ESG on the Chain: Unveiling the Impact of Different Blockchain Use Cases on Short-Term Stock Performance

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Abstract

We examine stock market reactions to different corporate blockchain use cases, particularly those related to environmental, social, and governance (ESG) issues. The study utilizes the event study methodology and analyzes an international dataset including 679 announcements from 291 firms worldwide. The findings indicate significant positive shareholder reactions to announcements related to traceability-, finance- and trading-, as well as ESG-related blockchain initiatives. In fact, ESG-related announcements generate superior market reactions compared to non-ESG-related news. These results contribute to the understanding of factors influencing shareholder value in the context of corporate blockchain initiatives and emphasize the substantial impact of ESG-related blockchain use cases on stock performance.

Keywords: Blockchain, event study, ESG, stock market reaction

1. Introduction

The popularity of corporate blockchain applications, the distributed ledger technology which originated from the cryptocurrency Bitcoin in 2008, is determined to grow at a rapid pace. Reports of successful adoptions such as Maersk's and Walmart's introduction of "TradeLens" (Jensen et al., 2019) are manifold. Academic research also identifies blockchain technology as one of the most valuable emerging technologies in the financial sector (Chen et al., 2019). Beyond applications in the field of finance, blockchain use cases emerged dominantly in the field of supply-chain- and operations management (Choudary et al., 2019). Various pilot projects show that blockchain offers efficient ways to ensure traceability of food and other goods (Hastig & Sodhi, 2020), detect counterfeits (Pun et al., 2021) and simplify interorganizational data sharing (Z. Wang et al., 2021). Moreover, certification processes (Bauer et al., 2022) as well as environmental-, social- and governance (ESG) related issues (Saberi et al., 2019) represent fields where blockchain exploration is accelerating. Hereby, blockchain systems can contribute to environmentally friendly supply chains by tracking CO2 emissions and facilitating the adoption of circular economy business models (Varriale et al., 2020). By utilizing decentralized ledgers, firms can verify responsible resource harvesting and fair compensation for workers, particularly in sourcing materials or products from developing countries (Kshetri, 2022).

Fragmented practical evidence is still the current foundation for most blockchain value definitions (Klöckner et al., 2022). In contrast, the profound research on the value of information technology (IT) has highlighted the existence of a significant positive relationship between introducing new IT and firm value (e.g., Dehning & Richardson, 2002; Dos Santos et al., 1993). Beyond the general examination of IT investments and firm performance, past research also investigated the impact of specific new technologies on company value. For example, Dehning et al. (2004) find increased stock valuations after the introduction of e-commerce systems and Teo et al. (2016) show that capital markets react positively to announcements of firms introducing new business analytics technology. Recently, scholars also started to analyze the relationship between blockchain announcements and stock performance. Results show uniformly positive stock returns to blockchain announcements (e.g., Ali et al., 2023; Cahill et al., 2020; Klöckner et al., 2022). Yet, to the best of our knowledge, existing research does neither provide differentiated insights into effects on market performance of prominent blockchain use cases, nor have scholars centered their analyses around the possible impact of ESG-related blockchain initiatives. Overall, our research is guided by the following question:

What types of stock market reactions are observed for different blockchain use cases, particularly those related to ESG issues?

Most scholars apply the event study methodology (MacKinlay, 1997) when intending to analyze the

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relationship of IT investments and firm market value. It is especially suited for determining short-term market reactions in the form of abnormal returns (AR). The method can offer initial hints on the future business value of corporate blockchain initiatives (Klöckner et al., 2022). In this context, we execute an event study based on an international sample of 679 announcements from 291 firms and conduct subsampling analyses to answer the research question. To highlight the factors impacting the stock market reactions as well as for robustness reasons, we subsequently perform multivariate regression analyses on the cumulative ARs (CAR) calculated. Our results in both univariate- and multivariate analyses suggest that announcements related to traceability-, finance- and trading issues lead to positive stock market reactions. Furthermore, blockchain initiatives that are related to ESG relevant topics exhibit positive stock market returns. A post-hoc analysis also reveals that these ESG-related blockchain announcements yield more positive stock market reactions than non-ESG-related news. Hence, we complement the current discussion on factors influencing shareholder value during corporate blockchain news and outline the impact of ESG blockchain use cases on stock performance.

The rest of the paper is structured as follows. First, we provide an overview of already existing research on the relationship between blockchain technology announcements and stock performance. Then, we derive our hypotheses and describe the data collection process. Consequently, we provide a detailed description of the methodology applied and present our results. At the end, we discuss implications for research and practice and present limitations to the study as well as future research paths.

2. Related Work

Research on the impact of blockchain technology on firms' stock values reveals several key findings. Cheng et al. (2019) find that speculative blockchain announcements lead to investor overreactions, particularly when Bitcoin prices are higher. Cahill et al. (2020) demonstrate positive stock market reactions to corporate blockchain news, with reactions correlated to Bitcoin prices. Autore et al. (2021) observe an initial stock increase of 13% following blockchain investment announcements, but this increase reverses over three months. Zhang et al. (2022) identify positive market reactions to blockchain initiatives in the Chinese market, boosted by CIOs with R&D backgrounds and supportive governmental policies. Klöckner et al. (2022) highlight the impact of supply-chain blockchain announcements, showing weaker reactions for tracking physical objects or sharing sensitive data. External IT service providers enhance reactions, while innovativeness and government regulations affect the value associated with blockchain projects. Liu et al. (2022) show that strategic-level blockchain initiatives generate higher market returns than operational-level projects. Ali et al. (2023) confirm positive stock market reactions to blockchain news in the US, particularly when cost- or time savings are mentioned, benefiting smaller companies more. Sharma et al. (2023) apply the dynamic capabilities lens and find that blockchain adoptions increase financial performance, measured in the form of Tobin's Q.

