Financial and Operational Consequences of Blockchain Technology Adoption in Supply Chains: Do Intent, Motivation and Industry Context Matter?

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1 Introduction

Blockchain Technology (hereafter "BCT") is one of the new disruptive technologies that have the potential to improve supply chain management in several ways (Gartner, 2020) such as to improve supply chain resilience, enhance product traceability, and improve transparency (Forbes, 2019; Babich and Hilary, 2020). In BCT transactions, data resides as distributed and decentralized tokenized copies (verified and updated regularly) with multiple involved agencies, and therefore, data cannot be easily manipulated, thus making transactions immutable and trustworthy. Despite the promise and potential of BCT, the contextual need and business impact of the technology vary considerably across firms and industry sectors (Sun et al. 2020). Additionally, financial and operational returns from BCT adoption in the supply chain are unclear (Babich and Hilary, 2020). Most existing literature in the context of BCT is related to the technological aspects of blockchains, and studies related to the impact of BCT on firm performance are sparse at best (Chod et al., 2020). The objective of this paper is to bridge this gap by investigating the financial and operational impact of BCT adoption.

The first research question we address is: (i) How does a stock market react when firms announce the adoption of BCT in their supply chains? An important aspect of announcements related to BCT adoption is that some announcements are speculative, i.e., prospective in nature declaring intent to adoption, and some other announcements are done after actual implementation has progressed considerably, i.e., non-speculative. Our second research question sheds light on this issue, which has received limited attention in the literature in the context of BCT adoption in supply chains: (ii) Do speculative and non-speculative announcements related to BCT adoption in supply chain have differential impacts on the stock market returns? Several contingencies may affect the relationship between BCT adoption announcements and stock market returns. It is unlikely that firms operating in different environments will gain similar stock market benefits from BCT adoption in the supply chain. Firms operating in a highly competitive environment may face more challenges. Additionally, different industries may need different levels of supply chain traceabilities. Accordingly, the third research question that we investigate is: (iii) How do competitive intensity and industry growth impact stock market returns from BCT adoption in supply chains? Firms invest in new technology such as BCT not only for stock market returns, but also to improve operating performance such as to reduce costs of transactions in supply chains, and improve asset utilization. However, literature has suggested that BCT is an inefficient system because of its low transaction throughput (Wong et al., 2020). Therefore, the fourth question we analyze is: (iv) Does BCT adoption result in improvement in operating performance?

2 Existing Research on BCT Adoption

The literature on BCT refers back to the white paper by Nakamoto (2008), which proposed a BCT system for trustful financial transactions. Subsequently, practitioners explored the application of BCT in several application areas such as healthcare supply chains to prevent counterfeiting (Pun et al., 2021), logistics (Hackius and Petersen, 2017), sharing economy (De Filippi, 2017), and food supply chains (Behnke and Janssen, 2020). Chod et al. (2020) showed that the deployment of BCT in supply chains is associated with transparency at lower costs. Hastig and Sodhi (2020) discussed the

advantages and challenges of BCT implementations in supply chains. Similarly, Babich and Hilary (2020) indicated several strengths of this technology in providing visibility, system resilience, and contract automation. Cai et al. (2021) found that BCT mitigates moral hazard issues in supply chains. Contrarily, literature has also pointed out that BCT has some weaknesses such as lack of standardization, lack of privacy and inefficiency. Pun et al. (2021) documented that the linkages of BCT with supply chain profits are unclear (Chod et al., 2020). There are very few studies on the effect of BCT implementation in supply chains on stock returns and operational performance. To the best of our knowledge, ours is one of the early studies that empirically examines the impact of BCT adoption in the supply chains on stock market return and operating performance.

3 Theory and Hypotheses

The theoretical underpinning of stock market reaction to BCT announcement is based on signaling theory (Spence, 1973). In finance, signaling theory has been extensively used to analyze and understand the stock market reaction to firm-level events (Asquith and Mullins Jr, 1986; Bergh and Gibbons, 2011). Signaling theory is used to analyze how decision makers such as investors in the stock market make decisions in the presence of incomplete and asymmetric information among involved parties, such as the announcing firm and the investors. Signaling theory is based on four premises: the signaler, the nature of the signal, the receiver, and the feedback (Connelly et al., 2011). we expect that the announcement of BCT implementation in supply chain positively impacts the stock market returns of a firm, which leads to Hypothesis 1 (H1).

