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RESEARCH PAPER

On the performance of blockchain-based token offerings

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Abstract
Initial coin offerings (ICOs) and initial exchange offerings (IEOs) are distinct blockchain-based token offerings. Following multiple frauds associated with decentralized and unregulated ICOs, IEOs are emerging as a novel pathway that relies on centralized crypto exchange platforms acting as intermediaries. However, the question as to how this shift affects fundraising processes in what has traditionally been a decentralized environment remains unresolved. We here address this issue by empirically comparing the performance of ICOs and IEOs through the lens of signaling theory, focusing specifically on the impact of social media information across 305 token offerings (ICOs and IEOs). Our work introduces IEOs and explains how and why the volume and sentiment of social media signals may serve as predictors of fundraising performance. We furthermore find that the impact of these electronic word-of-mouth (eWOM) media signals is reduced in the case of IEOs—in the presence of a central cryptocurrency exchange platform mediator. We delineate implications for investors, ventures, platform providers, and regulators alike.

Keywords Initial exchange offering (IEO) · Initial coin offering (ICO) · Blockchain · Electronic word-of-mouth (eWOM) · Social media signals · Cryptocurrency exchange platforms

JEL classification A1

Introduction

The digitalization of the global financial industry led to new "Fintech" ventures (Muzellec et al., 2015), offering services ranging from peer-to-peer (P2P) lending (Najaf et al., 2022) to applications of blockchain technology (Nofer et al., 2017). One of the most prominent applications of blockchain technology in Fintech today is initial coin offerings (ICOs) and initial exchange offerings (IEOs). Both are distinct blockchain-based fundraising mechanisms that offer tokenized assets (i.e., a "coin" or "token") in exchange for cryptocurrency (e.g., "Bitcoin") (Dell'Erba, 2018). Blockchain-based fundraising is assumed to be a "killer app" of blockchain technologies (Chanson et al., 2018a, b) because it may overcome challenges associated with traditional forms of fundraising (e.g., initial public offerings on stock markets). For example, ICOs allow entrepreneurs to reach a global investor base at greatly reduced costs (Adhami et al., 2017) and enable trading on liquid secondary markets, which promise considerable returns for investors (Chen, 2018). However, ICO are also known to be incompliant with existing regulations (Seth, 2018), which led to numerous lawsuits against issuers; for instance, SEC v. Ripple (Rohr & Wright, 2018). In response, crypto exchange platforms like "Binance" introduced a new form of self-regulation through IEOs as an alternative, centralized approach to blockchain-based

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fundraising. Specifically, IEOs aim to protect investors, with a crypto exchange platform taking on the role of a trusted intermediary that administers and manages the IEO in a manner not dissimilar to what a bank might do during an initial public offering (IPO) in traditional share markets (Purdy, 2019).

Today, ICOs and IEOs are of great interest to information system (IS) research and practitioners alike because they are at the core of the conversation around technological determinism. Technological determinism refers to the notion that advances in technology are key drivers of change in a given society (Robey et al., 2013; Sarker et al., 2019). For example, blockchain technologies have inspired the vision of technological disintermediation—a trust-free economy (Beck et al., 2016)—and sparked hope for a "code-as-law" philosophy (De Filippi & Wright, 2018), which proposes that societies can establish and enforce novel and technologically determined systems via self-executing, transparent, and tamper resistant code (De Filippi & Wright, 2018). In this sense, ICOs are technologically determined because they are automatically executed via blockchain-based smart contracts (Chanson et al., 2018a, b). However, in the case of IEOs, crypto exchange platforms rely on more traditional institutional or "social" qualities like reputation, honesty, trust, and market disciplinary mechanisms to facilitate the fundraising process (Sarker et al., 2019). Perhaps counterintuitively, the blockchain community thereby accepted the re-introduction of trusted market mediators, hoping these entities may mitigate the challenges associated with ICOs. Ultimately, the phenomenon of blockchain-based fundraising represents a unique setting within which the digitalization of societies in general, and the global financial industry can be explored to develop much-needed guidance for managerial practice and policymakers alike.