However, past research has not yet made a clear distinction between different blockchain use cases. Klöckner et al. (2022) focus on traceability-blockchains, but the authors do not oppose their findings to other blockchain use cases such as finance-related blockchain projects. Moreover, existent research on the market value of blockchain has neglected the relevance of ESG-related blockchain announcements. Occasional ESG news might be a part of strategic-level blockchain projects mentioned by Liu et al. (2022), but the isolated effect of ESG-blockchain news remains unknown. Hence, our research aims at (1) enhancing knowledge about the explicit effects of different blockchain use cases and (2) shedding light on the effect of ESG-related blockchain initiatives on stock performance by also exposing possible differences to non-ESG related blockchain news.

3. Hypotheses Development

Past research already emphasized the importance of differentiating between the various groups of blockchain use cases when analyzing the effect of blockchain technology announcements on the market value of firms (Klöckner et al., 2022). One major stream of research explores existing use cases in the field of supply chain management and traceability (e.g., Hastig & Sodhi (2020); Sodhi & Tang (2019)). Hereby, blockchain is being explored for tracking objects such as luxury goods, cars, food, or commodities such as cobalt or diamonds (Bauer et al., 2022; Choi, 2019; Sodhi & Tang, 2019). Tracing products via blockchain can lead to cost reductions for products prone to counterfeits because manufacturers can reduce the amount of differential pricing necessary to signal authenticity (Pun et al., 2021). Moreover, data traced and stored via distributed ledger technology can hardly be tampered. Blockchain technology is currently not able to solve the so-called garbage in, garbage out-problem (Babich & Hilary, 2019; Klöckner et al., 2022) which refers to the data-input quality. Nonetheless, in cases where upfront data quality assurance processes exist, blockchain should provide the opportunity of

increased data security (Babich & Hilary, 2019). Furthermore, in supply chains consisting of two or more suppliers, initial suppliers often lack the incentive to increase product quality because they cannot be identified as the source of poor quality and product defects. The effects of this issue, in literature also referred to as double moral hazard, could be reduced through blockchain systems who can increase traceability in serial supply chains, already beginning at the initial supplier (Cui et al., 2023). Higher product quality should lead to increased customer satisfaction and ultimately to higher profitability (Anderson et al., 1994). These effects in summary should have a direct impact on the perceived business value of companies applying blockchain in a supply-chain context. Consequently, shareholders and investors should recognize these circumstances. We posit:

H1: Announcements of traceability blockchain projects lead to positive stock market reactions.

Another large corporate application area for blockchain lies in the field of financial transactions. Blockchain can facilitate financial flows in supply chains through simplified and secure verification processes of transactions (Dong & Qiu, 2022). By increasing supply-chain transparency through blockchain, firms are also able to increase their chances of receiving more favorable financing conditions (Chod et al., 2020). Moreover, the use of blockchain-based smart contracts can reduce debt financing costs for firms due to a higher degree of transparency and automated commitments (X. Wang, 2022). Other blockchain applications in the field of finance can be found in various institutional trading settings. Hereby, firms either build financial platforms for trading securities or utilize the technology for the settlement of various kinds of lending and payment processes (White, 2017). In these use cases the prescribed goal is also the reduction of costs as well as settlement times. For instance, the exploration of intraday repo transactions, which describes a selling- and rebuying transaction between financial institutions, by Morgan Stanley revealed meaningful shorter transaction- and settlement times leading to a higher degree of intraday liquidity. Furthermore, past research has shown that counterparty risk can be reduced through the inherent decentralizing and immutability characteristics of blockchain (Ross et al., 2019). This should enhance the business value and thereby also the market value of blockchain for financial- and trading activities by both financial- and non-financial firms.

H2: Announcements of blockchain projects related to financial transactions lead to positive stock market reactions.

Certification processes constitute another area of corporate blockchain use cases. Blockchain-based verification and identification processes have been explored in areas such as luxury-good tracking (Choi, 2019), car-selling (Bauer et al., 2022) or cybersecurity (Neisse et al., 2019). As blockchain-technology offers the possibility to build ledgers of trusted and immutable data in a decentralized manner (Sarker et al., 2021), in theory it enables corporate multi-party constellations to exchange historical product data securely and efficiently and also making this data available to customers (Bauer et al., 2022). Consequently, this should lead to decreasing information asymmetries between different parties. On the other hand, even though blockchain should theoretically mitigate data security risks due to not having a single point of failure, its potential security risks are still not out of discussion. For example, the immutability of data is often portrayed as an advantage in theory, but in practice this can often lead to critical conflicts with data privacy requirements (Babich & Hilary, 2019; Klöckner et al., 2022). Moreover, especially in corporate blockchain systems where several entities have direct access to the digital ledger, the possibility of either unintended or unauthorized data access arises, leading to an increased risk of sensitive data leaks (Feng & Shanthikumar, 2018; Klöckner et al., 2022). These risks should be especially relevant for blockchain use cases related to certification processes as in these circumstances the authenticity, reliability and security of data is of particular importance (Babich & Hilary, 2019). On the contrary, data privacy issues should be less relevant in cases such as food traceability or tracking of raw material data where only few or no certification processes take place.

