Deciphering Blockchain's Impact on Earnings Quality and Firm Value

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ABSTRACT: This study investigates the impact of blockchain technology adoption on earnings quality and firm value. Using a global sample of 115 large public companies implementing blockchain, we employ a difference-in-differences methodology with a propensity score-matched control group to examine changes in earnings management practices and corporate valuation around blockchain implementation. Contrary to expectations that blockchain's transparency would curtail earnings manipulation, we find that adopting firms exhibit increased income smoothing post-implementation. However, this smoothing appears to be informative rather than opportunistic, enabling managers to signal future earnings trajectories and mitigate short-term volatility arising from substantial implementation costs. Consistent with the informative perspective, we further show that blockchain-driven income smoothing is positively associated with future firm value, particularly among firms with higher pre-adoption information asymmetry. Our findings provide novel evidence on the interaction between emerging technologies and financial reporting, highlighting blockchain's potential to reduce information asymmetry and enhance earnings informativeness.

Keywords: Blockchain technology; Earnings quality; Income smoothing; Firm value; Information asymmetry.

JEL codes: M41, G34, G39.

1 Introduction

Blockchain technology has emerged over the past decade as a transformative innovation reshaping business operations and interactions across industries. Defined as a decentralized, distributed ledger that enables secure, transparent, and immutable record-keeping, blockchain allows multiple stakeholders to independently verify and record transactions in real time without central oversight (Dai & Vasarhelyi, 2017). Its adoption has been driven by a range of potential benefits, including reductions in transaction costs, enhanced fraud prevention, accelerated settlement processes, and improved auditability (Dai & Vasarhelyi, 2017). Reflecting this momentum, the global blockchain market is projected to grow from approximately USD 27.85 billion in 2024 to USD 746.41 billion by 2032 (Fortune Business Insights, 2024). As blockchain continues to redefine cross-border business relationships and international financial reporting practices (Yermack, 2017; Zhang, Xue, & Liu, 2019), its implications for corporate transparency and governance have attracted increasing attention from global regulatory bodies and multinational firms alike. However, despite blockchain's promise to revolutionize financial reporting and governance, empirical evidence on its impact on earnings quality and firm value remains limited and inconclusive. This study addresses that gap by investigating how blockchain adoption influences firms' financial reporting practices and subsequent market valuations.

Beyond efficiency gains, blockchain's strategic value lies in its ability to enhance operational resilience and corporate sustainability. The distributed ledger system significantly transforms verification and security in business processes across jurisdictions, positioning blockchain as a key driver of global digital innovation (Deloitte, 2021). Financial markets have recognized this potential, as evidenced by positive stock price reactions to blockchain-related patent filings (Chen, Wu, & Yang, 2019) and technology adoption announcements (Cahill, Baur, Liu, & Yang, 2020). Firms that implement blockchain solutions also tend to secure more favorable financing terms, reflecting investor confidence in the technology's ability to improve business operations and risk management practices (Chod, Trichakis, Tsoukalas, Aspegren, & Weber, 2020). These observations suggest that investors anticipate long-term benefits from blockchain adoption.

A critical feature of blockchain technology is its potential to mitigate information asymmetry in financial reporting. By ensuring that transaction records are permanent and transparent, blockchain fundamentally alters the dynamics between management and stakeholders (Yermack, 2017). Its inherent characteristics—decentralized verification, timestamped transactions, and immutable records—constrain opportunities for financial manipulation or backdating, particularly in complex multinational entities (Dai & Vasarhelyi, 2017). This heightened transparency has led researchers to advocate blockchain as a superior alternative to traditional accounting systems (Coyne & McMickle, 2017). Emerging evidence further suggests that blockchain enhances financial reporting quality and audit efficiency (Cao, Cong, & Yang, 2024; Liao, Lin, & Sun, 2025), ultimately improving how firms communicate financial information to stakeholders.

Although blockchain's greater transparency may deter earnings manipulation in the long run, its short-term impact on reporting behavior presents a more complex picture. The implementation phase of blockchain involves substantial financial commitments, with initial investments often reaching millions of dollars that can strain a company's short-term earnings. Additionally, the scarcity of specialized blockchain expertise drives up personnel costs through increased salaries and related expenses. These significant upfront costs create a tension: while blockchain aims to reduce information asymmetry and enhance transparency, the short-run pressure on earnings might incentivize earnings management during early adoption stages. As Cong and He (2019) note, distributed ledgers can prevent many individual manipulation attempts, but the possibility of coordinated actions among network participants remains a concern. In other words, managers may still find ways to manage financial results within the bounds of the technology's transparency, especially if motivated by short-term performance targets.

Given the limited empirical evidence on how emerging technologies like blockchain affect financial reporting practices (Moll & Yigitbasioglu, 2019), this study focuses specifically on the impact of blockchain adoption on income smoothing—a prevalent form of earnings management. Income smoothing refers to managers' deliberate efforts to maintain a steady and predictable earnings trajectory over time through various accounting and real activities. These activities include income-increasing measures during periods when earnings would otherwise fall short of expectations, and income-decreasing measures during periods of unusually strong performance, thereby creating reserves for future downturns. By accelerating revenues or delaying expenses in lean periods and doing the reverse in strong periods, managers aim to minimize earnings volatility and influence stakeholders' risk perceptions (Walker, 2013). We posit that although successful blockchain implementation is initially costly, it should improve firms' information environments over time such that earnings volatility is reduced and information transparency is enhanced, ultimately leading to increased firm value (Leuz & Verrecchia, 2000).

Our empirical analysis addresses two key research questions. First, we examine whether blockchain adoption affects firms' propensity to engage in income smoothing. This relationship is theoretically ambiguous. On the one hand, blockchain's enhanced transparency and data integrity might discourage discretionary earnings management, as managers could fear that earnings manipulation will be more easily detected and penalized. On the other hand, the substantial implementation costs and operational disruptions during early adoption could motivate managers to smooth earnings to offset these financial impacts. This tension is especially relevant in the initial adoption phase when significant R&D and integration expenditures are incurred, and firms seek to avoid adverse earnings surprises that might erode analyst coverage (Lang, Lins, & Miller, 2004) or trigger negative stock price reactions (Kinney, Burgstahler, & Martin, 2002). Second, if income smoothing behavior changes with blockchain adoption, we investigate whether such smoothing ultimately serves a beneficial (informative) or detrimental (opportunistic) role for future firm value. Specifically, we examine whether post-adoption income smoothing is associated with subsequent changes in firm value. Prior literature presents two competing theoretical views on managerial motivations for income smoothing. Under the opportunistic view, managers smooth earnings to conceal negative information or achieve personal benefits (DeFond & Park, 1997; Healy, 1985; Jin & Myers, 2006; Khurana, Pereira, & Zhang, 2018; Leuz, Nanda, & Wysocki, 2003). Opportunistic smoothing can temporarily mask poor performance, but when accumulated bad news eventually comes to light, the repercussions can be severe, leading to severe negative market reactions (Chen, Kim, & Yao, 2017; Yu, Hagigi, & Stewart, 2018). In contrast, the informative view suggests that managers use income smoothing to convey private information about the firm's future prospects, thereby improving the quality of information available to investors and enhancing firm value (Amiram, Landsman, Owens, & Stubben, 2018; Kasznik & McNichols, 2002; Myers, Myers, & Skinner, 2007; Tucker & Zarowin, 2006). By aligning reported earnings more closely with the expected long-term earnings trajectory, informative income smoothing can reduce uncertainty for investors and lower the firm's cost of capital (Goel & Thakor, 2003; Trueman & Titman, 1988).

Our study utilizes a unique hand-collected sample of 115 of the largest public companies worldwide that have implemented blockchain technology. This international sample spans 30 countries, providing a global perspective on blockchain's financial reporting implications. We employ a difference-in-differences research design with propensity score matched treatment and control groups to examine how blockchain adoption affects income smoothing and subsequent firm value. Each blockchain-adopting firm (the treatment group) is matched with up to three non-adopting firms (the control group) operating in the same country and industry. This matching approach helps ensure that the treatment and control firms are comparable before blockchain implementation, mitigating endogeneity concerns related to selection on observable characteristics (Shipman, Swanquist, & Whited, 2017). To measure income smoothing, we use multiple proxies capturing both accrual-based and real earnings management. In particular, we combine measures of discretionary accruals (using the modified Jones model of Dechow, Sloan, & Sweeney, 1995) and real activities management (abnormal production costs and discretionary expenses following Roychowdhury (2006) and Zang (2012)) to construct a comprehensive income smoothing index. This approach allows us to observe various dimensions of income smoothing practices rather than relying on a single metric.