Our present work is positioned within this setting. Indeed, this is important to note since the body of existing research investigating blockchain-based fundraising is nascent. Emerging contributions predominantly focus on ICOs and their fundraising performance, but largely excluded IEOs to date. For example, extant contributions explored the impact of technical and regulatory aspects on ICO processes (Boreiko & Sahdev, 2018; Huang et al., 2020), the types of tokens offered in ICOs (Adhami et al., 2017; Bachmann et al., 2022), or the characteristics of ICO founders (An et al., 2019). Furthermore, a distinct stream of work associated with ICOs aimed to explore the question of how the performance of ICO fundraising can be improved and what role information asymmetry plays in this process (Davydiuk et al., 2023; Thies et al., 2022; Wang et al., 2022). Reducing information asymmetry (e.g., knowledge about a venture attempting to raise funds via an ICO) between fundraisers and potential investors is a key challenge for any fundraising attempt (Connelly et al., 2011; Spence, 1973). In traditional fundraising markets (i.e., IPOs that disseminate shares), improvements in electronic word-of-mouth (eWOM)—defined as social media sentiment and volume (Cheung et al., 2014; Risius & Beck, 2015)—have been linked to increased fundraising amounts, but so have expert ratings (Roosenboom et al., 2020) or published whitepapers (Amsden & Schweizer, 2018; Fisch, 2019; Fisch et al., 2019; Jin et al., 2017). Within ICO research, factors like the social media presence of a venture seeking funds (Thies et al., 2022), the sentiment of the wider investment community (Albrecht et al., 2020), and volume of Twitter (Benedetti & Kostovetsky, 2021) or Reddit (Chanson et al., 2018a, b) postings are associated with improved ICO fundraising performance. However, no empirical study to date compared the *efficacy* of these signals across technologically unregulated (ICO) and institutionally self-regulated fundraising contexts (IEO). As we elaborate in more detail below, signaling theory suggests that the presence of a trusted intermediary changes the signaling process and the role of eWOM between ICOs and IEOs. Accordingly, Brochado and Troilo (2021) call to explore blockchain-based fundraising mechanisms using signaling theory. We contribute to this important issue by addressing the research question of *what are the differential effects of social media signals on ICO and IEO fundraising performances*? In doing so, our present work thereby provides two important contributions to the IS literature.

First, our empirical work compares 305 (ICOs and IEOs) token offerings, thus providing a unique empirical contribution. We find that the fundraising performance of IEOs is *less* affected by social media signals compared to ICOs. Specifically, we find that different eWOM characteristics (i.e., volume and valence) can have varying effects. In particular, we find that eWOM valence is more impactful for ICOs than IEOs, and eWOM volume has a more general positive effect on the fundraising performance. This challenges our discipline's current understanding of how signaling factors can reduce information asymmetry in financial services (Risius et al., 2015). By identifying the moderating boundary conditions, we provide important new input in the literature on signaling theory. Lastly, our empirical work extends prior studies that focused on ICOs but excluded IEOs from their inquiries (Huang et al., 2020), while also providing a complementary perspective to those studies that took online signal volume into consideration, but excluded the effect of sentiment (e.g., Chanson et al., 2020). As such, our work advances the emerging discourse associated with Fintech (Breidbach et al., 2020), blockchain, and cryptocurrencies (Risius &

Spohrer, 2017), as well as the literature on blockchain-based fundraising (e.g., Chanson et al., 2020), while also delineating guidelines for future IS research and managerial practice from here.

Second, our theoretical contribution stems from our explanation of how differential effects of online signals (i.e., electronic word-of-mouth) can reduce information asymmetry in the context of blockchain-based fundraising. Applying signaling theory helps us understand not only the performance of blockchain-based fundraising (e.g., Ante et al., 2018; Fisch, 2019) but also the role of intermediaries in blockchain-centered investment communities more broadly (Risius & Spohrer, 2017). Specifically, we suggest that additional information (i.e., social media posts) can reduce information asymmetry and may, in turn, affect fundraising performance within these communities (Chanson et al., 2018a, b). However, contrary to previous work which found that eWOM valence and volume positively affect fundraising performance (for an overview see Risius et al., 2015), our findings suggest that this is very much contingent on the prior extent to which information asymmetry has already been reduced through effective signals from established market institutions (i.e., crypto exchange platforms). We explain, and test, with our theory that potential investors are less reliant on eWOM signals whenever a trusted intermediary facilitates the fundraising process (i.e., an IEO). By exploring and explaining the implications of third-party intermediaries on the financial performance of blockchain-based fundraising, we respond to calls for research investigating synergies between intermediaries and blockchain technologies (Risius & Spohrer, 2017), especially within the increasingly important context of cryptocurrencies in financial services (Breidbach et al., 2020).