Lastly, even sophisticated blockchain systems are not free from the risk of data breaches. Various malicious attacks on blockchain systems between 2011 and 2018 led to cumulative losses of over $2 billion for its users (Madnick, 2019). Consequently, shareholders could be reluctant and doubt the progressivity of the technology with regards to reliable verification processes. Consequently, we hypothesize:

H3: Announcements of blockchain projects related to certification processes do not lead to positive stock market reactions.

In addition to its impact on operational processes, another current application area of enterprise blockchains is the field of sustainability-linked impacts (Parmentola et al., 2022). Scholars consider blockchain as valuable in the context of so called “green supply chains” where firms can utilize the technology to trace, store and share environmentally critical data such as carbon emissions or the sourcing of sustainable materials (Saberi et al., 2019). As such, blockchain systems can also enable environmentally friendly supply chains by tracking carbon emissions and facilitating the introduction of circular economy

business models (Varriale et al., 2020). Moreover, corporate ethical issues can be tackled via blockchain. Firms that source materials or products from developing countries are able to verify via decentralized ledgers that resources are harvested responsibly and that workers receive fair compensation (Kshetri, 2022). This area of application becomes even more relevant under the consideration of worldwide governmental mineral sourcing regulations. Furthermore, distributed ledger technologies can facilitate environmentally efficient logistics through real-time data exchanges and enabling supply-chain optimizations (Philipp et al., 2019). Research has shown that shareholders value companies that are engaged in tackling ESG issues (e.g., Eccles et al. (2014); Krüger, (2015)). Additionally, firms with higher ESG indicators tend to benefit in the form of a lower cost of capital (Chava, 2014). Consequently, ESG-related blockchain initiatives should have beneficial effects for investors. We posit:

H4: ESG-related blockchain projects lead to positive stock market reactions.

4. Data

The data collection process for this study involved utilizing Nexis Uni (previously known as Lexis-Nexis) to collect announcements of blockchain initiatives. Nexis Uni is a comprehensive database that provides daily worldwide press news. We focus on public firms that announced their intention to implement blockchain technology, following established approaches that relied on a predefined set of firms from the S&P500 Index and the STOXX Europe 600 index. These indexes were selected because all their constituents are either large-cap or mid-cap sized, indicating a high trading volume of the firm's stocks.

Public attention to blockchain technology is considered to have been weak prior to 2014 (Cahill et al., 2020). Therefore, the study focused on announcements made between January 1, 2014, and December 31, 2022. To obtain relevant blockchain announcements from the sample firm pool, a structured approach was followed. Based on earlier studies that utilized event studies with news headlines, the study focused on the search of the news sources PR Newswire and Business Wire, as well as investor-relations news websites of the respective companies (Teo et al., 2016). The search process involved combining each company name with the terms *blockchain* or *cryptocurrency*.

Our initial data sample is comprised of a total of 16,249 announcements. To ensure that only announcements related to the study's purpose were included, news unrelated to blockchain, duplicates as well as statements on general outlooks on blockchain technology were eliminated. Finally, announcements that could potentially have a confounding effect, such as financial earnings announcements, executive changes, or merger and acquisition (M&A) announcements that occurred during the event window were eliminated. The final sample includes 679 announcements from 291 unique firms overall. Of those, 271 announcements belonged to specific blockchain projects. The remaining announcements were non-project specific ones such as joining a blockchain consortium.

Next, stock price data of the companies filtered were collected from Refinitiv Workspace. We chose the MSCI World Index as our market benchmark for the combined data sets as publicly listed companies from the US and Europe represent more than 50% of the worldwide market capitalization of publicly traded stocks. For the US and European data sets, the market benchmarks are the S&P500 index and the STOXX Europe 600 index, respectively. Additionally, we retrieved Fama-French factors from the Dartmouth College database website. In case of differing announcement dates among different sources, the earlier date was chosen. Announcements on non-trading days were moved to the next trading day.

5. Methodology

Our quantitative analysis is comprised of a univariate analysis, consisting of subsampling event studies, as well as a multivariate regression. We start our analysis by applying the event study methodology (MacKinlay, 1997). We utilize the Fama-French five factor model (FFM5) to describe the expected return $r_{i,t}$ of firm *i* on day *t*:

$$r_{i,t} - r_{f,t} = \propto_i + \beta_{1i}(r_{m,t} - r_{f,t}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}RMW_t + \beta_{5i}CMA_t + \varepsilon_{it}$$

Here, r_f is the risk-free rate and r_m captures the return of the market portfolio. *SMB* represents the size factor which measures the excess return of small stock companies over large stock companies. *HML* is the growth factor describing differences in returns of value stocks and growth stocks. *RMW* captures differences in high- and low profitability stocks whereas *CMA* is a factor for measuring the impact of the stock performance of firms with a low degree of investments versus firms with a high degree of investments (Fama & French, 2015). In the next step we calculate ARs as the difference between actual and expected returns:

$$AR_{i,t} = r_{i,t} - r_{f,t} - [\hat{\alpha}_i + \hat{\beta}_i(r_{m,t} - r_{f,t}) + \hat{\beta}_i SMB_t + \hat{\beta}_i HML_t + \hat{\beta}_i RMW_t + \hat{\beta}_i CMA_t]$$

