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BLOCKCHAIN TECHNOLOGY AND FINANCIAL MARKET EFFICIENCY: TRANSPARENCY, SPEED, AND TRANSACTION COST EFFECTS

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Abstract: *Blockchain technology is among the most talked-about innovations in modern finance because it has the potential to transform how transactions are recorded, verified and settled across financial markets. Much of the early discussion has been about cryptocurrencies. But a more important question for finance is whether blockchain infrastructure can improve the efficiency of the broader financial markets. This article explores the relationship between blockchain technology and financial market efficiency in three dimensions: transparency, transaction speed, and transaction cost. The paper relies on the Efficient Market Hypothesis, transaction cost economics and recent scholarship on financial market infrastructure to suggest that blockchain can promote operational efficiency and post-trade transparency, especially in the clearing, settlement, and recording functions. But these benefits are not assured. They rely on governance design, legal enforceability, institutional adoption, and regulatory coordination to do so. The article argues overall that blockchain is not a cure-all for inefficiency but an infrastructural innovation that has different effects in different market environments.*

Keywords: *Blockchain technology; financial market efficiency; transparency; transaction costs; settlement; financial innovation*

1. INTRODUCTION

Financial market efficiency is one of the fundamental concepts of finance because it relates to the extent of the market's handling of information, the distribution of capital and the promotion of fair exchange. In classical finance theory, an efficient market is one in which the prices of assets reflect the available information efficiently and quickly (Fama, 1970). But in real financial markets, there are institutional frictions beyond information flows: delayed settlements, fragmented data systems, costly intermediation, and reconciliation failures. These frictions influence the efficiency of the functioning of the market and the cost of transactions for the participants (Malkiel, 2003; Allen, Gu and Jagtiani, 2022).

Now blockchain technology has joined the discussion and may be an

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infrastructure for change. A blockchain is a distributed ledger that maintains verified transactions in a linear, tamper-evident chain shared by the members of a network (Nakamoto, 2008; Pilkington, 2016). In finance, the importance of blockchain is not only in digital assets but also in its possible application to payment systems, securities settlement, trade finance, syndicated lending and cross-border transfers (Treleaven, Brown and Yang, 2017; Aggarwal and Goodell, 2023). Blockchain could reduce duplication and improve traceability and settlement times by replacing fragmented record systems with synchronised ledgers (Peters and Panayi, 2016; Cong and He, 2019).

But the passion for blockchain often exceeds the strength of the evidence. Most of the early literature was speculative and portrayed blockchain as a disruptive technology that would eliminate intermediaries and create frictionless markets (Iansiti and Lakhani, 2017; Werbach, 2018). For all their apparent sophistication, financial markets are ruled by legal rules, compliance structures and risk-management frameworks that cannot simply be coded away (Yermack, 2017; Zetzsche, Arner and Buckley, 2020). The more analytically useful question is not whether blockchain will replace finance as currently structured, but whether it can improve market efficiency in ways that are measurable.

This paper deals with this question by investigating to what extent blockchain technology influences the financial market's efficiency via three mechanisms: increased transparency, faster transaction processing, and lower transaction costs. It argues that blockchain could improve important aspects of operational market efficiency, especially in post-trade infrastructure, but that its contribution is conditional and not automatic. The analysis begins with the conceptual relationship between market efficiency and blockchain infrastructure, then addresses its impact on transparency, speed, and transaction costs, and finally, its limitations and implications.

2. Financial market efficiency and blockchain: conceptual foundations

The most influential starting point of discussions of market efficiency is the efficient market hypothesis (EMH). Fama (1970) distinguishes between weak-form, semi-strong and strong-form efficiency, which relates to the extent to which prices reflect available information. In its classic form, EMH is about informational efficiency: if information is rapidly incorporated into prices, it is hard to make abnormal returns systematically. But later scholarship has shown that efficiency is more than an informational problem. Liquidity, trading infrastructure, transaction cost, settlement reliability, and institutional trust (Malkiel, 2003; Yermack, 2017) also influence market quality.