Background and hypotheses

Differences between ICOs and IEOs as blockchain-based fundraising mechanisms

ICOs and IEOs are novel blockchain-based fundraising mechanisms. As such, they stand in stark contrast to traditional IPOs, venture capitalism, or crowdfunding in that they offer tokenized assets (i.e., a "coin") in exchange for another cryptocurrency (i.e., "Bitcoin") (Dell'Erba, 2018). Individual tokens that investors can acquire serve multiple purposes (Bachmann et al., 2022). First, *utility tokens* provide access to a venture's product or service offering, yet without enforceable ownership rights (Kaal & Dell'Erba, 2017); second, *cryptocurrency tokens* serve as a means of payment and to store monetary value (Ackermann et al., 2020; Liu & Wang, 2019) while *security tokens* intend to secure an investor's enforceable access to dividend or interest payments (Ante & Fiedler, 2020). Figure 1 describes the mechanisms underlying ICOs—the most prominent form of blockchain-based fundraising today.

The first step for any venture seeking funds via an ICO is to create two smart contracts. These smart contracts define the type of tokens to be issued (e.g., a utility token), as well as the conditions of the ICO (e.g., duration and price),

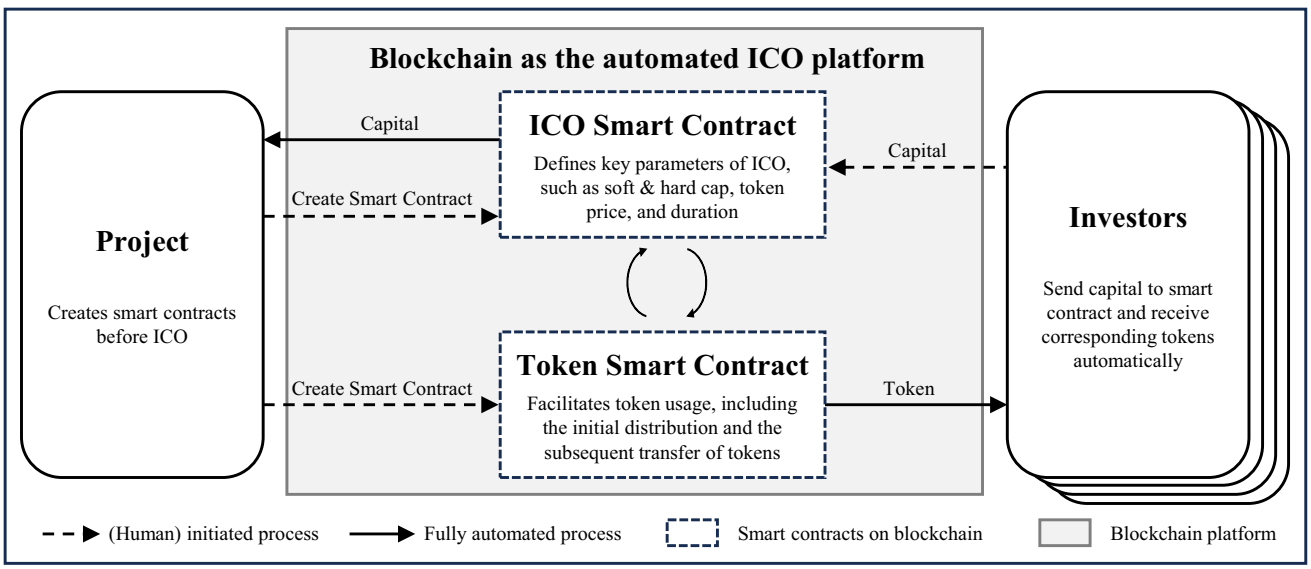

Fig. 1 Initial coin offering (ICO) fundraising process

before deploying them on a blockchain such as Ethereum (Fridgen et al., 2018). Investors can then participate in the ICO by sending cryptocurrency to the smart contract (Hrga et al., 2019). If the conditions specified in the smart contract are met (e.g., token price at a particular time), the venture receives access to the cryptocurrency sent by the investor (e.g., Bitcoin), and the investors receive their tokens (e.g., utility tokens) in return. As such, smart contracts make intermediaries like lawyers or investment banks obsolete (Momtaz, 2019), reduce the cost of raising capital by avoiding compliance costs, and can accelerate the fundraising process due to reduced due diligence (Lipusch, 2018). However, despite their benefits, ICOs have become infamous for their lack of regulation (Tiwari et al., 2020), and fraudulent schemes associated with them (e.g., BitConnect or Ripple) incurred multi-billion dollar losses (Seth, 2018). In response, the U.S. Security and Exchange Commission (SEC) began prosecuting some token sellers (Mendelson, 2019), while fundraising platforms introduced initial exchange offerings (IEOs), a revised blockchain-based fundraising mechanism that promises better investor protection.

