The Long Term Effect of Blockchain Adoption on Firm Value

Emergent Research Forum (ERF) Paper

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Abstract

The justification of investments in blockchain has puzzled information technology (IT) managers because of the lack of empirical evidence on the benefits generated by blockchain technology. This study addresses this issue by analyzing the return on investment of blockchain from a financial market perspective using calendar-time portfolio analysis. Preliminary findings from 138 announcements by 77 firms that have adopted blockchain reveal positive effects on the firms’ long-term abnormal return of market values. Furthermore, we observed that firms that apply collaborative strategies do not obtain more long-term positive results than individual strategies. Overall, this study provides the first objective evidence of the effects of blockchain adoption on firm financial performance. Such findings present an encouraging message to firms to invest in blockchain and provide insights into how collaborative strategies influence the effects of blockchain adoption on the long-term financial performance of firms.

Keywords

Blockchain, calendar-time portfolio analysis, event study, market value, IT investment

Introduction

“Blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value” (Tapscott and Tapscott 2016). Blockchain has captured the attention of academics and practitioners as the basis of virtual currency systems, such as Bitcoin. However, blockchain’s capabilities extend far beyond cryptocurrency, generating other types of digital values. Blockchain has been applied in varies fields, including smart contracts, supply chain auditing, stock trading, and land title registrations.

According to a report by the International Data Corporation, the total blockchain spending in 2021 is expected to reach US$9.2 billion, and the five-year compound annual growth rate from 2016 to 2021 will be 81.2%. Owing to the increasing blockchain investments among firms, whether blockchain provides competitive advantages to firms is a critical issue. Although numerous firms are engaged in ongoing experimentations on blockchain solutions, they experience difficulties in determining whether the value of blockchain can justify their investments. Moreover, a few conceptual studies and white papers have discussed the impact and value of blockchain technologies (Underwood 2016). For example, Underwood (2016) discussed the potential applications and benefits of blockchain. However, the existing literature provides limited evidence on the benefits of blockchain adoption. Therefore, the first purpose of this study is to fill this research gap by examining the long-term effect of blockchain adoption on firm value (in terms of stock returns).

The second purpose of this study is to examine how the blockchain adopters’ adoption strategies influence the long-term effect of blockchain adoption on firm value. It is a common phenomenon for firms to form collaboration to develop blockchain solution. For example, J.P. Morgan partnered other banks in 2017 to use blockchain technology for global payments. Previous studies suggest that collaborations affect market return of IT investment (Das et al. 1998). However, understanding in this area remains limited.

We perform the calendar-time portfolio analysis method combined with the Fama–French (FF) model to examine the long-term impact of blockchain adoption on market value. We then conduct subsample analysis to examine how adoption strategies influence the long-term impact.
Impact of IT on Firm Value

Researchers have continued to study the impact of IT adoption on firm value and how contextual factors (e.g., type of IT investment, firm factors, and industry characteristics) influence that impact. For example, Mithas et al. (2012) find that IT is positively associated with profitability. However, as blockchain investment is relatively new to the IT field, to the best of our knowledge, this is the first research that studies the impact and contingencies of blockchain investment on firm value.

Hypotheses

From an operational perspective, blockchain has a strategic value for firms by enabling cost reduction and eliminating middlemen (Carson et al. 2018). Blockchain can reduce two major operational costs, namely, transaction costs within a network without the need of a middleman and cost of verifying the transaction attributes. In the former case, blockchain is based on an open and a distributed infrastructure and a consensus process that enables firms and individuals to conduct transactions without a middleman. Thus, the transaction costs and time of working through a middleman are reduced (Underwood 2016). For the latter case, blockchain technology provides a platform that securely records and time stamps information. For example, through blockchain smart contracts, tasks can be automatically executed without investing resources to audit the transaction and assess the truth. This process promotes efficiency and simplifies settlements and reconciliations across firms.

Moreover, when firms effectively embrace a novel technology, they may be able to obtain a competitive advantage over their competitors who lag behind (Roztocki and Weistroffer 2015). Thus, firms that have embraced blockchain in the early stage can likely derive tangible gains. Overall, consider the aforementioned benefits, we anticipate that blockchain will lead to long-term positive impacts on the market value of the adopting firms. Therefore, we make the following hypothesis:

**Hypothesis 1**: Blockchain adoption is positively associated with a firm’s market value in the long term.

Following Dodgson (1993), the present study defines collaboration as a cooperative agreement between two or more firms that contribute differential resources and technological know-how to work together on a blockchain investment. Blockchain is considered as a novel technology that is highly uncertain. Subsequently, a common practice among firms is to form collaborations to develop blockchain solutions. In fact, alliances are particularly essential when the development costs are large or when the transactions are highly complex (Teece 1986). Dodgson (1993) suggested that technological collaborations enhance firms’ abilities to handle innovations and educate firms on turbulent and uncertain technological changes.