Why does this broader understanding matter? Blockchain technology does not inherently guarantee improved price discovery. Its main effect

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is rather infrastructural. It affects the architecture with which transactions are recorded, verified, and completed. Thus, the blockchain should also be analysed from the perspective of transaction cost economics. Transaction costs are the expenses of searching for, verifying, bargaining over, monitoring, and enforcing performance in exchange relationships. Costs in financial markets include broking fees, custodial charges, reconciliation costs, and back-office processing costs arising from delayed settlements or counterparty uncertainty (Catalini and Gans, 2020; Allen, Gu, and Jagtiani, 2022). Technologies that reduce these frictions can improve the way markets function, even if they do not change the theoretical logic of information efficiency.

This infrastructural view is particularly relevant to blockchain because it provides a shared ledger among participants rather than separate institutional databases that must be reconciled repeatedly. Ownership records, settlement instructions, and compliance data in legacy systems may be distributed across a multitude of entities, such as brokers, exchanges, custodians, central securities depositories, and clearing houses. Fragmentation could lead to delays and mismatches. Distributed ledger technology provides a "single source of truth" with synchronised information accessible to authorised participants, which can lower operational uncertainty (Peters and Panayi, 2016; Kim, Laskowski, and Nan, 2021).

But blockchain is not a panacea for all ills. For example, the blockchains of open crypto networks differ from the permissioned blockchains used by financial institutions. Public systems are geared toward decentralisation and open participation; permissioned systems are geared toward governance, privacy, and regulatory compliance and limit access. Permissioned architectures are more relevant for mainstream finance as they are more consistent with legal accountability and controlled access requirements (Catalini and Gans, 2020; Aggarwal and Goodell, 2023). Hence, any assessment of blockchain efficiency effects needs to distinguish between abstract technological claims and actual institutional applications.

A more crucial point is that the term "efficiency" itself is too often misused in blockchain discussions. Several authors equate less settlement time with a more efficient market. But this argument confuses operational efficiency with allocative or informational efficiency. Markets can settle quickly, but they can still misprice assets, misallocate capital, or amplify speculative behaviour. A slower infrastructure market, on the other hand, may still do a decent job of price discovery. The literature thus needs conceptual discipline. Although blockchain may improve post-trade efficiency and record integrity, these gains do not necessarily lead to better market pricing or more stable financial

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outcomes (Malkiel, 2003; Allen, Gu and Jagtiani, 2022).

Moreover, it is common in professional and academic circles to compare blockchain to legacy systems that are either obsolete or inefficient, rather than to best-practice existing infrastructure. This induces a favourable benchmark bias. In highly developed financial centers, much of the market infrastructure is already fast, reliable, and tightly regulated. In such contexts, the incremental efficiency improvement from blockchain may be relatively modest once we consider implementation costs, migration risks, and interoperability constraints. The relevant analytical question is therefore comparative, not absolute: what are the circumstances under which blockchain outperforms existing systems, taking into account governance and transition costs? Much of the literature has not explored this question thoroughly.

3. Blockchain and transparency in financial markets

Transparency is central to efficient markets, as it impacts trust, price discovery and monitoring. Financial market participants require reliable information on ownership, transaction status, exposure and counterparty obligations. Uncertainty increases and the chance of disputes rises when information is fragmented or delayed. One of the most often cited advantages of blockchain is its ability to increase transparency by offering a consistent and auditable history of transactions (Pilkington, 2016; Treleaven, Brown and Yang, 2017).

In traditional finance, an institution could record a transaction separately. These records may be different in their timing, format or completeness, necessitating reconciliation. Particularly in post-trade processes, inconsistencies can give rise to increased operational risk and administrative cost. A distributed ledger could mitigate this problem, as authorised parties could see the same validated transaction record in near real time (Peters and Panayi, 2016; Kim, Laskowski and Nan, 2021). This can improve records' integrity, increase traceability, and ease audit processes.

There are several reasons why, from a finance perspective, greater transparency matters. First, it may decrease information asymmetry in operational processes. Market participants can more accurately assess exposure and settlement progress when transaction status is more visible. Second, transparency may reduce disagreements over ownership, sequencing and execution. Thirdly, it might increase market confidence in systems where fragmentation of records has frequently resulted in mistrust or inefficiency, such as in trade finance and cross-border payment chains (Iansiti and Lakhani, 2017; Aggarwal and Goodell, 2023).