We determine CARs as the sum of a firm's event specific ARs during the event windows t_1 and t_2:

$$CAR_{i,t_1;t_2} = \sum_{t_1}^{t_2} AR_{i,t}$$

Lastly, we calculate the average cumulative abnormal return (CAAR) as the average of all CARs of all *n* events:

$$CAAR_{i,t_1;t_2} = \frac{1}{n}\sum_{1}^{n} CAR_{i,t_1;t_2}$$

We apply the Patell- as well as the Adjusted Standardized Cross-Sectional (Adjusted StdCSect) test as the two parametric tests to examine if CAARs are statistically different from zero. Nevertheless, parametric tests assume a normal distribution of ARs. As we need to ensure that our results are not driven by non-normally distributed returns and outliers, we also perform two non-parametric tests, namely the Corrado test (Corrado & Zivney, 1992) and the Generalized sign test (Cowan, 1992). Two independent coders were responsible for the categorization of measures, reaching a sufficient inter-rater reliability (percent agreement > 85%) for the variables. Occurring differences in coding outcomes were discussed and resolved by the authors.

6. Event Study Results

Table 1 features event study results for H1-H4. Hereby, Panel 1 shows results for the subsample event study of announcements of traceability-related blockchain initiatives. The CAAR of 1.00% for the three-day event window is statistically significant at the 1% level for both parametric tests as well as the Corrado test. Moreover, the Generalized sign test shows significance at the 10% level. For the five-day event window, the CAAR of 1.21% is significant at the 1% level for both the Adjusted StdCSect test and the Corrado test. The Patell- and Generalized Sign test are significant at the 5%- and 10% level, respectively. Lastly, the CAAR for the five-day event window (1.40%) shows statistical significance at the 5% level for both the Adjusted SdtSect- and Corrado test. The Generalized Sign- and the Patell z-test are also statistically significant at the 1%- and 10% level. Panel 2 presents positive and statistically significant CAARs for the subsample of finance-related blockchain project announcements for all three event windows. The three-day event window CAAR of 0.56% as well as the two-week event window CAAR of 1.51% are statistically significant at the 5% level for both parametric- and non-parametric tests. Moreover, the five-day event window CAAR (1.11%) shows significance at the 1% for all

Table 1: Event study results

Event Window	CAAR	Patell (Z)	Adjusted StdCSect (Z)	Corrado (Z)	Generalized Sign (Z)	Observations
Panel 1: Announcements of Traceability Blockchain Projects (-120 to -15)						
[-1;+1]	1.00%	2.76***	2.67***	2.82***	1.65*	86
[-2;+2]	1.21%	2.50**	2.75***	2.81***	1.65*	86
[-5;+5]	1.40%	1.82*	2.18**	2.21**	2.94***	86
Panel 2: Announcements of Finance Blockchain Projects (-120 to -15)						
[-1;+1]	0.56%	2.01**	2.18**	2.09**	2.44**	118
[-2;+2]	1.11%	3.25***	2.95***	3.02***	2.07**	118
[-5;+5]	1.51%	2.40**	2.45**	2.29**	2.62**	118
Panel 3: Announcements of Certification Blockchain Projects (-120 to -15)						
[-1;+1]	0.50%	1.40	1.82*	1.84*	1.44	48
[-2;+2]	1.94%	3.22***	3.33***	3.30***	2.60**	48
[-5;+5]	0.83%	1.43	1.27	2.28**	1.44	48
Panel 4: Announcements of ESG Blockchain Projects (-120 to -15)						
[-1;+1]	0.85%	0.87	0.70	2.18**	2.16**	19
[-2;+2]	1.20%	0.66	0.50	2.38**	0.78	19
[-5;+5]	2.48%	1.18	1.05	3.22***	1.70*	19

*p<10%, **p<5%, ***p<1%

tests except for the Generalized Sign test, which is significant at the 5% level.

Results of the event study subsampling analysis for H3 are presented in Panel 3. The three-day event window CAAR of 0.50% for announcements of blockchain projects related to certification-issues is significant at the 10% level for both the Adjusted StdCSect test as well as the Corrado test. The five-day event window shows a higher CAAR of 1.94% which features statistical significance at the 1% level for both parametric tests as well as the Corrado test. Lastly, we observe a CAAR of 0.83% for the [-5;+5]-event window with a statistically significant Corrado test at the 5% level.

Ultimately, Panel 4 shows CAARs of the subsample of ESG-related blockchain announcements. Hereby, all parametric tests show no statistical significance. The three-day event window CAAR (0.85%) is significant at the 5% level for both non-parametric tests. The five-day event window CAAR of 1.20% only shows statistical significance at the 5% level for the Corrado tests. Finally, we measure a two-week event window CAAR of 2.48%. For this observation, the Corrado test and the Generalized Sign test are both significant at the 1%- and 10% level, respectively.

We also performed robustness checks to validate the results of our event study. First, we adjusted the estimation window by choosing a [-200;-50] time horizon. Moreover, the choice of the FFM5 model could have an impact on our results. Therefore, we also performed an analysis based on the market model. Our findings remain robust to both the alternative estimation window as well as the alternative expected return model.