Our findings indicate that blockchain adoption is associated with a significant change in earnings management behavior and firm value. Blockchain-adopting firms exhibit higher levels of income smoothing following adoption compared to both their own pre-adoption periods and matched non-adopting peers. We provide evidence that this increased smoothing behavior, likely driven by the need to manage substantial implementation costs during the early adoption phase, helps reduce earnings surprises and is associated with enhanced firm value for blockchain adopters. These results suggest that managers are using financial reporting discretion not to obscure performance, but rather to communicate more effectively with investors about blockchain's long-term value proposition while managing short-term earnings volatility. The corresponding increase in firm value indicates that the market interprets these smoothing actions as informative rather than opportunistic. Cross-sectional analysis further reveals that the positive effects of blockchain on the value relevance of earnings are particularly pronounced for firms with higher pre-implementation information asymmetry—supporting

Yermack's (2017) prediction that blockchain can improve a firm's information environment. This interpretation is further reinforced by Liao et al. (2025), who show that blockchain adoption in China improves financial reporting quality primarily by enhancing accounting efficiency, making reported earnings more informative for external users. Our results are robust to controlling for potential self-selection bias using a Heckman (1979) two-step model and placebo tests using pseudo-adoption years.

This study makes several contributions. First, we provide novel empirical evidence on how blockchain adoption affects earnings management practices. While prior work has theorized about blockchain's potential impact on financial reporting (e.g., Yermack, 2017), our study offers one of the first large-sample empirical analyses documenting how firms adapt their reporting behavior during the implementation of this technology. Second, we demonstrate that the relationship between blockchain adoption and income smoothing has significant implications for firm value. Our findings suggest that managers successfully use financial reporting discretion to mitigate negative earnings surprises and to communicate the long-term benefits of blockchain implementation while managing short-term cost pressures. These insights inform both corporate decision-making regarding blockchain investments and investor evaluation of firms' blockchain initiatives. Finally, our results have broader implications for various stakeholders. By showing how blockchain adoption influences financial reporting practices and shareholder value, we provide valuable information to investors, creditors, and regulators who are assessing the widespread adoption of blockchain technology. In particular, we highlight that increased transparency from blockchain does not directly eliminate earnings management but can change its nature toward a more informative form.

The remainder of this paper is organized as follows. Section 2 reviews relevant literature and develops our hypotheses. Section 3 details our research design and sample selection. Section 4 presents the empirical results and additional robustness tests. Section 5 concludes.

2 Literature Review and Hypotheses Development

2.1 Blockchain Technology and Financial Reporting

The concept of blockchain was first introduced by Haber and Stornetta (1991), who developed a digital time-stamping method to preserve the integrity of documents. Their framework stored records sequentially and linked each entry with a cryptographic hash, so any attempt to alter a prior record would create a detectable hash mismatch in subsequent entries. This early conceptualization of an immutable and verifiable chain of records laid the groundwork for modern distributed ledger technology (Yermack, 2017). The concept was operationalized by Nakamoto (2008), who implemented the first public blockchain as the foundational infrastructure for Bitcoin. Nakamoto's design demonstrated that a peer-to-peer network can maintain a secure, decentralized ledger of transactions without a central authority, reducing transaction costs and improving processing speed through distributed verification mechanisms.

In contemporary financial settings, blockchain has evolved into a secure platform for validating and tracking transactions (Fanning & Centers, 2016). Verification of transactions on a blockchain network can be executed more efficiently than under traditional methods due to advanced identity-verification protocols and distributed consensus mechanisms (Lumineau, Wang, & Schilke, 2021; Moll & Yigitbasioglu, 2019). Every participant in a blockchain network has access to the entire sequence of transaction records while collectively maintaining the system. This transparency and decentralization make it extremely difficult for any single party to manipulate accounting records undetected; any attempted modification would be immediately identified by other network participants (Dai & Vasarhelyi, 2017). In technical terms, blockchain implements a triple-entry system, consisting of a debit, a credit, and a cryptographic verification, which ensures that altering a past transaction would require reprocessing all subsequent blocks in the chain (Moll & Yigitbasioglu, 2019). These features–transparency, real-time consensus, and immutability–have led scholars to describe blockchain as an "immune system" against financial record manipulation (Coyne & McMickle, 2017).

Blockchain's governance potential spans several dimensions. First, it enables users of financial information to produce real-time, customized reports, reducing dependence on static periodic statements and improving the relevance of information for decision-making. Second, the visibility of each transaction in the ledger constrains managerial discretion in financial reporting and enhances the oversight of compensation and performance (Yermack, 2017). Third, as a decentralized system requiring collective verification for ledger updates, blockchain prevents unilateral manipulation of financial data (Zhang et al., 2019). Furthermore, the continuous, system-wide availability of verified records strengthens audit capabilities and internal controls (Dai & Vasarhelyi, 2017; Fanning & Centers, 2016). Collectively, these attributes position blockchain as a protocol-driven complement to traditional governance mechanisms (Lumineau et al., 2021). Supporting this view, PwC's (2018) Global Blockchain Survey highlights that blockchain's ability to maintain immutable, decentralized records can enhance contracting efficiency, internal controls, and stakeholder transparency in financial reporting (Davies & Vermeulen, 2018). Building on this, Deloitte's (2021) Global Blockchain Survey reports that nearly 80% of financial services executives view blockchain as strategically important, recognizing its potential to enhance compliance, transparency, and the resilience of financial infrastructures. These trends underscore blockchain's increasing maturity and perceived value as a governance tool, while blockchain applications have also been shown to accelerate settlement times, reduce transaction disputes, and enable real-time reconciliation and audit trails. For example, Cho, Lee, Cheong, No, and Vasarhelyi (2021) show that integrating blockchain into a value-added tax system can effectively reduce VAT-related fraud by increasing the visibility of underlying transactions.

Despite these benefits, blockchain adoption also poses implementation challenges. Public blockchains raise privacy and confidentiality concerns due to the broad visibility of transaction data, whereas private blockchains limit access but may compromise transparency (Coyne & McMickle, 2017). Moreover, while blockchain is designed to limit unilateral manipulation, it may inadvertently facilitate collusive behavior among network participants. Cong and He (2019) argue that shared access could enable coordination among insiders or even competitor firms, potentially undermining market efficiency and social welfare. These limitations highlight that the net effect of blockchain on corporate reporting quality remains an empirical question. In particular, it remains uncertain whether blockchain adoption constrains or exacerbates managerial discretion in financial reporting. To address this question, this study examines how blockchain implementation influences income smoothing—one of the most common forms of earnings management—and the broader implications for firm value.

2.2 Income smoothing

Income smoothing refers to managerial practices aimed at reducing fluctuations in reported earnings over time to present a more stable financial performance (Dechow, Ge, & Schrand, 2010). Managers may increase reported income during weak periods and, conversely, understate it in strong periods by, respectively, engaging in income-increasing and income-decreasing activities. By shifting income from high-performing years to low-performing ones, and vice versa, managers aim to present a steadier earnings trajectory than would otherwise result from underlying operations. This often requires reasonably accurate forecasting of future performance so that current earnings can be adjusted upward or downward to meet targets or create reserves for future downturns. The intended outcome is reduced earnings volatility, which managers believe will make the firm appear less risky to investors and other stakeholders (Walker, 2013).

Managers can engage in income smoothing through both accounting-based and real activities. Accounting-based smoothing, operating within Generally Accepted Accounting Principles (GAAP), involves the use of discretionary accruals, such as adjusting depreciation methods, altering provisions for bad debts, or changing the timing of revenue recognition. Real activities smoothing, on the other hand, involves operational decisions, such as accelerating sales through discounting, deferring discretionary expenditure (e.g., on R&D or advertising), or strategically disposing of assets to influence earnings. Both forms of smoothing represent purposeful interventions intended to align reported earnings with internal benchmarks, expectations, or market pressures. These actions are generally shaped by contracting frictions, asymmetric information between insiders and external stakeholders, and the bounded rationality of investors (Beyer, Cohen, Lys, & Walther, 2010).

The literature identifies two dominant and opposing theoretical views regarding the motivation for income smoothing: the opportunistic and the informative. From the opportunistic perspective, managers use smoothing to advance private interests, such as meeting performance-linked compensation targets (DeFond & Park, 1997; Grant, Markarian, & Parbonetti, 2009; Healy, 1985), avoiding covenant violations, or deterring shareholder activism during periods of underperformance (Acharya & Lambrecht, 2015; Fudenberg & Tirole, 1995). Empirical studies show that such behavior can delay the disclosure of negative information, ultimately leading to more severe market corrections when the accumulated effects come to light. This pattern often results in heightened stock price volatility and reputational damage (Chen et al., 2017; Jin & Myers, 2006; Khurana et al., 2018; Leuz et al., 2003; Yu et al., 2018). Under this viewpoint, smoothing impairs earnings quality and misleads stakeholders by distorting the true economic performance of the firm.