IEOs redefine blockchain-based fundraising (Fig. 2) by requiring tokens to be issued on a dedicated crypto-exchange platform (i.e., Binance) (PWC, 2020). IEOs thereby introduce an intermediary into the fundraising process that conducts a due diligence assessment and negotiates the underlying conditions of the fundraising process (Vitáris, 2020). If these conditions are met, the venture seeking funds can instantiate a smart contract to execute the IEO on "their" crypto exchange platform acting as the intermediary (Corporation, S, 2023; Ooi, 2018), with the platform promoting the IEO among their users (MN, 2019). Any investor interested in the IEO can then purchase tokens but has to use the exchange platform's native cryptocurrency (i.e., assuming crypto-exchange platform "Binance" were to launch an IEO, investors would have to use "Binance Coin") (Ozturk, 2019). Once the IEO process is complete, the new tokens are listed on the administering cryptocurrency exchange platform, which now acts as the secondary market to allow further trading and speculation (Vitáris, 2020).

Applying signaling theory to blockchain-based token offerings

Information asymmetry and fundraising performance

Reducing information asymmetry is a key challenge for any fundraising attempt—including blockchain-based fundraising via ICOs and IEOs. Signaling theory proposes that information asymmetry (e.g., knowledge about a venture attempting to raise funds) between two entities (e.g., fundraisers and investors) can be overcome through effective signals (Connelly et al., 2011; Spence, 1973). The sender of a message needs to provide clear messages for a recipient if that message is to have the intended effect (e.g., purchasing signal) (Mavlanova et al., 2012). Reducing information asymmetry translates to better fundraising performance in traditional fundraising processes (Certo, 2003; Karasek & Bryant, 2012). Ventures that fundraise via ICOs can reduce information asymmetry to improve performance through voluntary disclosures prior to an ICO launch (Roosenboom et al., 2020), by operating a social media presence (Thies et al., 2022), or releasing white papers (Chen, 2019). Relevant information for capital seeking ventures to disclose and improve their financial performance regard their technological capabilities (Fisch, 2019), their source code (Adhami