7. Multivariate Regression Results

Next, we test whether the findings of the univariate event studies can be confirmed via a multivariate regression analysis. We conduct several regressions on the CARs of the five- and, for robustness reasons, also on the three-day event window. The regression model has the following form:

$$CAR_i = \alpha_i + \beta_1 Traceability_i + \beta_2 Finance_i + \beta_3 Certification_i + \beta_4 ESG_i + \beta_5 ROE_i + \beta_6 Free\ Float_i + \beta_7 \frac{Cash}{Assets_i} + \beta_8 \frac{Debt}{Equity_i} + \beta_9 \frac{Debt}{Equity_i} + \beta_{10} Net\ Income_i + \beta_{11} Time_i + \in_i$$

The first four dependent variables are binary variables referring to the four hypotheses tested. The binary variables *Traceability*, *Finance*, *Certification*, and *ESG* refer to H1-H4 and are one, if the blockchain announcement refers to traceability- finance and trading-, certification- and ESG-related projects, respectively, and else zero. As suggested by previous literature, we also include control variables in the form of firm-specifi leverage-, profitability- and valuation-related metrics (Bassen et al., 2019). Hence, we retrieved the independent variables *Return on Equity (ROE), Free Float, Cash to Assets, Debt to Equity* and *Net Income* from the Refinitiv Workspace Database. Two of the four models also include time-fixed effects.

Table 2 presents the results of the multivariate regressions performed. The variable *Traceability* is positive and significant in all model variations. Thus, we find support for H1. Academic research as well as practitioners have already identified the field of supply chain management as a major beneficiary of

Table 2: Multivariate regression results

	CAR [-2; 2]		CAR [-1; 1]	
Parameter	Model 1	Model 2	Model 3	Model 4
Traceability	0.027 (3.18***)	0.028 (3.45***)	0.025 (2.55**)	0.026 (2.69***)
Finance	0.023 (3.15***)	0.024 (3.28***)	0.021 (2.45**)	0.021 (2.51**)
Certification	0.031 (2.83***)	0.031 (2.91***)	0.018 (1.45)	0.018 (1.46)
ESG	0.037 (2.33**)	0.036 (2.30**)	0.036 (1.96*)	0.036 (1.95*)
ROE	-0.004 (-0.93)	-0.003 (-0.93)	-0.003 (-0.72)	-0.003 (-0.68)
Free Float	0.074 (4.44***)	0.074 (4.47***)	0.081 (4.15***)	0.081 (4.19***)
Cash to Assets	0.054 (1.35)	0.028 (0.74)	0.046 (0.99)	0.018 (0.40)
Debt to Equity	0.000 (-0.02)	0.000 (-0.12)	0.000 (0.00)	0.000 (-0.10)
Net Income	0.006 (0.28)	0.010 (0.45)	-0.004 (-0.15)	0.001 (0.03)
Intercept	-0.011 (-0.16)	-0.083 (-5.34***)	-0.016 (-0.19)	-0.087 (-4.77***)
Time-fixed	Yes	No	Yes	No
Adjusted R^2	4.84%	4.74%	2.88%	2.39%
F Statistic (p-value)	4.78 (0.000)	2.96 (0.000)	3.21 (0.001)	1.96 (0.012)

*p<10%, **p<5%, ***p<1%

blockchain applications (e.g., Chod et al., 2020; Hastig & Sodhi, 2020). Consequently, investors seem to value blockchain projects settled in the field of logistics. Traceability-related corporate blockchain statements also constitute the second largest group of use cases in our sample of announcements (n=86) which emphasizes the relative importance of this type of blockchain application. We observe similar effects for the binary variable *Finance*. It is positive in all regression models and shows continuous statistical significance. Therefore, we find support for H2 as well. In our dataset of subsamples of blockchain project announcements, this use case is the largest group (n=118). As blockchain technology originated as an alternative for the centralized financial system (Nakamoto, 2008), this finding confirms the importance of trading- and finance-related blockchain applications. Shareholders seem to value the fact that blockchain provides numerous opportunities to facilitate financial transaction flows and

thereby providing opportunities to mitigate counterparty risks (Ross et al., 2019). Moreover, many finance-related blockchain projects such as Nasdaq's proprietary trading platform *Linq* already proved to be successful under real market conditions. The dummy variable *Certification* is positive across all models but only statistically significant in two of the four regression models. Therefore, we cannot confirm the findings of the univariate event study and H3 is supported. We interpret that investors might recognize the garbage in, garbage out-problem (Babich & Hilary, 2019) which makes the additional value of blockchain technology for certification processes highly uncertain. Human manipulation prior to entering the blockchain is still possible which currently makes additional quality assurance steps necessary. This leads to additional costs, making the return on blockchain investments doubtful. Lastly, the binary variable *ESG*, representing ESG-related blockchain announcements, is significant across all four model variations. Therefore, H4 is supported. It implies that shareholders could be especially sensitive to blockchain-related ESG news. As such, companies might benefit from addressing ESG issues with blockchain technology in the form of increasing transparency and accountability via immutable and environmentally relevant information.