In contrast, the informative perspective argues that income smoothing may serve as a mechanism for signaling private information about the firm's long-term prospects. Given that managers have access to internal forecasts and strategic plans, smoothing allows them to reduce the noise from short-term fluctuations and better align reported earnings with sustainable trends. In doing so, they improve the information environment for external stakeholders, particularly less-informed investors who may otherwise overreact to temporary deviations from expected performance (Goel & Thakor, 2003; Kirschenheiter & Melumad, 2002; Sankar & Subramanyam, 2002). Furthermore, smoother earnings are associated with lower default risk perceptions and reduced costs of capital (Trueman & Titman, 1988). Empirical evidence supports this perspective, linking smoother earnings to increased future earnings predictability, more favorable credit terms, and stronger market valuations (Amiram et al., 2018; Kasznik & McNichols, 2002; Myers et al., 2007; Tucker & Zarowin, 2006). The survey by Graham, Harvey, and Rajgopal (2005) reinforces this viewpoint, showing that CFOs believe investors reward stable earnings with higher firm valuations. Consequently, from an informative standpoint, income smoothing enhances the decision usefulness of reported earnings and can serve a value-relevant role.

2.3 Blockchain Adoption and Income Smoothing (H1)

Blockchain technology adoption can influence a firm's propensity to engage in income smoothing through competing theoretical mechanisms. On the one hand, blockchain implementation requires considerable upfront investments in infrastructure, specialist personnel, and process restructuring. These substantial implementation costs often result in immediate downward pressure on earnings, potentially motivating managers to engage in income smoothing to manage market expectations and maintain investor confidence. Firms undergoing such costly and disruptive technological transitions face strong incentives to minimize earnings volatility and avoid negative market reactions arising from what managers view as temporary implementation-related expenses. Furthermore, firms with the financial capacity to adopt blockchain technology tend to be larger, more established organizations with sophisticated managerial capabilities and forecasting abilities. These resources enable more effective implementation of smoothing strategies, allowing managers to strategically shift income between periods to maintain earnings stability—whether from opportunistic motives to safeguard executive compensation and meet analyst forecasts or from informative motives to signal the firm's underlying long-term financial stability despite short-term implementation disruptions.

Conversely, blockchain technology's intrinsic characteristics—transparency, immutability, and decentralized verification—can significantly reduce information asymmetry and constrain managerial discretion in financial reporting. The distributed ledger system inherently discourages the manipulation of reported performance by making transactions more visible and traceable to multiple stakeholders (Dai & Vasarhelyi, 2017; Yermack, 2017). Consequently, managers in blockchain-adopting firms face greater reputational and detection risks when attempting discretionary earnings adjustments. This heightened transparency may serve as a disciplining mechanism, mitigating the incentives and opportunities for income smoothing. From this perspective, blockchain adoption is likely to reduce income smoothing activities by enhancing external monitoring capabilities and constraining managerial reporting flexibility.

Given these contrasting theoretical predictions—one suggesting increased smoothing due to implementation costs and the other suggesting decreased smoothing due to enhanced transparency—we propose the following non-directional hypothesis:

Hypothesis H1: Blockchain technology adoption influences firms' propensity to engage in income smoothing.

2.4 Income Smoothing and Future Firm Value (H2)

The relationship between income smoothing and firm value in the context of blockchain adoption remains theoretically ambiguous and empirically unresolved. During technological transitions such as blockchain implementation, the valuation implications of smoothing activities become particularly salient due to the substantial costs and operational disruptions that characterize the adoption phase. We identify two competing theoretical frameworks that predict different outcomes regarding the impact of income smoothing on firm value for blockchain adopters.

On the one hand, from an opportunistic perspective, smoothing may diminish firm value if used to conceal unfavorable information or temporarily inflate performance metrics. When managers prioritize the preservation of short-term benchmarks, such as meeting earnings forecasts or protecting compensation packages, they may use smoothing to defer the recognition of adverse outcomes, particularly during the costly adoption phase. Although this may shield firms from immediate market backlash, the eventual revelation of underlying problems often triggers disproportionately negative investor reactions. Prior research highlights that such delayed disclosures can lead to abrupt increases in bid-ask spreads (Yu et al., 2018), increased stock price crash risk (Chen et al., 2017), and erosion of management credibility (Jin & Myers, 2006; Leuz et al., 2003). Under this view, income smoothing is associated with distorted financial reporting that ultimately undermines firm value.

On the other hand, the informative perspective posits that smoothing can enhance valuation by enabling managers to credibly signal long-term prospects in the face of temporary disruptions. Given their relative superior knowledge of expected future performance, managers may use income smoothing to align reported earnings more closely with internal forecasts, helping investors interpret firm fundamentals more accurately. This signaling function is particularly valuable during blockchain adoption, where implementation costs and delays could otherwise obscure the underlying value proposition of the technology. By reducing transitory earnings volatility, managers help investors differentiate between short-term shocks and sustainable performance trends. Consistent with this view, prior studies demonstrate that informative smoothing can reduce uncertainty among investors, decrease perceived firm risk, and ultimately lead to lower cost of capital and increased firm value (Amiram et al., 2018; Kasznik & McNichols, 2002; Myers et al., 2007).

Blockchain-adopting firms face heightened valuation pressures during the implementation phase, as the associated R&D and integration expenditures are substantial. Prior research indicates that earnings surprises, particularly negative ones, can adversely affect analyst coverage (Lang et al., 2004) and trigger negative stock price reactions (Kinney et al., 2002). Income smoothing thus becomes a strategic tool that may serve either to protect managerial interests or to credibly convey confidence in future performance. If managers engage in income smoothing to manage short-term expectations without credible justification, such behavior could erode firm value. However, if income smoothing communicates genuine long-term benefits from blockchain adoption, investors may respond favorably, enhancing firm valuation. Given these competing perspectives on how blockchain-driven income smoothing might affect future firm value, we propose the following non-directional hypothesis:

Hypothesis H2: Income smoothing by blockchain-adopting firms influences future firm value.

3 Data and Methodology

3.1 Data and Sample Selection

To investigate blockchain technology's impact on earnings quality and firm value, we construct an international sample of blockchain-adopting firms (treatment group) and a matched control group of non-adopting firms. We begin by manually identifying blockchain adopters using the 2018 Forbes Global 2000 list,[1] focusing explicitly on firms that announced or implemented blockchain solutions between 2015 and 2018. To accurately pinpoint the adoption year, we consult multiple credible sources, including corporate annual reports, official press releases,

[1] Available at: https://www.forbes.com/sites/michaeldelcastillo/2018/07/03/big-blockchain-the-50-largest-public-companies-exploring-blockchain/.

and reputable business news outlets. Specifically, we define the blockchain adoption year as the first fiscal year during which blockchain solutions became operational, indicated through tangible milestones, such as platform deployment, integration into supply chains or payment systems, or other clearly documented implementation activities.

To implement our difference-in-differences research design, we require each adopting firm to have at least three years of financial data both preceding and following the adoption year.[2] Consequently, our final sample covers the period from 2012 to 2021, while we exclude the adoption year itself from the analysis to avoid potential noise during the transition period. Following these criteria, we obtain a final treatment sample of 115 blockchain-adopting firms across 30 countries, totaling 620 firm-year observations.

We then match each blockchain-adopting firm to a set of control firms that did not adopt blockchain during our sample window. We employ propensity score matching (PSM) to ensure the control firms are comparable to the treatment firms in terms of size, industry, and other characteristics prior to adoption. Specifically, for each treatment firm we identify up to three non-adopting firms from the same country and Fama-French 48 industry (Fama & French, 1997) that have similar likelihood of adopting blockchain. The propensity score is estimated via a logistic regression where the dependent variable is an indicator for blockchain adoption and the independent variables (measured pre-adoption) include firm size, market-to-book ratio, leverage, profitability (return on assets), and operating cash flow (e.g., Klöckner, Schmidt, & Wagner, 2022; Liu, Wang, Jia, & Choi, 2022). These variables capture key firm attributes related to technology investment propensity and financial profile. Using the estimated propensity scores, each blockchain firm is matched with the nearest three neighbors among potential controls within a caliper of 5% propensity score difference. This matching procedure

[2] By creating a balanced event-time panel dataset, consisting of three years of observations before and after blockchain adoption for each firm, we effectively address methodological concerns related to staggered adoption timing, which might otherwise bias our difference-in-differences estimations (Baker, Larcker, & Wang, 2022).

yields 302 unique control firms (or 1,630 firm-year observations) that closely resemble blockchain firms before adoption. By design, the matching mitigates observable differences between the two groups, helping address selection bias. This enhances the reliability of our inferences, as any differential changes post-adoption can be more credibly attributed to blockchain adoption (Shipman et al., 2017).