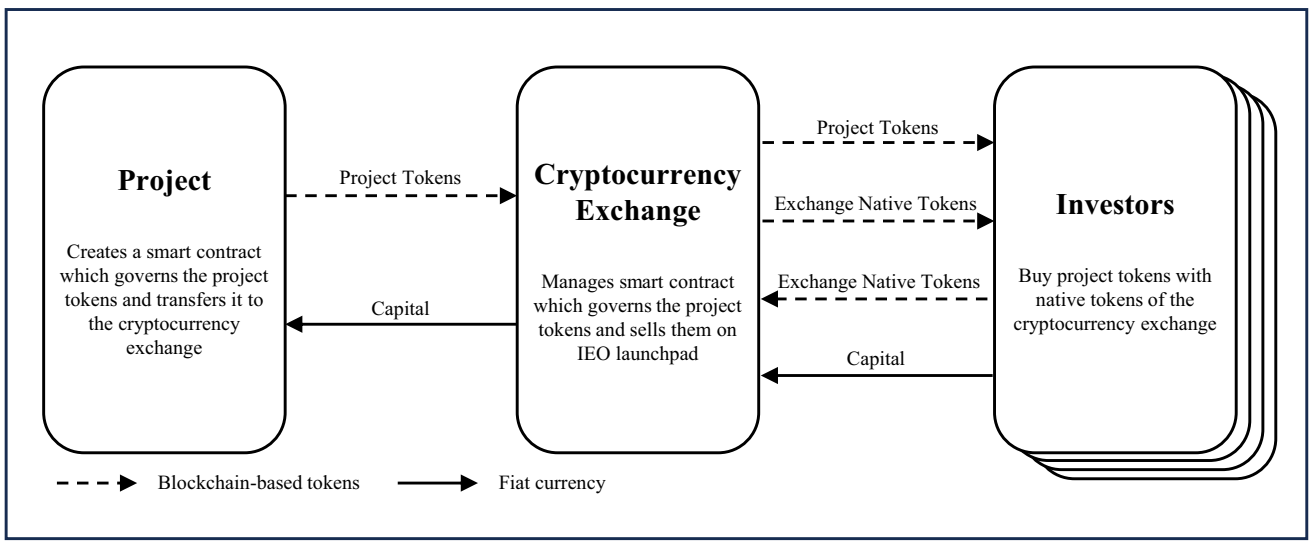

Fig. 2 Initial exchange offering (IEO) fundraising process

et al., 2017), the share of tokens retained during the launch (Davydiuk et al., 2023), or the project characteristics themselves (e.g., ICO launch and available human capital) (An et al., 2019; Huang et al., 2020; Perez et al., 2020). However, research has yet to address performance drivers of other types of blockchain-based token offerings such as IEOs.

Signaling differences between ICOs and IEOs

The effectiveness of a signal is determined by the characteristics of the entity that shares information (Lins & Sunyaev, 2017). For example, the presence of a *reputable* signaler (Aiken et al., 2004) with a proven record of *honesty* (Connelly et al., 2011) is known to enact *market disciplinary mechanisms* that reveal and penalize low quality signalers (Srivastava & Lurie, 2001). While signaling theory has been successfully applied to predict ICO fundraising performance (Thies et al., 2022), its implications for IEOs are not documented. We draw on signaling theory to fill this knowledge gap on the shift from unregulated ICOs to self-regulated IEOs. We propose that the cryptocurrency exchange platforms serve as an effective signaler for IEOs and help reduce the information asymmetry in three ways (Aiken et al., 2004): first, IEOs rely on a cryptocurrency platform that, in its role as an intermediary, reduces the probability that fraudulent token offerings emerge in a market. This, in turn, not only increases the long-term viability of blockchain-based fundraising (Purdy, 2019) but also increases the level of honesty required for successful fundraising when compared to ICOs.

Second, cryptocurrency platforms provide legitimacy to IEOs through their brand and position in the market when promoting IEOs among potential investors (Tran, 2019). ICO ventures, on the contrary, must make significant marketing investments to establish a sufficient reputation (Ozturk, 2019). When viewed through the lens of signaling theory, this suggests that the benefits IEOs can gain from collaborations with cryptocurrency exchange platforms are linked to their reputation (Connelly et al., 2011).

Third, cryptocurrency platforms streamline and control and increase the efficiency of the fundraising process (MN, 2019). This ensures that issued IEO tokens are instantly tradeable and removes the arduous process of securing a listing partnership on cryptocurrency platforms ICOs experience (Ozturk, 2019). IEOs enable cryptocurrency platforms can not only create but also enforce adherence to their policies (Tran, 2019; Vitáris, 2020). The presence of such market disciplinary mechanisms in and of itself is an effective signal ICOs do not possess and reduces the overall information asymmetry of IEOs more effectively compared to unregulated ICOs (Srivastava & Lurie, 2001).