Hypothesis 1. *The announcement of BCT adoption in supply chain is associated with a positive stock market return.*

Announcements of BCT adoption can be prospective, expressing a future intent, as well as retrospective after definitive adoption actions such as partnering with technology providers have taken place. Accordingly, we categorize the announcements as speculative and nonspeculative (Chen and Yano, 2010).

Hypothesis 2. *Non-speculative announcements are associated with higher stock market returns than speculative announcements of BCT adoption in supply chains.*

The theoretical lens for the next two hypotheses (H3 and H4) is based on the contingency theory (Sousa and Voss, 2008). This theory suggests that outcomes of firm strategies and technology adoption are contingent on a firm's contextual factors such as competitive intensity, growth potential, and others (Bose et al., 2011; Dewan and Ren, 2007).

Hypothesis 3. *BCT adoption positively impacts stock returns for firms that operate in more competitive industries.*

Hypothesis 4. *The impact of BCT adoption on firms' stock market returns is higher for firms operating in high growth industries than in relatively stable industries.*

The impact of new technology on operational performance measures is an important practical motivation and consideration. Extant literature points towards the potential organizational performance benefits of BCT (Babich and Hilary, 2020; Wang et al., 2021). However, the

The impact of new technology on operational performance measures is an important practical motivation and consideration. Extant literature points towards the potential organizational performance benefits of BCT (Babich and Hilary, 2020; Wang et al., 2021). However, the relationship between BCT adoption and its effect on operating performance has not been analyzed empirically. The theoretical lens for this hypothesis is based on Transaction Cost Economics (TCE). (Williamson, 2010). Lumineau et al. (2021) argued that BCT governance reduces both ex-ante and ex-post transaction cost in supply chains.

Hypothesis 5. *BCT adoption has a positive impact on a firm's operating performance.*

4 Data and Methodology

We conducted a comprehensive search for announcements of BCT related collaboration or partnerships in the supply chains in different databases such as Factiva, Thomson Reuters Eikon database, Wall Street Journal (WSJ), Financial Times, New York Times and PR Newswire (PRN). The final study sample consists of 128 unique BCT adoption

announcements. We use an event study approach to analyze the stock market reactions associated with an event, i.e., announcements of BCT adoption in supply chains. Consistent with prior finance literature, investors expect higher (lower) future cash flow from stock price rise (drop) in reaction to the announcement of new information ("the event"). The abnormal return (AR) represents shareholders' value due to the event. It is defined as the difference between stock price return due to the event and its expected return if the event had not occurred (Mukherjee et al., 2021). Next, we explore the determinants of CAR by utilizing a regression model, to test Hypotheses 3 and 4. We use cross-sectional pooled regression estimates with year dummies, because the events occur only within one year in a specific firm, and a panel estimate will not be identified. The results support the proposed Hypothesis 1 and indicates that a BCT adoption announcement in a supply chain positively impacts the stock market return of the adopting firm. Overall, we find support for Hypotheses 1-5.

5 Discussions and Conclusion

Our study sheds light on implications of BCT adoption in supply chains, and its consequences for financial and operational performance. First, in our research, we empirically link BCT adoption in supply chains to stock market returns using the event study approach.Second, our study makes an important contribution to signaling theory. This study is amongst the few studies that considered signaling theory to analyze the link between adoption of new technology and stock market returns. Third, we apply the contingency theory (CT) literature in the context of BCT. This theory suggests that different firms operate in different environments, and hence firms' performance should be analyzed considering different contingent factors (Wong et al., 2011).Thus, from the perspective of contingency theory, this study deepens the understanding of market reaction to BCT-related partnership announcements in the short run by analyzing the contingent factors of growth and competition. Our study makes significant practical and theoretical contributions towards BCT adoption and usage.

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