We collect financial and stock price data for both groups from Compustat North America and Compustat Global. Panel A of Table 1 presents the distribution of blockchain-adopting firms by country, indicating that the United States dominates the treatment sample (19 firms), followed by India (11 firms), Japan (10 firms), and the United Kingdom (8 firms). Panel B of Table 1 further reports the distribution of adopters by year of adoption and industry, with the retail sector demonstrating the highest blockchain uptake (36 firms throughout the sample period).

[Insert Table 1 Here]

3.2 Methodology

To test our hypotheses, we implement a difference-in-differences (DiD) research design using a matched sample of blockchain-adopting firms (treatment group) and non-adopting firms (control group). This approach allows us to compare changes in outcomes around the adoption of blockchain in the treatment firms, relative to any concurrent changes in similar firms that did not adopt blockchain. Specifically, to test hypothesis H1 (blockchain adoption and income smoothing), we estimate the following baseline model to examine the change in income smoothing associated with blockchain adoption:

$$ISMOOTH_{i,t} = \beta_0 + \beta_1 BC_i + \beta_2 POST_{i,t} + \beta_3 BC_i \times POST_{i,t} + \sum \beta_i Controls_{i,t} + \sum \beta_j Industry\_FE_j + \varepsilon_{i,t} \quad (1)$$

Where the dependent variable *ISMOOTH* is our proxy for income smoothing for firm *i* in year *t*. Following prior literature (Demerjian, Lewis-Western, & McVay, 2020; Zang, 2012), *ISMOOTH* is constructed to capture the overall magnitude of income smoothing activities. Specifically, we calculate income smoothing as the sum of the absolute values of (i) discretionary accruals (estimated using the modified Jones model of Dechow et al., 1995) and (ii) abnormal real activities (estimated following Roychowdhury (2006) for production costs and discretionary expenditures).[3] This composite measure reflects the total extent to which a firm engages in income-increasing or income-decreasing manipulations through either accounting or real decisions, with higher values indicating more aggressive income smoothing. By taking absolute values, we focus on the magnitude of earnings management rather than its direction. The primary independent variables in Equation (1) are *BC* and *POST*, along with their interaction. *BC* is an indicator variable that takes the value 1 if the firm belongs to the treatment group, and zero otherwise; *POST* is a time dummy equal to 1 for post-adoption years, and zero otherwise; and the interaction term *BC×POST* is the DiD estimator of interest, which captures the change in income smoothing from pre- to post-adoption for the blockchain firms relative to the control firms. A positive and significant coefficient for β_3 would indicate that blockchain adoption is associated with an increase in income smoothing, supporting the idea that adopters smooth more after implementing blockchain, whereas a negative and significant β_3 would indicate a decrease in smoothing post-adoption. We include a vector of control variables to account for underlying financial characteristics that might affect earnings management, including firm size (*SIZE*), leverage (*LEV*), profitability (*ROA*), operating cash flow (*OCF*), capital expenditure (*CAPEX*), and research and development intensity (*RND*). We further include industry fixed effects, using the Fama and French (1997) 48-industry classification, to control for time-invariant industry characteristics, and we cluster standard

[3] Following Zang (2012), we do not examine abnormal cash flows from operations because real activities manipulation impacts this component in different directions and the net effect is ambiguous. Nevertheless, including abnormal cash flows from operations in our proxy does not alter our inferences.

errors at the firm level to account for within-firm correlation over time. All variables are defined in the Appendix.

To test hypothesis H2 (income smoothing and future firm value), we implement a DiD regression model that examines whether the value relevance of income smoothing changes for blockchain adopters in the post-adoption period. We use Tobin's Q as our proxy for firm value, defined as the market value of equity plus the book value of liabilities, divided by total assets (Fama & French, 1993). The regression model for H2 involves interacting the proxy for income smoothing (*ISMOOTH*) with the treatment (*BC*) and post (*POST*) variables. The full specification is as follows:

$$\begin{aligned} TOBINQ_{i,t+1} = {} & \beta_0 + \beta_1 ISMOOTH_{i,t} + \beta_2 BC_i + \beta_3 POST_{i,t} \\ & + \beta_4 ISMOOTH_{i,t} \times BC_i + \beta_5 ISMOOTH_{i,t} \times POST_{i,t} + \beta_6 BC_i \times POST_{i,t} \\ & + \beta_7 ISMOOTH_{i,t} \times BC_i \times POST_{i,t} \\ & + \sum \beta_i Controls_{i,t} + \sum \beta_j Industry\_FE_j + \varepsilon_{i,t} \end{aligned} \tag{2}$$

Where $TOBINQ_{it+1}$ is firm *i*'s Tobin's Q, measured at year *t*+1 to capture future market valuation outcomes.[4] This specification enables us to examine both the general impact of blockchain adoption on firm value (captured by *BC* × *POST*) and, importantly, whether blockchain adoption alters the relationship between income smoothing and firm value (captured by the triple interaction term *ISMOOTH* × *BC* × *POST*). In this model, β_7 is our main coefficient of interest for H2, indicating whether there is a differential effect on the value relevance of income smoothing for blockchain-adopting firms post-adoption. A significant and positive coefficient for β_7 would indicate that following the adoption of blockchain technology, the relationship between income smoothing and future firm value becomes more positive for treatment firms relative to non-adopters, supporting the informative interpretation. Conversely, a significant and negative coefficient for β_7 would indicate that income smoothing becomes

[4] The results are qualitatively similar if we use alternative windows, such as using the average of the next two years' Tobin's Q to smooth out noise.

less positively (or more negatively) related to firm value for adopters, suggesting an opportunistic interpretation where smoothing erodes future firm value. Control variables include factors known to affect firm value (size, leverage, profitability, operating cash flow, capital expenditures, and R&D intensity), and we also include industry fixed effects and cluster standard errors at the firm level.

3.3 Summary Statistics

Table 2 presents summary statistics for the key variables used in this study for the treatment (blockchain) and control groups. The matching procedure based on PSM yields treatment and control firms that are largely comparable across observable characteristics, confirming successful covariate balance. The mean values of *ISMOOTH* (0.8539 and 0.8718 for control and treatment firms, respectively) and *TOBINQ* (1.9685 and 2.0619 for control and treatment firms, respectively) are statistically indistinguishable between the two groups. Blockchain-adopting firms exhibit significantly larger average firm size, measured as the natural logarithm of total assets (mean *SIZE* = 10.4501), compared to matched control firms (mean *SIZE* = 7.0541). Furthermore, adopters demonstrate higher average profitability (*ROA* of 4.81% versus 2.15%) and stronger operating cash flows (*OCF* of 9.17% versus 7.61%). These differences align with expectations that blockchain implementation requires substantial resources and financial strength. Other financial characteristics, including leverage (*LEV*), capital expenditures (*CAPEX*), and R&D intensity (*RND*), show no statistically significant differences between adopters and non-adopters. Overall, these descriptive statistics confirm that blockchain adopters are larger, more profitable, and generate higher operating cash flows, while baseline income smoothing activities remain comparable between the two groups prior to blockchain adoption.