Scholars have therefore argued that the contribution of blockchain to transparency is less about revealing all market information publicly and more about ensuring that relevant participants

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share a consistent and tamper-resistant record (Iansiti and Lakhani, 2017; Yermack, 2017). That difference matters. Radical openness is not the same as financial transparency. Institutional participants need confidentiality, data protection, and commercially appropriate disclosure levels. Permissioned distributed ledgers attempt to balance visibility with controlled access, thereby enhancing transparency without eliminating legitimate privacy boundaries (Allen, Gu, and Jagtiani, 2022).

That said, the transparency advantages of blockchain should not be overstated. A ledger can preserve data integrity after entering, but it cannot guarantee that the original data entered are accurate. If the system records incorrect information, it may efficiently store the error instead of removing it. Moreover, financial transparency depends not only on the visibility of technology but also on the legal interpretability, reporting standards and governance quality. While blockchain can deliver trustworthy records, it does not in and of itself solve all information problems in finance (Werbach, 2018; Aggarwal and Goodell, 2023).

Another criticism is that more ledger visibility does not automatically mean economically meaningful transparency. Transparency is only useful if actors can interpret and act on the information provided. If distributed ledgers produce a lot of data that can be seen but not used commercially, the outcome may be one of informational abundance rather than informational clarity. This issue holds particular significance in complex financial markets, where derivatives, collateral chains, and legal structures structure transactions. In these cases, transparency at the ledger level may coexist with opacity at the economic risk level.

There is also a distributional problem. Blockchain can enhance transparency for some actors and reinforce asymmetries for other actors. Shared ledgers may benefit larger institutions with better technical capabilities, legal support, and analytics than smaller participants. As a result, the market may not evenly distribute the benefits of transparency. This complicates the assumption that more transparent infrastructure always leads to fairer or more efficient outcomes.

4. Transaction speed, settlement and operational efficiency

The second big claim made for blockchain is that it can speed up transaction processing and settlement. This problem is very important, as traditional settlement systems are often characterised by time lags. Trades in securities markets can settle one or more days after execution in trading. In the meantime capital is tied up, counterparties are exposed and back-office systems need to coordinate multiple messages and confirmations. Settling delays are therefore not trivial administrative details; they are part of the cost and risk structure of financial

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markets (Peters and Panayi, 2016; Allen, Gu and Jagtiani, 2022).

Blockchain systems can reduce settlement times by combining validation, messaging and record updating in a common platform. Instead of sending separate confirmations through intermediaries that would have to be reconciled later, participants update the same ledger, according to agreed rules. Smart contracts could also automate some post-trade actions such as coupon calculations, collateral calls or entitlement transfers, further reducing the processing time (Cong and He, 2019; Schär, 2021).

Market efficiency implications are important. A faster settlement can reduce counterparty risk by more quickly resolving obligations. It could enhance liquidity management by freeing up capital being locked in the settlement cycle. It could also reduce operational backlogs during busy trading periods. These efficiencies can be economically meaningful in markets where delayed settlement is a source of systemic stress (Treleaven, Brown and Yang, 2017; Aggarwal and Goodell, 2023).

But sometimes faster is not better. Market participants may need to prefund trades to allow for real-time or near-time settlement, which will constrain flexibility in putting liquidity to work. For institutions with a history of netting arrangements, continuous settlement, as opposed to settlement at scheduled times, may require additional intraday liquidity. Therefore, efficiency improvements from speed vary with overall market design, including credit arrangements, collateral structures and central bank support mechanisms (Allen, Gu and Jagtiani, 2022).

This indicates that the effect of blockchain on speed should be interpreted in context instead of assuming it is universally positive. Operational speed-ups can be helpful where they reduce unnecessary friction without destabilising funding arrangements. Where speed creates new liquidity strains or legal uncertainties, the net benefit may be less than originally expected. The relevant conclusion is that settlement efficiency involves system-wide design, not simple technological acceleration; blockchain can still be effective.

A more critical reading of the literature also reveals speed is often treated as an unquestioned good. But in financial markets, certain kinds of friction do useful stabilising jobs. Batch settlement, netting windows and intermediary controls can reduce gross liquidity demands and allow time for error detection, compliance checks and dispute resolution. Removing those frictions too aggressively may just move risk around rather than eliminating it. Therefore, a faster system can be operationally efficient while becoming more demanding in terms of liquidity, compliance, and contingency management.