In addition, the value of blockchain is best realized through its network effects and interoperability, and all parties have to follow a common standard to offer consumers cheap and fast services (Carson et al. 2018). Collaboration strategies provide firms a position to shape and capture the value of new blockchain standards. However, individual adopters face considerable regulatory and standardization barriers. A market standard will emerge as the technology develops, and investments in the nondominant standard may be wasted (Carson et al. 2018).

Based on the aforementioned arguments and compared with an individual blockchain initiative, collaboration announcements of blockchain investments indicate that firms deploy high-value use cases. Thus, we make the following hypothesis:

**Hypothesis 2**: Collaborative blockchain initiatives create more positive impacts on market values in the long term than individual blockchain initiatives.

Methodology

**Data Collection**

We collected 2015–2018 blockchain investment announcements through a complete search of the Factiva database using “blockchain” as the key word. The database initially showed thousands of announcements; thus, we applied a systematic review mechanism to ensure data validity. Each announcement was carefully examined to determine its relation to blockchain adoption by a firm. Based on previous studies
(Dos Santos et al. 1993), blockchain investment was defined to include purchases, agreements to purchase, or plans to purchase blockchain equipment, software, or services. The research objective is to investigate the impact of blockchain investment on a firm’s financial value; thus, news related to developers investing in the development of the blockchain technology (either hardware or software) were excluded. Announcements containing news on multiple companies jointly engaged in blockchain initiatives, such as building a strategic partnership, were counted as multiple events, with each event corresponding to a specific firm. We excluded announcements that were affected by confounding events (e.g., merger and acquisition). After careful filtering, we collected a total of 138 announcements by 77 firms. Blockchain investment appears the most popular to finance industry (SIC 60). Also, the majority (66%) of the announcements are released in 2018. The sample announcements are presented in Table 1.

<table>
<thead>
<tr>
<th>Firm</th>
<th>Date</th>
<th>Content</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Express</td>
<td>16/11/2017</td>
<td>American Express today announced the introduction of blockchain-enabled, business-to-business cross-border payments.</td>
<td>Individual</td>
</tr>
<tr>
<td>Ford</td>
<td>05/02/2018</td>
<td>Ford, General Motors, BMW, and IBM are among the companies that have joined a consortium that wants to use blockchain to ensure connectedness and security in the auto industry.</td>
<td>Collaborative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firm X invests in blockchain</th>
<th>Firm Y invests in blockchain</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
</table>

Table 1. Sample Announcements

Stock market data was obtained from the Center for Research in Security Prices (CRSP) for firms covered in the sample. We relied on news articles collected from Factiva to determine the appropriate subsample based on collaboration strategy. We considered an initiative as collaborative if it involved at least two firms; otherwise, it is an “individual” subsample.

**Calendar-Time Portfolio Analysis**

We performed the calendar-time portfolio analysis to determine the long-term effect of blockchain adoption. The major benefits of using the calendar-time portfolio analysis to calculate the long-term impact is that it does not depend on cross-sectional variance (Lyon et al. 1999) and the monthly returns are serially uncorrelated (Kothari and Warner 2007). Therefore, the statistical significance of the results is believed to be better than that of conventional event study methods.

To calculate the long-term returns for 12 months, we built an investment portfolio P at the beginning of the month following the announcement month. The announcing firm is included in the portfolio and its stock is bought at US$1 and hold for the next 12 months. As illustrated in Figure 1, Stock X is bought at the beginning of Month 1 because Firm X adopts blockchain before Month 1. At the beginning of Month 13, Stock X is sold after it has been hold for 12 months. Similarly, stock Y is bought at the beginning of month 2, hold for 12 months, and sold at month 14.

**Figure 1. Example of Calendar-time Portfolio Construction**

Fama and French (1996) first introduced the FF model on the basis of the traditional capital asset price model (CAPM) in which two factors were added to control the size and book-to-market ratio factors. Thus, the FF model provides better and more conservative estimates of expected stock returns than the CAPM (Fama and French 1993). The FF model has been increasingly used in various fields such as phishing alerts (Bose and Leung 2014).

We compute the return for the portfolio \( R_{pt} \) every month based on which stocks are included in the portfolio and obtain the abnormal monthly return, which is captured by \( \alpha_p \) using the FF model below:

\[
R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p \text{SMB}_{pt} + \delta_p \text{HML}_{pt} + \epsilon_{pt},
\]
where $R_{pt}$ is the rate of return for portfolio $P$ on month $t$, $R_{ft}$ is the risk-free rate on month $t$ and is equivalent to the return of the treasury bill, $\alpha_p$ is the $y$-intercept for portfolio $P$, $R_{mt}$ is the rate of return of the market index $m$, $\beta_p$ is the slope that measures $R_{mt}$, SMB$_{pt}$ is the size factor that measures the difference of returns between the large and small stocks in the value-weighted portfolio constructed on month $t$, $\gamma_p$ is the slope that measures SMB$_{pt}$, HML$_{pt}$ is the book-to-market factor that measures the difference of returns between the high and low stocks in the value-weighted portfolio constructed on month $t$, $\delta_p$ is the slope that measures HML$_{pt}$, and $\epsilon_p$ is the error term. The monthly return data for the SMB and HML are retrieved from the Kenneth R. French website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html), and the data on monthly stock returns are retrieved from the CRSP.