[Insert Table 2 Here]

4 Results

4.1 Blockchain Adoption and Income Smoothing

We begin our analysis by investigating whether blockchain adoption influences firms' income smoothing behavior, consistent with Hypothesis H1. Table 3 reports the results from our difference-in-differences (DiD) regressions specified in Equation (1). Model 3.1 examines the control group, showing that the coefficient on *POST* is 0.0598 and marginally significant (*p*-value < 0.1), indicating a modest increase in income smoothing among non-adopting firms, potentially driven by general economic or time trends unrelated to blockchain. In contrast, Model 3.2 reveals a significantly stronger effect within the treatment group: the *POST* coefficient (0.1887) is positive and significant at the 1% level, suggesting that blockchain adopters substantially intensified their income smoothing activities following implementation. Model 3.3 formally tests hypothesis H1 through the interaction term *BC* × *POST*, which captures the incremental change in smoothing for adopters relative to non-adopters. The coefficient for the interaction term (0.1512) is positive and statistically significant at the 1% level, confirming that blockchain adoption is significantly associated with a more pronounced increase in income smoothing activities relative to non-adopting peers. Economically, this relative increase in smoothing (0.1512) represents approximately 17% of the overall average level of income smoothing observed among adopting firms (0.8718), reflecting a substantial economic impact. These findings suggest that blockchain-adopting firms may be strategically using income smoothing to manage the potential negative financial repercussions associated with significant blockchain implementation costs, thus maintaining a stable earnings profile during transitional disruptions. Given that these adopters are typically large, financially robust entities with sophisticated managerial capabilities, they possess the necessary resources and expertise to strategically defer or absorb such implementation costs. Consequently, the increased income smoothing activity observed aligns with managerial incentives to portray financial stability amid the disruptive blockchain adoption phase. Collectively, our results support hypothesis H1, highlighting blockchain adoption as a significant driver of increased income smoothing in adopting firms.

[Insert Table 3 Here]

4.2 Income Smoothing and Earnings Surprise

Having established that blockchain adoption is associated with increased income smoothing, we now examine whether such smoothing serves an informative or opportunistic purpose. Specifically, we analyze how income smoothing affects earnings surprises conditional on whether earnings changes are positive or negative. Income smoothing is generally employed to manage earnings surprises—the unexpected component of reported earnings. This practice becomes particularly important during the initial stages of blockchain adoption, as firms may experience substantial expenses or operational disruptions that cause unmanaged earnings to deviate significantly from underlying economic performance. Managers facing negative earnings changes may employ income smoothing informatively to reduce negative surprises and convey positive private information to shareholders regarding expected performance recovery following blockchain adoption. Conversely, income smoothing during periods of positive earnings changes could reflect opportunistic behavior aimed at artificially inflating short-term reported performance to extract private benefits, potentially harming shareholders' long-term interests, as discussed in Section 2.2.

Table 4 presents regression results examining the changes in the relationship between income smoothing and earnings surprises around blockchain adoption, with separate analyses conducted for periods of positive earnings changes (Models 4.1 and 4.3) and negative earnings changes (Models 4.2 and 4.4). Models 4.1 and 4.2 examine the control group and reveal no significant changes in the way non-adopting firms utilize income smoothing to influence earnings surprises, irrespective of the earnings change direction (coefficients on *ISMOOTH×POST* are −0.0465 and 0.012, respectively; both statistically insignificant). This indicates that for non-adopting firms, the relationship between income smoothing and earnings surprises remains stable throughout the sample period. In contrast, Models 4.3 and 4.4 identify a distinct pattern among blockchain adopters. Model 4.3 provides weak evidence that blockchain adopters engage in income smoothing during periods of positive earnings changes, as evidenced by the coefficient on *ISMOOTH×POST* (0.1621), which is marginally significant at the 10% level. However, Model 4.4 demonstrates a substantially stronger effect when earnings are decreasing; the coefficient on *ISMOOTH×POST* is 0.3527, significant at the 1% level, and more than double the magnitude observed for positive earnings changes. The Chi-squared test confirms that the difference between these coefficients is statistically significant at the 1% level.

Collectively, these results suggest that blockchain-adopting firms primarily use income smoothing to mitigate negative earnings surprises rather than to amplify positive ones. Specifically, these firms appear to strategically employ income smoothing techniques to moderate the adverse impact of significant implementation costs during the early stages of blockchain adoption. This finding aligns with an informative use of income smoothing, where managers communicate that temporary implementation setbacks do not reflect the firm's underlying long-term performance or the anticipated future benefits of blockchain technology. Thus, rather than engaging in opportunistic earnings manipulation to mislead investors, managers employ income smoothing in an informative manner to prevent short-term volatility from obscuring the firm's fundamental earnings trajectory.

[Insert Table 4 Here]

4.3 Income Smoothing and Firm Valuation

Building on our prior analyses, this section investigates the impact of blockchain adoption and income smoothing on future firm valuation, addressing hypothesis H2. Specifically, we evaluate whether the informative use of income smoothing observed among blockchain adopters translates into enhanced firm valuation, as captured by Tobin's Q. Table 5 presents the results of two complementary sets of difference-in-differences regression analyses. The first set (Models 5.1 to 5.3) examines changes in future firm valuation around blockchain adoption, while the second set (Models 5.4 to 5.6) examines whether blockchain adoption influences the valuation relevance of income smoothing.

Model 5.1 shows that non-adopting firms experience a modest reduction in firm value over the sample period, with a coefficient on *POST* of −0.2797 (p-value < 0.1). In contrast, Model 5.2 reveals that blockchain-adopting firms exhibit a significant increase in firm value following adoption, with a coefficient on *POST* of 0.5462 (p-value < 0.01). The difference-in-differences estimator (*BC×POST*) reported in Model 5.3 is positive (0.7544) and significant at the 1% level, indicating substantial value creation for blockchain adopters relative to their non-adopting peers. This finding aligns with prior research documenting positive valuation effects from blockchain adoption (Klöckner et al., 2022; Liu et al., 2022).

Turning to our second hypothesis concerning the value implications of income smoothing (H2), Model 5.4 shows no significant change in the value relevance of income smoothing for control firms, as indicated by the insignificant coefficient on the interaction term *ISMOOTH×POST*. Conversely, Model 5.5 demonstrates that, for blockchain adopters, income smoothing becomes significantly more positively associated with firm value post-adoption (coefficient on *ISMOOTH×POST* = 1.0653; p-value < 0.01). Furthermore, in Model 5.6, the coefficient on the triple interaction term *ISMOOTH×BC×POST* is positive (1.9061) and significant (p-value < 0.05), indicating that blockchain adoption amplifies the positive impact of income smoothing on firm valuation relative to non-adopting firms.

Collectively, these empirical findings offer support for an informative rather than opportunistic interpretation of income smoothing among blockchain adopters. Instead of using smoothing practices to obscure economic realities or manipulate short-term perceptions of performance, managers appear to utilize income smoothing strategically to communicate future financial prospects. Investors interpret this smoothing positively, rewarding adopters with higher valuations and recognizing that short-term implementation costs do not undermine blockchain's long-term value proposition. Therefore, our results corroborate the theoretical perspective that managerial income smoothing, when used informatively, can significantly enhance shareholder value, particularly amidst transformative technological transitions such as blockchain adoption.

[Insert Table 5 Here]

4.4 Robustness Tests and Additional Analyses

To further validate our main findings and address potential methodological concerns, we conduct a series of robustness tests and additional analyses that strengthen our inferences regarding blockchain's impact on income smoothing and firm valuation.

4.4.1 Cross-sectional variation by information asymmetry

We first explore whether the relationship between blockchain adoption, income smoothing, and firm value varies with firms' pre-adoption information environments. Blockchain technology is theoretically expected to enhance transparency and reduce information asymmetry between managers and stakeholders (Yermack, 2017). If this mechanism underpins our main findings, we would anticipate the valuation benefits of blockchain adoption to be more pronounced among firms experiencing higher pre-adoption information asymmetry, as these firms stand to benefit more substantially from blockchain's transparency-enhancing properties.

To test this prediction, we partition our treatment sample into high and low information asymmetry subsamples based on firms' average bid-ask spread during the pre-adoption period. Table 6 presents the results of this cross-sectional analysis. The coefficient on the triple interaction term *ISMOOTH×BC×POST* in Model 6.2, representing firms with high pre-adoption information asymmetry, is 1.9550. Conversely, the coefficient for firms with low pre-adoption information asymmetry (Model 6.1) is lower, at 1.1193. The Chi-squared test confirms that the difference between these two coefficients is statistically significant at the 1% level. Consistent with our expectations, these results indicate that the positive impact of blockchain-driven income smoothing on firm valuation is significantly stronger for firms with higher pre-adoption information asymmetry.

These findings substantiate the information enhancement mechanism as a key channel through which blockchain adoption creates value. Specifically, firms characterized by greater pre-adoption information opacity experience more pronounced benefits from blockchain implementation, as income smoothing becomes significantly more informative and value-relevant for these previously less transparent entities. Thus, this cross-sectional variation provides evidence that blockchain technology generates value by improving the quality and transparency of financial information, with particularly strong effects for firms operating in previously opaque information environments.