8. Post-hoc Analysis

The initial objective of our study lies in the exploration of impacts of different corporate blockchain use cases on the short-term stock market reaction of firms. Thereby, we find evidence for the positive impact of ESG-related blockchain announcements. Consequently, the question arises whether ESG-related- and non-ESG related blockchain announcements show different stock market reactions. To carry out this analysis, we summarized all blockchain announcements that were not identified as ESG-related news and performed a separate event study. In the second step we compared the respective CAARs of both subsamples via Welch t-tests. Table 3 shows the results of this analysis. For all three event-windows, CAARs of ESG blockchain announcements are higher than CAARs for non-ESG blockchain news. The difference in CAARs is statistically significant at the 10% level for the two-week event window. This indicates that shareholders might react more positively to announcements of blockchain projects with an ESG focus than to initiatives that lack this focus. Especially

Table 4: Examples of environmental blockchain announcements

Announcement	**Date**	**[-5+5]-CAR**
SAP, Unilever pilot blockchain technology supporting deforestation-free palm oil.	21.03.22	2.59%
BASF and arc-net collaborate to use blockchain technology for livestock sustainability.	17.04.18	3.34%

Table 3: Post-hoc analysis of ESG - vs. non-ESG announcements

Panel 5a: ESG Blockchain Announcements (-120 to -15)						
Event Window	**CAAR**	**Patell (Z)**	**Adjusted StdCSect (Z)**	**Corrado (Z)**	**Generalized Sign (Z)**	**Observations**
[-1;+1]	0.85%	0.87	0.70	2.18**	2.16**	19
[-2;+2]	1.20%	0.66	0.50	2.38**	0.78	19
[-5;+5]	2.48%	1.18	1.05	3.22***	1.70*	19
Panel 5b: Non-ESG Blockchain Announcements (-120 to -15)						
[-1;+1]	0.34%	2.71***	2.75***	2.14**	1.74*	660
[-2;+2]	0.50%	3.01***	2.92**	2.69***	3.26***	660
[-5;+5]	0.28%	0.81	0.81	1.01	2.75***	660

*p<10%, **p<5%, ***p<1%

Event Window	**Delta CAAR**	**Welch t-Test**
[-1;+1]	0.51%	0.72
[-2;+2]	0.70%	0.70
[-5;+5]	2.20%	1.69*

*p<10%, **p<5%, ***p<1%

environmentally linked blockchain projects exhibit positive abnormal returns. Examples are shown in Table 4.

9. Discussion

9.1. Implications for Research

We complement and extend research on the corporate value of blockchain technology in several ways. First, we confirm the results of Klöckner et al. (2022) by finding substantial support for positive stock market reactions to traceability-related corporate blockchain news. Moreover, we extend blockchain research such as Babich & Hilary (2019) and Pun et al. (2021) by showing that blockchain's positive effects on cost reductions, preventing counterfeiting, and enabling more efficient data security are also recognized by investors. Existing research on finance-related blockchain applications states that blockchains can simplify financial transactions, cut down durations and costs of financial settlements and reducing counterparty risk in trading (Dong & Qiu, 2022; X. Wang, 2022; White, 2017). We substantiate these qualitative findings by empirically demonstrating that these types of projects lead to positive stock returns. Our dataset shows that this use case, with 118 announcements, represents the largest field of corporate blockchain applications. This displays the still existing importance of blockchain use cases in the field of finance, which is not surprising, given the fact that blockchain technology originally stems from replacing the existing currency system (Nakamoto, 2008).

Furthermore, we augment blockchain value research which critically assesses the data security and data privacy aspects of blockchain. We complement the findings of Klöckner et al. (2022) by showing that shareholders do not uniformly recognize the additional value of blockchain for certification processes in corporate environments. Input data for distributed ledgers still requires additional confirmation processes, as a blockchain does not ensure correctness of data (Babich & Hilary, 2019; Klöckner et al., 2022). Moreover, investors might be aware of possible security risks or the existing potential for conflicts with data privacy requirements (Klöckner et al., 2022). With this finding, we supplement existing knowledge on current borders of blockchain value and substantiate the uprise of critical blockchain analyses.

Prior academic work also suggests that corporate blockchain applications can enable green supply-chains (Varriale et al., 2020), facilitate the ethical sourcing of food and raw materials, and enhance carbon emission tracking (Saberi et al., 2019). We extend research on the value of blockchain in an ESG context by showing that ESG-related blockchain projects lead to positive abnormal stock market returns. Moreover, our study is one of the first ones to underscore the supplementary worth attributed by shareholders to blockchain projects within an ESG framework, in contrast to initiatives lacking ESG affiliation. Additionally, our study validates previous conclusions that underscore shareholders' propensity to appraise companies actively addressing ESG concerns (Krüger, 2015).

9.2. Implications for Practice

Our findings also have relevant practical implications. We identify various circumstances under which blockchain announcements can lead to positive stock market reactions. Therefore, we help managers to maximize the potential value of blockchain initiatives under consideration. We encourage managers to execute blockchain projects that are either related to supply-chain activities or to finance-related systems. Moreover, we emphasize the particular importance of ESG-related blockchain initiatives. Not only do executives benefit from positive shareholder reactions to ESG blockchain news, but these types of announcements also lead to more positive stock market reactions than announcements not related to ESG-relevant topics. This should encourage managers to put more focus on ESG-related blockchain use cases such as establishing green supply-chains or tracking data related to ethical sourcing of materials. On the other hand, firms should be cautious when focusing on initiatives that solely intend to solve certification issues in situations where their primary goal is to achieve positive abnormal stock returns with such announcements. Finally, practitioners need to be aware that blockchains for certification processes do not solve the "black-box effect" (Klöckner et al., 2022).