A regression is conducted to determine the monthly abnormal return $\alpha_p$. The number of stocks in the portfolio $P$ varied from one month to another; thus, we used the weighted least-squares method to run the regression, where the weight was the square root of the number of stocks for a particular month (Sorescu et al. 2007). Furthermore, we constructed the portfolio for 3, 6, and 9 months and estimated the abnormal returns in a similar approach to analyze the effect of blockchain adoption for different periods.

## Results and Discussion

Based on calendar-time portfolio analysis method combined with the FF models, we tested the hypotheses and examined the long-term returns on investment of blockchain using four different time periods ranging from 3 to 12 months. Table 2 presents consistent positive abnormal returns of the full sample ranging from 3 to 12 months. Specifically, all periods showed that the abnormal returns are significantly positive ($p < 0.10$). The magnitude of the portfolio abnormal returns ranged from 1.907% (12-month return) to 5.403% (6-month return). The results revealed that in the long run, the financial market considerably rewarded blockchain adopters. Therefore, H1 is supported.

<table>
<thead>
<tr>
<th>Duration (months)</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Return</td>
<td>3.408</td>
<td>5.403</td>
<td>2.315</td>
<td>1.907</td>
</tr>
<tr>
<td>$p$ value</td>
<td>0.061</td>
<td>0.005</td>
<td>0.012</td>
<td>0.017</td>
</tr>
</tbody>
</table>

**Table 2. Long Term Impact of Blockchain Adoption**

Table 3 presents the results of the subsample analysis of the adoption strategy. Although a significant and strong positive abnormal return is found for collaborative adopters in the quarter data, the significant positive abnormal return becomes less than that for the individual adopters in 6, 9, and 12 months. Thus, H2 is not supported.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>collaboration</td>
<td>Individual</td>
<td>collaboration</td>
<td>Individual</td>
</tr>
<tr>
<td>Abnormal Return</td>
<td>8.196</td>
<td>4.158</td>
<td>1.516</td>
<td>5.294</td>
</tr>
<tr>
<td>$p$ value</td>
<td>0.008</td>
<td>0.226</td>
<td>0.173</td>
<td>0.015</td>
</tr>
</tbody>
</table>

**Table 3. Long Term Impact of Adoption Strategy**

The findings confirm our prediction that blockchain adoption provides stock returns in the long run. The result aligns with most previous IT investment-related short-term event studies that report significant positive reactions around the announcement day (Teo et al. 2016).

With respect to the moderating effect of adoption strategy, the result differs from previous studies, which show that the formation of technology-related collaboration announcements increases the firm’s value in short-term event studies (Das et al. 1998). Our finding implies that although the prospect of cooperation seems attractive to investors in the beginning, they consider implementation uncertainties and challenges involved thereafter. For example, numerous collaboration proposals receive positive initial reactions from the stock market but later end up as failures (Kale et al. 2002).

From a theoretical standpoint, such findings are important in the blockchain literature because they provide the first objective evidence of the effects of blockchain adoption on the market value. Moreover, although previous research has explored the value creation effects of collaboration formation announcements (Yang et al. 2014), limited attention has been given to the wealth effects of strategic
alliances in the long term. Therefore, this study also enriches the understanding of the influence of strategic alliances on the link between blockchain adoption and long-term market value.

From a managerial perspective, the findings of this study provide an encouraging message to top firm managements to continue investing in blockchain. The stock return of strategic alliances in blockchain adoption becomes less than that of individual adoption in the long run; thus, managers have to consider the effect when implementing collaborative blockchain adoption.

Several limitations in the present study should be addressed. First, the study may not be fully representative of blockchain adoption by all firms given that only publicly listed firms are included. Unlisted private firms and government organizations are excluded because of the lack of publicly available financial data. Second, the announcements of the sample are from press announcements of firms. Thus, firms that do not report their blockchain adoption to the press are excluded from this study.

Our findings indicate three directions for future research. First, the abnormal market return on a short event window should be further investigated to understand the immediate market reaction. Second, further examining the influence of the collaboration characteristics (e.g., similarity, profitability, industry, firm size, and age among partners) would be a worthwhile task. Finally, providing additional insights to business researchers and managers may help in further studying the effect of other factors, such as firm, industry, and geographical characteristics related to blockchain adoption.

REFERENCES