[Insert Table 6 Here]

4.4.2 Addressing self-selection bias

A methodological concern in our analysis arises from potential self-selection bias, as firms choose whether to adopt blockchain technology rather than being randomly assigned to treatment and control groups. This non-random selection could introduce bias if unobservable factors simultaneously influence firms' blockchain adoption decisions and their propensity to engage in income smoothing. To mitigate this concern, we implement the Heckman (1979) two-step approach. In the first step, we model the probability of blockchain adoption as a function of firm characteristics, including size, profitability, growth opportunities, and the total sales-to-assets ratio, which serves as our exclusion restriction. From this model, we compute the inverse Mill's ratio (*IMR*), which captures the probability of selection into treatment based on observable characteristics. In the second step, we incorporate the *IMR* as an additional control variable into our regression analyses, effectively accounting for potential selection bias (Klöckner et al., 2022).

Table 7 presents the results from the second-stage regressions that re-examine hypotheses H1 and H2 while controlling for potential self-selection. In Model 7.1, the coefficient on *BC×POST* remains positive (0.1321) and significant at the 1% level, reaffirming that blockchain adopters exhibit significantly increased income smoothing post-adoption. Similarly, Model 7.2 confirms that blockchain adopters experience a significant increase in firm valuation following adoption (coefficient on *BC×POST* = 0.9529; p-value < 0.01), while Model 7.3 reinforces our central finding regarding the informative nature of income smoothing among blockchain adopters. Specifically, the coefficient on the triple interaction term *ISMOOTH×BC×POST* remains positive (2.0635) and significant at the 5% level after controlling for self-selection, indicating that income smoothing becomes significantly more value-relevant for blockchain adopters post-implementation. Overall, these results demonstrate that our main findings are robust to potential self-selection bias.

[Insert Table 7 Here]

4.4.3 Placebo tests

Finally, to ensure the robustness of our findings against potential placebo effects, we create artificial "pseudo-adoption" years by falsely lagging the actual adoption year by one period

(*POST_1*) and two periods (*POST_2*) for treatment firms. If our findings genuinely capture blockchain implementation effects rather than spurious correlations or other confounding events, we expect these placebo treatments to yield statistically insignificant findings.

Table 8 presents the results of these placebo tests. Model 8.1 re-examines hypothesis H1 using the placebo adoption years and shows that the difference-in-differences coefficient becomes statistically insignificant when using pseudo rather than actual adoption timings. Similarly, Models 8.2 and 8.3 revisit hypothesis H2, demonstrating that placebo adoption years have no significant effect on either firm value or the association between income smoothing and firm value.

Collectively, these placebo tests corroborate that our primary findings are driven by blockchain adoption rather than confounded by concurrent events or pre-existing trends. The lack of significant effects when using artificially assigned adoption years reinforces the causal validity of our main findings and underscores the robustness of our empirical strategy.

[Insert Table 8 Here]

5 Conclusion

This study investigates the impact of blockchain technology adoption on earnings quality and firm valuation using a global sample of 115 large public companies across 30 countries. Employing a difference-in-differences research design with propensity score matching, we examine how blockchain implementation affects firms' income smoothing behavior and their subsequent firm value.

Contrary to theoretical expectations that blockchain's enhanced transparency would constrain earnings manipulation, we document that blockchain-adopting firms engage in significantly higher levels of income smoothing post-implementation. Our evidence suggests that blockchain-adopting firms predominantly smooth earnings to mitigate negative earnings surprises arising from substantial implementation costs and operational disruptions during the adoption phase. Importantly, our findings reveal that the increased income smoothing among blockchain adopters serves primarily an informative role. Specifically, rather than misleading stakeholders or opportunistically obscuring poor performance, this behavior signals that short-term earnings disruptions do not reflect the firm's underlying long-term economic potential. Investors respond positively to these informative signals, as evidenced by the significantly enhanced firm valuation associated with post-adoption income smoothing.

Our cross-sectional analyses further demonstrate that the positive valuation effects from blockchain-driven income smoothing are particularly pronounced among firms with higher pre-adoption information asymmetry. These firms benefit mostly from blockchain's capacity to improve financial transparency and mitigate investors' informational disadvantage. This observation underscores blockchain's potential to serve as a significant mechanism for enhancing information environments, especially in firms previously constrained by opacity and informational frictions.

Our study makes several contributions to the literature. First, we provide novel empirical evidence on how blockchain adoption affects earnings management practices, extending beyond theoretical predictions to document actual reporting behaviors during technological transition. While prior research has theorized about blockchain's potential impact on financial reporting (e.g., Yermack, 2017), our study offers one of the first large-sample empirical analyses of how firms adapt their reporting behavior during blockchain implementation. Second, we contribute to the informativeness versus opportunism debate in the earnings management literature by identifying a context where managerial discretion appears to communicate credible information about long-term prospects, enhancing rather than eroding firm value. Our findings demonstrate that the nature and consequences of income smoothing are context-dependent, with blockchain adoption creating conditions where informative smoothing dominates opportunistic motives. Third, we provide evidence that blockchain-driven income smoothing creates tangible economic benefits, particularly for firms with higher information asymmetry. This finding demonstrates that the relationship between technological innovation and firm value is mediated by changes in financial reporting behavior, highlighting a previously unexplored mechanism through which blockchain creates shareholder value.

These findings have important implications for various stakeholders, including managers, investors, and regulators. Managers considering blockchain investments should recognize that strategic, informed income smoothing can effectively communicate long-term value and confidence during transitional periods characterized by significant implementation costs. Investors should evaluate whether increased smoothing around blockchain implementation signals confidence in future performance rather than opportunistic manipulation. Finally, regulators and standard setters should acknowledge that increased earnings management during technological transitions might actually enhance informational quality when used to navigate implementation challenges.

As blockchain technology continues to evolve, future research could extend our findings by examining how different implementation strategies affect financial reporting outcomes, how blockchain interacts with other emerging technologies, such as artificial intelligence, to shape corporate transparency, and whether the valuation effects we document persist across different market conditions and economic cycles. Exploring how blockchain's reporting implications vary across smaller firms, different regulatory environments, and industry-specific settings will further deepen our understanding of how transformative technologies reshape corporate transparency and accountability in global capital markets.

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Appendix: Variable Definitions

Variable	Definition
ΔEARN	Change in net income before extraordinary items from year *t*-1 to year *t*.
BC	Indicator variable equal to 1 for firms that adopt blockchain technology, and 0 otherwise.
CAPEX	Capital expenditure intensity, defined as capital expenditures divided by total assets.
ESURPRISE	Earnings surprise, calculated as the difference between current earnings per share and prior year earnings per share, scaled by the firm's current stock price.
ISMOOTH	Composite measure of income smoothing, defined as the sum of the absolute residuals from three models: (i) accrual-based earnings management using the Modified Jones model (Dechow et al., 1995); (ii) production-based earnings management following Roychowdhury (2006); and (iii) discretionary expenditure-based earnings management, based on Roychowdhury (2006).
LEV	Financial leverage, defined as the sum of long-term debt and debt in current liabilities, divided by total assets.
OCF	Operating cash flow, measured as cash flow from operations scaled by total assets.
POST	Indicator variable equal to 1 for years following blockchain adoption, and 0 otherwise.
RND	Research and development intensity, calculated as R&D expenses divided by total assets.
ROA	Return on assets, calculated as net income before extraordinary items divided by total assets.
SIZE	Firm size, measured as the natural logarithm of total assets.
TOBINQ	Firm value, measured as the ratio of the market value of equity plus the book value of total liabilities to total assets.

Table 1: Sample Distribution

Panel A: Distribution of Blockchain-Adopting Firms by Country

Country	Number of adopters	Country	Number of adopters	Country	Number of adopters
Australia	2	India	11	South Korea	3
Austria	1	Ireland	1	Spain	4
Bahrain	1	Italy	1	Sweden	1
Belgium	2	Japan	10	Switzerland	4
Brazil	2	Malaysia	1	Taiwan	1
Canada	2	Netherlands	3	Thailand	4
China	5	Portugal	1	Turkey	3
France	6	Russia	3	United Arab Emirates	2
Germany	6	Saudi Arabia	2	United Kingdom	8
Hong Kong	3	Singapore	3	United States	19

Total = 115 blockchain-adopting firms

Panel B: Distribution of Blockchain-Adopting Firms by Industry and Year of Adoption

Industry Classification	2015	2016	2017	2018	Total
Financial institutions	5	6	15	4	30
Manufacturing & energy	0	0	5	8	13
Mining & construction	0	3	9	10	22
Retail	5	2	18	11	36
Services	1	2	3	8	14
Total	11	13	50	41	115

Notes: This table presents the distribution of blockchain-adopting firms in the sample. Panel A reports the number of adopting firms by country. Panel B reports the distribution by industry classification and year of adoption, where the adoption year is defined as the first fiscal year in which blockchain solutions became operational.