Moreover, the marginal benefit of blockchain-based speed is specific to a market segment. The gains can be

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material in wholesale cross-border payments or trade finance, where delays are large. In already technologically advanced domestic market infrastructures, the improvement may be incremental rather than a step change. This matters because universal acceleration arguments often ignore differences in the quality of baseline infrastructure.

5. Blockchain and transaction cost reduction

Transaction costs are an important issue in finance because they impact market participation, liquidity, and profitability. These costs comprise not only explicit charges but also administrative, informational and coordinational costs. There are good reasons why financial markets rely on intermediaries, such as building trust, legal accountability and dealing with risk. However, multilayered intermediation could also generate duplicated functions, manual processing burdens and expensive reconciliation (Catalini and Gans, 2020; Milian, Spinola and de Carvalho, 2019).

Blockchain proponents often say distributed ledgers can lower transaction costs by cutting out unnecessary middlemen and automating verification. There is some truth to the argument especially in terms of back office functions. A common ledger could cut down on the number of times records need to be matched, documents validated and exceptions processed, which would lower operating costs. Likewise, smart contract logic could facilitate the automation of routine actions that would otherwise need to be confirmed or processed manually by a legal entity (Cong and He, 2019; Schär, 2021).

Such improvements are most likely to be seen in markets where existing systems are based on large amounts of document handling or disjointed records, such as cross-border payments, trade finance and syndicated lending. In these cases, blockchain can reduce administrative duplication and reduce chain processing. Not only can direct costs be reduced but also opportunity costs related to the slow transaction completion (Peters and Panayi, 2016; Kim, Laskowski and Nan, 2021).

But to claim that blockchain gets rid of transaction costs is unrealistic. In regulated financial systems, many of the intermediary functions persist. Records distribution does not eliminate compliance checks, dispute resolution, governance oversight, customer due diligence and legal accountability. It is often the form of intermediation that changes. Some purely administrative functions may be lost on the part of traditional intermediaries, while new intermediaries are arising in digital custody, platform governance, smart-contract auditing and cybersecurity assurance (Werbach, 2018; Zetzsche, Arner and Buckley, 2020).

The most plausible reading, therefore, is that blockchain reconfigures but does not abolish intermediation. Its main efficiency gain is in cutting out redundant processing and reducing some

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operational costs, not in creating costless finance. This is an important point for any serious financial analysis, as it prevents technological rhetoric from substituting for institutional realism.

A more serious charge is that many claims of blockchain cost reductions ignore the expenditure required for implementation. To create or join a distributed ledger network, you need to invest in technology, re-engineer the law, re-train staff, negotiate and integrate governance and legacy systems. These costs can be significant, particularly for large financial institutions. An innovation might reduce long-run processing costs but also be associated with poor medium-run cost efficiency if there are high transition costs. The cost analysis should therefore be dynamic and not static.

Besides, some blockchain systems may introduce new kinds of cost rather than just getting rid of existing types. These include the cost of smart-contract auditing, cybersecurity, digital custody and the costs of ensuring interoperability across institutions. Cost reduction is not guaranteed; it depends on whether the new cost structure proves to be more efficient than the old one over time. This is a key area where the literature is often normative rather than empirically demonstrated.

6. Constraints, risks and limits of blockchain-based efficiency

Blockchain can improve transparency, speed and certain cost structures, but there are a number of key constraints that limit its impact. The first one is scalability. The financial markets handle large transaction volumes and require a high level of reliability. Some blockchain systems have throughput limitations and latency issues relative to traditional high-performance financial infrastructure (public blockchains in particular). Even permissioned systems will need to demonstrate that they are capable of working at the right scale without sacrificing security or resilience (Treleaven, Brown and Yang, 2017; Schär, 2021).

The second is governance. Financial systems rely on clearly defined decision rights for upgrades, permissions, liabilities and dispute resolution. Governance allocation is a key differentiator in blockchain designs. In finance, particularly where legal obligations are complex, ambiguous governance can be a source of inefficiency rather than improvement. Without strong governance arrangements, ambiguity about authority and accountability can negate the benefits of shared infrastructure (Yermack, 2017; Werbach, 2018).

