combining the above goals to both explain mechanisms and provide quantitative predictions.

The last part of the paper points out the limited participation of researchers in artificial market analysis, especially the low attention from economics and finance theory researchers. Rather, researchers in other fields are actively taking advantage of the benefits of agent-based models. Finally, the paper expresses hope for broader adoption and further advancements in this research area. The author of this explanatory note has conducted research using an agent-based simulation and is paying attention to the transformative potential of recent advancements of generative AI technology. These developments have opened up vast new opportunities for modeling more sophisticated agent behaviors, broadening the scope of applications, and significantly enhancing analytical capabilities in the study of complex systems.

[Kimura Paper, "Big Data from Real Estate Registrations as Alternative Data"](#)

To create better markets, it is crucial to ensure that information about product quality and pricing is widely available. This concept is frequently discussed in the economics of information, a subfield of microeconomics, and is exemplified by the well-known "lemon market" problem in the used car market. The term "lemon" refers to used cars, which are often associated with unknown quality, much like a lemon whose true condition is revealed only after being cut open. In such market information about the quality of cars is asymmetric between sellers and buyers (sellers possess detailed knowledge of the car, while buyers lack this information). This asymmetry makes it difficult to form an efficient market. Specifically, it is noted that sellers can no longer sell at fair prices according to their quality, resulting in a predominance of low-quality, inexpensive cars in the market.

The Kimura Paper emphasizes the critical role of real estate registration information in promoting transparency and facilitating the distribution of information in this vast market. The paper underscores that efficient and advanced utilization of such information is vital for economic revitalization. It explains specific application cases using actual data provided as part of the company's services. The charts and tables included in the paper offer fascinating insights into these application cases, vividly supporting the author's arguments. These visual representations are not only compelling but also inspire numerous potential use cases.

For example, it illustrates that by observing the ownership transfers through purchases and sales within a certain area, it becomes possible to assess the real estate market activity and outlooks in that region, detect signs of large-scale development by major developers, analyze demand by property type and price range, forecast future prices trends, evaluate potential investment returns, and more. The charts and tables in the paper show the transaction points and estimated values for purchases and sales in the area east of JR Shibuya Station. It demonstrates that inspecting the real estate registry information on tower condominiums enables the examination of the ownership status of foreign nationals and the capture of the international real estate investment funds flow from both macro and micro perspectives through a record-accumulation approach. Additionally, it notes the efficiency of aggregating information beneficial to the domestic wealthy business. For example, it provides a list of the Japan's top national real estate owners residing in Singapore, inferred from name-based nationality indicator for corporates or individuals. One such owner is shown to possess multiple properties in the Niseko area, a famous ski resort in Hokkaido.

The paper emphasized the importance of leveraging real estate registration information with

new technologies. By using Geographic Information System (GIS) technology to display the location, characteristics, and value of properties on a map, users can intuitively grasp trends and price fluctuations in the real estate market in each region. Many charts and tables in the paper illustrate such examples. Furthermore, the integration with GPS has enhanced the use cases of real estate registration information. For instance, corporate and individual sales representatives of financial institutions can now instantly access property registration information for a building they come across in the city through their smartphones interface integrated with SNS. This is particularly appealing as it eliminates the need to visit registration offices in person and facilitate seamless and cross-sectional access to information segmented by regional registration offices. Since information related to properties and owners such as other owned properties and mortgages is widely dispersed across the country, the benefits of digitization are substantial.

The paper also exhibits that the utility value of real estate registration information increases when combined with other data. By collaborating with corporate credit research companies, it becomes possible to incorporate real estate properties owned by companies in the credit information. This integration allows for a more comprehensive evaluation of creditworthiness, including the financial health of the company, the value of collateral, and the status of mortgage registrations. Such insights can also enhance the resolution of business proposals by financial institutions.

As stated in the title of the paper, real estate registration information serves as both big data and alternative data. By digitizing this into a database, it can be transformed into a powerful tool that captures the dynamics of people and real estate from multiple perspectives. While the paper introduces only a few examples, when utilized by users with business motives, it has the potential to become valuable infrastructure for revitalizing and streamlining the real estate market, ultimately contributing to for the development of the socio-economic environment.

To fully realize such potential, the author finally underscores the importance of maintaining the openness of real estate registration information. This involves addressing the balance between openness and the "protection of rights and interests of individuals" aimed at by the Act on the Protection of Personal Information. Discussions on how to protect individual rights and interests, based on the premise that registration information includes personal information, have already been conducted both in the public and private sectors. The author, however, expresses serious concern over arguments advocating for usage restrictions based solely on personal information protection, without adequately considering these prior discussions or recognizing that real estate registration information underpins socio-economic activities as a public good. The paper calls for thoughtful discussions on the benefits and risks of personal information protection and information utilization. Such discussions must be conducted with

a deep understanding of real estate registration information and its social value. This issue is part of a broader challenge in designing systems for business and social infrastructure in the digital society.