Table 2: Summary Statistics

	Control (Non-adopting) Group							Treatment (Blockchain-adopting) Group						
	N	Mean	S.D.	Q1	Median	Q3		N	Mean	S.D.	Q1	Median	Q3	Diff. in Means
ISMOOTH	1,630	0.8539	0.7818	0.3470	0.5895	1.0501	*ISMOOTH*	620	0.8718	0.7750	0.3431	0.6002	1.1073	−0.0179
ESURPRISE	1,630	0.0020	0.5030	−0.0294	0.0026	0.0277	*ESURPRISE*	620	0.0148	0.5968	−0.0063	0.0024	0.0211	−0.0127
TOBINQ	1,630	1.9685	3.4425	0.9055	1.1848	2.0202	*TOBINQ*	620	2.0619	2.4065	0.9383	1.2078	2.2186	−0.0935
SIZE	1,630	7.0541	2.5883	5.2555	6.7451	8.8197	*SIZE*	620	10.4501	1.5882	9.5102	10.7049	11.7716	**−3.3960**
LEV	1,630	0.2421	0.2271	0.0408	0.1928	0.3783	*LEV*	620	0.2480	0.1457	0.1425	0.2482	0.3545	−0.0059
ROA	1,630	0.0215	0.1597	0.0052	0.0284	0.0733	*ROA*	620	0.0481	0.0575	0.0092	0.0340	0.0755	**−0.0266**
OCF	1,630	0.0761	0.1041	0.0098	0.0711	0.1287	*OCF*	620	0.0917	0.0707	0.0360	0.0879	0.1328	**−0.0156**
CAPEX	1,630	0.0369	0.0442	0.0029	0.0217	0.0556	*CAPEX*	620	0.0388	0.0355	0.0087	0.0299	0.0597	−0.0019
RND	1,630	0.0094	0.0277	0.0000	0.0000	0.0011	*RND*	620	0.0075	0.0175	0.0000	0.0000	0.0038	0.0019

Notes: This table reports descriptive statistics for the main variables used in the analysis for both the control (non-adopting) and treatment (blockchain-adopting) groups. The final column reports the difference in means between control and treatment groups. Bold values denote statistical significance at the 5% level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix.

Table 3: Income Smoothing around Blockchain Adoption

	Model 3.1	Model 3.2	Model 3.3
	Control group	Treatment group	Full sample
	ISMOOTH	*ISMOOTH*	*ISMOOTH*
BC			0.1669**
			(2.07)
POST	0.0598*	0.1887***	0.0573*
	(1.77)	(5.23)	(1.95)
BC×POST			0.1512***
			(3.41)
SIZE	−0.0690***	0.0089	−0.0635***
	(−7.22)	(0.20)	(−3.35)
LEV	0.3227***	0.1845	0.2799*
	(3.42)	(0.49)	(1.84)
ROA	−0.1666	−0.5067	−0.2104
	(−0.88)	(−0.45)	(−0.87)
OCF	0.6613**	1.6063***	0.9083**
	(2.34)	(3.26)	(2.41)
CAPEX	1.2604**	−0.4627	1.0565
	(2.40)	(−0.30)	(1.31)
RND	2.8508***	3.9166	3.1588*
	(3.43)	(0.75)	(1.90)
Constant	1.1092***	0.3222	1.0657***
	(13.57)	(0.64)	(6.92)
N	1,630	620	2,250
R^2	0.2544	0.3342	0.2800

Notes: This table presents difference-in-differences regression results examining changes in income smoothing activities around blockchain adoption. Model 3.1 reports results for the control group (non-adopters), Model 3.2 for the treatment group (blockchain adopters), and Model 3.3 for the full sample. The dependent variable in all models is *ISMOOTH*, our proxy for income smoothing. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.

Table 4: Income Smoothing and Earnings Surprises around Blockchain Adoption

	Model 4.1	Model 4.2	Model 4.3	Model 4.4
	Control Group		Treatment Group	
	$\Delta EARN > 0$	$\Delta EARN < 0$	$\Delta EARN > 0$	$\Delta EARN < 0$
	ESURPRISE	*ESURPRISE*	*ESURPRISE*	*ESURPRISE*
ISMOOTH	0.0627^{*}	−0.0318	0.0081	-0.0945^{*}
	(1.90)	(−1.14)	(0.11)	(−1.78)
POST	−0.0324	0.0097	−0.1342	−0.1166
	(−0.68)	(0.24)	(−1.48)	(−1.04)
*ISMOOTH*POST*	−0.0465	0.012	0.1621^{*}	0.3527^{***}
	(−1.11)	(0.35)	(1.82)	(3.64)
SIZE	-0.0190^{***}	−0.006	0.0749^{***}	0.0596^{**}
	(−2.62)	(−1.02)	(2.78)	(1.99)
LEV	0.0257	-0.0977^{*}	0.1351	0.1752
	(0.34)	(−1.68)	(0.52)	(0.57)
ROA	-0.7475^{***}	1.1488^{***}	−0.0982	1.0866
	(−4.36)	(15.38)	(−0.10)	(1.06)
OCF	0.3321^{*}	−0.1812	−0.3426	0.7967
	(1.65)	(−1.19)	(−0.37)	(0.86)
CAPEX	-1.2610^{***}	0.5287	1.9472	−1.5609
	(−3.08)	(1.60)	(1.38)	(−1.15)
RND	−0.5104	0.7187	-4.0388^{*}	-6.0683^{*}
	(−0.80)	(1.16)	(−1.77)	(−1.72)
Constant	0.3121^{***}	-0.1068^{*}	0.1928	-0.6870^{**}
	(4.85)	(−1.89)	(1.25)	(−1.98)
	H_0: $ISMOOTH \times POST\ [\Delta EARN > 0] = ISMOOTH \times POST\ [\Delta EARN < 0]$			
	Chi-squared (χ^2) = 1.77; *p*-value = 0.1834		Chi-squared (χ^2) = 7.51; *p*-value = 0.0061	
N	872	758	326	294
R^2	0.1137	0.2408	0.0752	0.149

Notes: This table presents regression results examining the association between income smoothing and earnings surprises conditional on the sign of earnings changes around blockchain adoption. Models 4.1 and 4.2 report results for the control group (non-adopters) with positive and negative earnings changes, respectively. Models 4.3 and 4.4 report results for the treatment group (blockchain adopters) with positive and negative earnings changes, respectively. The dependent variable in all models is *ESURPRISE*, our proxy for earnings surprise. The Chi-squared (χ^2) statistics test the hypothesis that the difference between the coefficients on *ISMOOTH*POST* for the negative and positive change in earnings subsamples is significantly different from zero. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.

Table 5: Firm Value and Income Smoothing around Blockchain Adoption

	Model 5.1	Model 5.2	Model 5.3	Model 5.4	Model 5.5	Model 5.6
	Control group	Treatment group	Full sample	Control group	Treatment group	Full sample
	TOBINQ	*TOBINQ*	*TOBINQ*	*TOBINQ*	*TOBINQ*	*TOBINQ*
ISMOOTH				1.5899	−0.4908*	1.492
				(1.42)	(−1.78)	(1.37)
BC			0.4462			1.5158*
			(1.27)			(1.81)
POST	−0.2797*	0.5462***	−0.2695*	0.6433	−0.1308	0.6441
	(−1.68)	(3.35)	(−1.89)	(1.18)	(−0.67)	(1.20)
ISMOOTH×BC						1.5176
						(1.62)
ISMOOTH×POST				−1.1544	1.0653***	−1.135
				(−1.44)	(4.95)	(−1.43)
BC×POST			0.7544***			−0.7215
			(4.41)			(−1.24)
ISMOOTH×BC×POST						1.9061**
						(2.44)
SIZE	−0.2207***	−0.2387	−0.2430**	−0.1540*	−0.254	−0.1887**
	(−5.99)	(−1.34)	(−1.97)	(−1.93)	(−1.44)	(−2.34)
LEV	1.0393***	0.1651	0.8278*	0.9147**	−0.2262	0.7161*
	(2.74)	(0.20)	(1.84)	(2.08)	(−0.28)	(1.74)
ROA	0.7867	2.6740**	1.0584**	0.7631**	3.7791***	1.0751***
	(1.32)	(2.43)	(2.54)	(1.98)	(2.64)	(2.75)
OCF	−2.5498***	2.9064	−1.3205	−2.9208	2.0767	−1.6828
	(−2.70)	(0.74)	(−0.35)	(−0.71)	(0.53)	(−0.44)
CAPEX	2.9546	0.188	2.4741	1.6911	1.3236	1.4892
	(1.39)	(0.03)	(0.96)	(0.76)	(0.22)	(0.69)
RND	15.8341***	3.7108	14.3247***	12.4731**	4.0049	11.0790**
	(4.48)	(0.28)	(2.72)	(2.46)	(0.33)	(2.28)
Constant	3.3245***	3.2124	3.4604***	1.6816***	3.9704*	1.9696***
	(11.26)	(1.61)	(2.94)	(4.57)	(1.92)	(5.00)
N	1,630	620	2,250	1,630	620	2,250
R^2	0.0768	0.2187	0.0916	0.1267	0.2468	0.133

Notes: This table presents difference-in-differences regression results examining changes in firm value around blockchain adoption, and the valuation relevance of income smoothing before and after adoption. Models 5.1-5.3 examine changes in firm value around blockchain adoption for the control group, treatment group, and full sample, respectively. Models 5.4-5.6 examine whether blockchain adoption alters the relationship between income smoothing and firm value. The dependent variable in all models is *TOBINQ*, measured at year *t*+1. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.