11. Limitations and Future Research

We recognize that our study is limited in several ways which leaves room for future research paths. First, our observations are based on a data sample of US- and EU-based firms. Even though these two regions in sum constitute the majority of the worldwide economic landscape, we cannot automatically assume equal results for firms from emerging countries. Hence, we encourage future research to analyze our factors of blockchain value in the context of developing and emerging countries. Second, we only performed a broad clustering of blockchain use cases into four different categories. The sectors chosen are by no means exhaustive and future research might benefit from more particular use case clustering. For example, finance-related blockchain announcements might be further divided into use cases like accepting cryptocurrencies

for payments, building blockchain-based trading platforms, or using Initial Coin Offerings (ICOs) as investment vehicles (Cong et al., 2021). Furthermore, the basis for our results is the short-term event study and we do not provide evidence of longer-term market value by blockchain. Scholars could explore factors or use cases like the ones applied in this study, to examine their impact on longer-term market returns. Lastly, our research does not consider the exclusive impact of ESG on stock performance which might lead to a potential positive bias. Past research has found that investors do not react to an ESG announcement per se, but that the particular interest and circumstance surrounding the ESG topic- and technology is essential for the stock market reaction (Serafeim & Yoon, 2022). Hence, the inclusion of blockchain technology in an ESG announcement should have an additional unique impact on the stock market reaction. Nevertheless, we do not consider the magnitude of this effect in our analysis. Future research could analyze potential differences of stock market reactions to announcements of other technologies in combination with ESG, such as artificial intelligence- or digital twin ESG announcements.

12. References

Ali, H. S., Jia, F., Lou, Z., & Xie, J. (2023). Effect of blockchain technology initiatives on firms' market value. Financial Innovation, 9(1), 1-35.

Anderson, E. W., Fornell, C., & Lehmann, D. R. (1994). Customer Satisfaction, Market Share, and Profitability: Findings From Sweden. Journal of Marketing, 58(3), 53–66.

Autore, D. M., Clarke, N., & Jiang, D. (2021). Blockchain speculation or value creation? Evidence from corporate investments. Financial Management, 50(3), 727–746.

Babich, V., & Hilary, G. (2019). Distributed Ledgers and Operations: What Operations Management Researchers Should Know About Blockchain Technology. Manufacturing & Service Operations Management, 22(2), 223-240.

Bassen, A., Schiereck, D., & Schüler, P. (2019). The success of the activist investor Guy Wyser-Pratte in Continental Europe. International Journal of Entrepreneurial Venturing, 11(1), 24–46.

Bauer, I., Parra-Moyano, J., Schmedders, K., & Schwabe, G. (2022). Multi-Party Certification on Blockchain and Its Impact in the Market for Lemons. Journal of Management Information Systems, 39(2), 395–425.

Cahill, D., G. Baur, D., (Frank) Liu, Z., & W. Yang, J. (2020). I am a blockchain too: How does the market respond to companies' interest in blockchain? Journal of Banking and Finance, 113, 105740.

Chava, S. (2014). Environmental externalities and cost of capital. Management Science, 60(9), 2223–2247.

Chen, M. A., Wu, Q., & Yang, B. (2019). How Valuable Is FinTech Innovation? Review of Financial Studies, 32(5), 2062–2106.

Cheng, S. F., De Franco, G., Jiang, H., & Lin, P. (2019). Riding the Blockchain Mania: Public Firms' Speculative 8-K Disclosures. Management Science, 65(12), 5449–5956.

Chod, J., Trichakis, N., Tsoukalas, G., Aspegren, H., & Weber, M. (2020). On the financing benefits of supply chain transparency and blockchain adoption. Management Science, 66(10), 4378–4396.

Choi, T. M. (2019). Blockchain-technology-supported platforms for diamond authentication and certification in luxury supply chains. Transportation Research Part E: Logistics and Transportation Review, 128, 17–29.

Choudary, S. P., Alstyne, M. W. Van, & Parker, G. G. (2019). Platforms and blockchain will transform logistics. Harvard Business Review (1), 2–5.

Cong, L. W., Li, Y., & Wang, N. (2021). Tokenomics: Dynamic Adoption and Valuation. The Review of Financial Studies, 34(3), 1105–1155.

Corrado, C. J., & Zivney, T. L. (1992). The Specification and Power of the Sign Test in Event Study Hypothesis Tests Using Daily Stock Returns. Journal of Financial and Quantitative Analysis, 27(3), 465–478.

Cowan, A. R. (1992). Nonparametric event study tests. Review of Quantitative Finance and Accounting, 2(4), 343–358.

Cui, Y., Hu, M., & Liu, J. (2023). Value and Design of Traceability-Driven Blockchains. Manufacturing & Service Operations Management, 25(3), 1099-1116.

Dehning, B., & Richardson, V. J. (2002). Returns on Investments in Information Technology: A Research Synthesis. Journal of Information Systems, 16(1), 7–30.

Dehning, B., Richardson, V. J., Urbaczewski, A., & Wells, J. D. (2004). Reexamining the value relevance of E-Commerce initiatives. Journal of Management Information Systems, 21(1), 55–82.