Thirdly, legal and regulatory fragmentation remains a major obstacle. Cross-border financial transactions happen in jurisdictions with different rules about property rights, digital records, privacy, insolvency and settlement finality. Blockchain applications may work in practice but not make legal sense. This presents a hurdle to practical adoption as institutions cannot rely on uncertain legal footing to

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underpin core market infrastructure (Allen, Gu and Jagtiani, 2022; Zetzsche, Arner and Buckley, 2020).

The fourth issue is operational and cyber risk. Distributed systems can mitigate some of the risk of single-point failures but also introduce new vulnerabilities that have to do with code errors, access controls, key management and smart-contract exploits. The economic result is not what everyone wants, but a faulty smart contract can run as intended. This creates a tension between automation and adaptability (Cong and He, 2019; Schär, 2021).

Finally, do not confuse blockchain with perfect market efficiency. Asset mispricing, speculation, behavioural bias and macroeconomic shocks can prevail irrespective of the ledger design. The technology may improve the infrastructure of transactions but will not deal with the larger problems of irrational behaviour or unstable expectations. This means that the blockchain should be seen as a tool to improve the conditions for how markets work, not as a promise that markets will always allocate resources efficiently.

7. Discussion

The above analysis shows that the contribution of blockchain to the efficiency of financial markets is real, but limited. Its strength is not the price theory, but the market infrastructure. Blockchain enhances operational efficiency, with improved auditability, reduced reconciliation costs, and faster settlement (Peters and Panayi, 2016; Aggarwal and Goodell, 2023). These improvements may have an indirect effect on the market quality via reduction of frictions and confidence.

But the benefits are conditional on institutional settings. In highly regulated markets, permissioned blockchain systems are more likely to deliver usable efficiency gains than open public networks because they can be configured to meet governance, privacy and compliance requirements (Catalini and Gans, 2020; Allen, Gu and Jagtiani, 2022). Post-trade record-heavy and cross-institutional processes are more likely to benefit from efficiency gains than those where existing infrastructure is already highly optimised.

The discussion further demonstrates that finance researchers should avoid utopian and dismissive readings. It is not the case that blockchain will automatically replace all intermediaries or that it will create perfectly efficient markets. It is equally simplistic to dismiss the technology because it does not remove all inefficiency. More specifically, blockchain is an infrastructure innovation that is one of choice and whose value depends on whether it reduces frictions better than existing systems (Iansiti and Lakhani, 2017; Werbach, 2018).

A more critical synthesis is that technological determinism has shaped the blockchain debate in finance. It assumes better technical architecture will automatically lead to better market outcomes. But financial systems are not

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just processing networks but socio-technical institutions. Their performance is conditioned by law, governance, incentives, organisational capacity and political acceptance. A technologically elegant system may fail economically if it cannot satisfy these institutional conditions.

In this sense, the article suggests that future research should move beyond broad claims about disruption and ask narrower empirical questions. In which market segments do we see measurable cost reductions? When does faster settlement aid liquidity, rather than hurt it? When does increased transparency reduce risk, and when does it merely redistribute informational advantage? Such questions are more useful than broad statements that blockchain will or will not revolutionise finance.

8. Conclusion

Blockchain technology has a great potential to improve selected dimensions of financial market efficiency, in particular through increased transparency of transactional records, faster settlement processes and lower administrative transaction costs. Its biggest contribution is infrastructure. It can improve the architecture through which financial transactions are recorded and completed. In this sense, even if blockchain does not directly ensure informational efficiency in the strict EMH sense (Fama, 1970; Yermack, 2017), it can improve operational efficiency and post-trade market quality.

But the benefits of the technology are conditional. They depend on governance quality, scalability, legal clarity, interoperability and regulatory coordination (Allen, Gu and Jagtiani, 2022; Aggarwal and Goodell, 2023). So, blockchain should be evaluated pragmatically, not ideologically. In some environments it offers real efficiency gains, particularly where fragmented record systems and slow settlement processes are expensive. It is not, however, a panacea for all market imperfections.

Future research should focus on measurable postadoption outcomes in banking, securities settlement and cross-border payment systems. Comparative evidence on cost ratios, settlement times, operational risk and liquidity effects would help take the debate from promise to proof. The best that can be said at this stage is that blockchain has the potential to improve the efficiency of financial markets, but only if it is embedded within appropriate institutional and regulatory frameworks.

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