Table 6: Cross-sectional Analysis of Income Smoothing and Firm Value by Information Asymmetry

	Model 6.1	Model 6.2
	Low Information Asymmetry	High Information Asymmetry
	TOBINQ	*TOBINQ*
ISMOOTH	0.5805***	2.1180***
	(4.11)	(8.38)
BC	0.6810***	2.3013***
	(2.62)	(4.04)
POST	0.106	0.9727**
	(0.56)	(2.41)
ISMOOTH×BC	−0.5649*	−0.7061
	(−1.51)	(−1.88)
ISMOOTH×POST	−0.3177*	−0.6340**
	(−1.68)	(−1.98)
BC×POST	−0.3825	−0.7768
	(−1.04)	(−1.01)
ISMOOTH×BC×POST	1.1193***	1.9550***
	(2.79)	(3.90)
SIZE	−0.0631***	−0.2865***
	(−2.64)	(−5.26)
LEV	0.8988***	−0.1251
	(3.03)	(−0.23)
ROA	0.4168	1.3094
	(1.00)	(1.25)
OCF	2.9959***	−4.5988***
	(4.05)	(−3.45)
CAPEX	−1.7813	0.8879
	(−1.15)	(0.33)
RND	20.8157***	12.1183***
	(9.19)	(2.64)
Constant	1.3448***	2.5522***
	(5.42)	(4.97)

H_0: *ISMOOTH×BC×POST* [low information asymmetry] = *ISMOOTH×BC×POST* [high information asymmetry]
Chi-squared (χ^2) = 9.05; *p*-value = 0.0026

N	1,095	1,155	1,095	1,155
R^2	0.073	0.0894	0.1507	0.1332

Notes: This table presents difference-in-differences regression results examining the relationship between income smoothing and firm value conditional on pre-adoption information asymmetry. Firms are classified into low (Model 6.1) and high (Model 6.2) information asymmetry subsamples based on whether their average bid-ask spread in the pre-adoption period is below or above the industry median, respectively. The dependent variable in both models is *TOBINQ*, measured at year *t*+1. The Chi-squared (χ^2) statistic tests the hypothesis that the difference between the coefficients on *ISMOOTH*BC*POST* for the low and high information asymmetry subsamples is significantly different from zero. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.

Table 7: Addressing Self-selection Bias using Heckman Two-step Estimation

	Model 7.1	Model 7.2	Model 7.3
	H1	H2	H2
	ISMOOTH	*TOBINQ*	*TOBINQ*
ISMOOTH			1.5128
			(1.38)
BC	0.097	0.1065	1.4059^{*}
	(1.17)	(0.44)	(1.79)
POST	0.0479	-0.2926^{*}	0.8135
	(1.55)	(−1.75)	(1.29)
ISMOOTH×BC			1.6342^{*}
			(1.85)
ISMOOTH×POST			−1.2581
			(−1.44)
BC×POST	0.1321^{***}	0.9529^{***}	−0.9402
	(2.74)	(3.82)	(−1.32)
ISMOOTH×BC×POST			2.0635^{**}
			(2.34)
SIZE	0.3466^{***}	1.4882^{*}	1.2650^{*}
	(2.71)	(1.79)	(1.96)
LEV	−0.1167	−0.7184	−0.5546
	(−0.64)	(−0.80)	(−0.75)
ROA	1.3965^{***}	7.6339^{**}	6.5161^{**}
	(2.96)	(2.19)	(2.53)
OCF	3.8752^{***}	11.0053^{***}	8.7874^{***}
	(4.43)	(3.52)	(3.75)
CAPEX	0.8825	1.5945	0.8485
	(1.12)	(0.64)	(0.38)
RND	−1.9251	−7.3166	−7.1356
	(−0.82)	(−0.62)	(−0.65)
IMR	1.0719^{***}	4.4904^{*}	3.7722^{**}
	(3.06)	(1.85)	(2.07)
Constant	-4.0549^{**}	-18.1995^{*}	-16.3240^{*}
	(−2.50)	(−1.72)	(−1.86)
N	2,250	2,250	2,250
R^2	0.2895	0.109	0.1473

Notes: This table presents difference-in-differences regression results re-examining our main hypotheses while controlling for potential self-selection bias using the Heckman (1979) two-step approach. Model 7.1 re-tests the association between blockchain adoption and income smoothing. Model 7.2 re-examines the impact of blockchain adoption on firm value. Model 7.3 tests whether the valuation relevance of income smoothing differs post-adoption for blockchain adopters. The *IMR* (Inverse Mill's Ratio) is calculated from the first-stage probit model using total sales-to-assets ratio as the exclusion restriction. The dependent variable is *ISMOOTH* in Model 7.1 and *TOBINQ* in Models 7.2 and 7.3. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.

Table 8: Placebo Tests Using Pseudo-Adoption Years

	Model 8.1	Model 8.2	Model 8.3
	H1	H2	H2
	ISMOOTH	*TOBINQ*	*TOBINQ*
ISMOOTH			1.0033
			(1.44)
BC	0.1423^{**}	0.4596	1.0930^{*}
	(2.06)	(1.11)	(1.90)
POST_1	0.049	−0.2829	1.8722
	(1.10)	(−0.75)	(1.17)
POST_2	0.0316	0.0906	−1.6584
	(0.55)	(0.26)	(−1.24)
ISMOOTH×BC			0.8203^{*}
			(1.83)
ISMOOTH×POST_1			−2.6275
			(−1.12)
ISMOOTH×POST_2			2.0614
			(1.05)
BC×POST_1	0.1101	0.7400^{*}	−1.9674
	(1.37)	(1.67)	(−1.19)
BC×POST_2	0.0305	−0.044	1.6566
	(0.32)	(−0.11)	(1.18)
ISMOOTH×BC×POST_1			3.2006
			(1.37)
ISMOOTH×BC×POST_2			−2.0154
			(−1.01)
SIZE	-0.0630^{***}	-0.2426^{**}	-0.1897^{**}
	(−7.10)	(−1.98)	(−2.39)
LEV	0.2841^{***}	0.8325^{*}	0.7456^{*}
	(3.26)	(1.85)	(1.75)
ROA	−0.2176	1.0603^{**}	1.2866^{***}
	(−1.15)	(2.51)	(3.22)
OCF	0.9076^{***}	−1.2859	−1.7524
	(3.29)	(−0.34)	(−0.47)
CAPEX	1.0844^{**}	2.5353	1.3971
	(2.30)	(0.99)	(0.67)
RND	3.1317^{***}	14.3496^{***}	11.2286^{**}
	(3.81)	(2.72)	(2.34)
Constant	1.0303^{***}	3.4336^{***}	2.3966^{***}
	(12.05)	(3.15)	(5.16)
N	2,250	2,250	2,250
R^2	0.2792	0.0899	0.1507

Notes: This table presents placebo difference-in-differences regression results using artificial "pseudo-adoption" years to validate the main findings. *POST_1* is a placebo adoption year lagged by one period, while *POST_2* is lagged by two periods. Model 8.1 re-examines H1 (blockchain adoption and income smoothing), while Models 8.2 and 8.3 re-examine H2 (income smoothing and firm value). The dependent variable is *ISMOOTH* in Model 8.1 and *TOBINQ* in Models 8.2 and 8.3. All regressions include Fama and French (1997) 48-industry fixed effects. The t-statistics in parentheses are calculated based on standard errors clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in the Appendix. The asterisks indicate a 1% (***), 5% (**), and 10% (*) level of significance.