Dong, L., & Qiu, Y. (2022). Blockchain-Enabled Deep-Tier Supply Chain Finance. Manufacturing & Service Operations Management.

Dos Santos, B., KG, P., & DC, M. (1993). The impact of information technology investment announcements on the market value of the firm. Information Systems Research, 4(1), 1–23.

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. Management Science, 60(11), 2835–2857.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of Financial Economics, 116(1), 1–22.

Feng, Q., & Shanthikumar, J. G. (2018). How Research in Production and Operations Management May Evolve in the Era of Big Data. Production and Operations Management, 27(9), 1670–1684.

Hastig, G. M., & Sodhi, M. S. (2020). Blockchain for Supply Chain Traceability: Business Requirements and Critical Success Factors. Production and Operations Management, 29(4), 935–954.

Jensen, T., Hedman, J., & Henningsson, S. (2019). How TradeLens delivers business value with blockchain technology. MIS Quarterly Executive, 18(4), 221–243.

Klöckner, M., Schmidt, C. G., & Wagner, S. M. (2022). When Blockchain Creates Shareholder Value: Empirical Evidence from International Firm Announcements. Production and Operations Management, 31(1), 46–64.

Krüger, P. (2015). Corporate goodness and shareholder wealth. Journal of Financial Economics, 115(2), 304–329.

Kshetri, N. (2022). Blockchain systems and ethical sourcing in the mineral and metal industry: a multiple case study. International Journal of Logistics Management, 33(1), 1–27.

Liu, W., Wang, J., Jia, F., York, T., School, M., & Choi, T.-M. (2022). Blockchain Announcements and Stock Value: A Technology Management Perspective. International Journal of Operations & Production Management, 42(5), 713-742.

Lui, A. K. H., & Ngai, E. W. T. (2019). The Long Term Effect of Blockchain Adoption on Firm Value. Americas Conference on Information Systems, 25, Emergent Research Forum (ERF) Paper.

MacKinlay, A. C. (1997). Event Studies in Economics and Finance. Journal of Economic Literature, 35(1), 13–39.

Madnick, S. (2019). Blockchain Isn't as Unbreakable as You Think. MIT Sloan Management Review, 61(2), 65–70.

Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. Decentralized Business Review.

Neisse, R., Hernandez-Ramos, J. L., Matheu, S. N., Baldini, G., & Skarmeta, A. (2019). Toward a Blockchain-based Platform to Manage Cybersecurity Certification of IoT devices. 2019 IEEE Conference on Standards for Communications and Networking, 1–6.

Parmentola, A., Petrillo, A., Tutore, I., & De Felice, F. (2022). Is blockchain able to enhance environmental sustainability? A systematic review and research agenda from the perspective of Sustainable Development Goals (SDGs). Business Strategy and the Environment, 31(1), 194–217.

Philipp, R., Prause, G., & Gerlitz, L. (2019). Blockchain and Smart Contracts for Entrepreneurial Collaboration in Maritime Supply Chains. Transport and Telecommunication, 20(4), 365–378.

Pun, H., Swaminathan, J. M., & Hou, P. (2021). Blockchain Adoption for Combating Deceptive Counterfeits. Production and Operations Management, 30(4), 864–882.

Ross, O., Jensen, J., Ross, O., & Jensen, J. R. (2019). Assets under Tokenization: Can Blockchain Technology Improve Post-Trade Processing? International Conference on Information Systems (ICIS), 40, 1–10.

Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. International Journal of Production Research, 57(7), 2117–2135.

Sarker, S., Henningsson, S., Jensen, T., & Hedman, J. (2021). Use Of Blockchain As A Resource For Combating Corruption In Global Shipping: An Interpretive Case Study. Journal of Management Information Systems, 38(2), 338–373.

Serafeim, G., & Yoon, A. (2022). Which Corporate ESG News Does the Market React To? Financial Analysts Journal, 78(1), 59–78.

Sharma, P., Shukla, D. M., & Raj, A. (2023). Blockchain adoption and firm performance: The contingent roles of intangible capital and environmental dynamism. International Journal of Production Economics, 256, 108727.

Sodhi, M. S., & Tang, C. S. (2019). Research Opportunities in Supply Chain Transparency. Production and Operations Management, 28(12), 2946–2959.

Teo, T. S. H., Nishant, R., & Koh, P. B. L. (2016). Do shareholders favor business analytics announcements? Journal of Strategic Information Systems, 25(4), 259–276.

Varriale, V., Cammarano, A., Michelino, F., & Caputo, M. (2020). The unknown potential of blockchain for sustainable supply chains. Sustainability, 12(22), 1–16.

Wang, X. (2022). The Value of Smart Contract in Trade Finance. Manufacturing & Service Operations Management.

Wang, Z., Zheng, Z., Jiang, W., & Tang, S. (2021). Blockchain-Enabled Data Sharing in Supply Chains: Model, Operationalization, and Tutorial. Production and Operations Management, 30(7), 1965–1985.

White, G. R. T. (2017). Future applications of blockchain in business and management: A Delphi study. Strategic Change, 26(5), 439–451.

Zhang, Y., Chen, J., & Chen, J. (2022). Risk and Return of Blockchain Announcements in Chinese Stock Market – An Event Study. International Conference on Information Systems (ICIS), 43, 1–16.