Overall, we assume that the ICO performance—in the absence of a reputable intermediary with the power to enact market disciplinary mechanisms—ought to be more reliant on additional information such as electronic word-of-mouth compared to IEOs (Fig. 3 provides an overview). However, in the light of the recent scandal associated with the formerly 3rd largest cryptocurrency exchange FTX Trading Ltd., we feel compelled to note that IEOs might be adversely affected by the reputation of a cryptocurrency exchange in the future. We here propose that IEOs are generally more affected by the role and reputation of the intermediating organization—be it positive or negative—than by the publicly shared electronic word-of-mouth compared to ICOs.

Electronic word-of-mouth and the performance of blockchain-based fundraising

Over the past decade, electronic word-of-mouth (eWOM) emitted via social media emerged as an impactful source of information (Risius & Beck, 2015). eWOM comprises the valence (i.e., sentiment) and volume (i.e., amount of information) of online communication (Chen et al., 2011) and

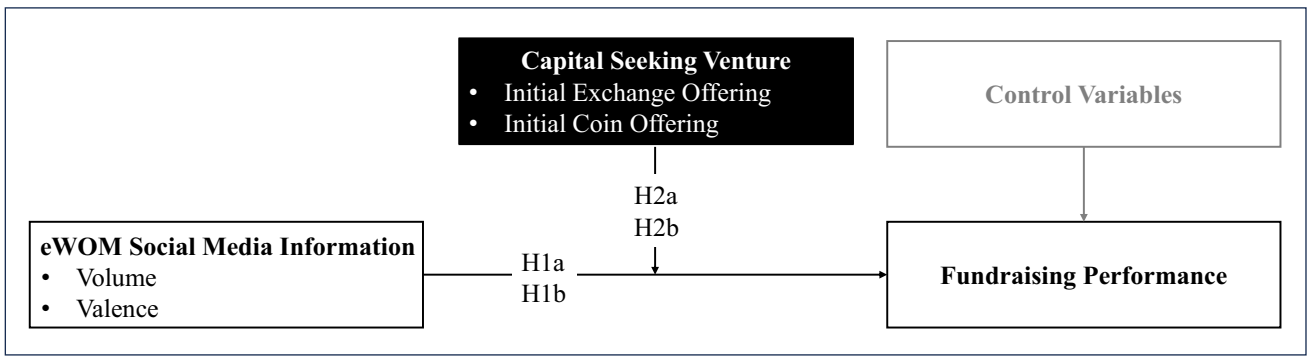

Fig. 3 Research model on the fundraising performance of blockchain-based token offerings

is generally found to play a significant role in the general financial market (Risius et al., 2015), for IPOs (Aggarwal et al., 2012) as well as ICOs (Chanson et al., 2018a, b). Signaling theory explains the process of acquiring additional information to compensate for weak signals to overcome information asymmetry (Karasek & Bryant, 2012). Due to the decentralized nature of the wider blockchain community, interactions between (potential) investors and the capital seeking ventures take place online (Arnold et al., 2019; Singer et al., 2014), on social media platforms. For example, Thies et al. (2022) demonstrated that ICOs who disseminate information through social media improved their fundraising performance, while Albrecht et al. (2020) found that increasingly positive sentiment and emotive language emitted on Twitter increased funding amount ICOs raised. ICO investors seek and share social media information to reduce information asymmetry and inform their decisions (Bruckner et al., 2020). Accordingly, we propose:

Hypothesis 1a: eWOM volume has a significant positive effect on the fundraising performance of token offerings.
Hypothesis 1b: eWOM valence has a significant positive effect on the fundraising performance of token offerings.

Signaling theory suggests that these findings do not uniformly translate to the context of IEOs, where cryptocurrency exchange platforms serve as intermediaries. We thus advance from the assumption that signals from such third-party intermediators reduce information asymmetry between a venture seeking to raise funds via an IEO and potential investors (Hobbs, 2004). The absence of effective signals from an established institutional player like a cryptocurrency exchange platform will be compensated for by additional information disseminated as eWOM on social media. The information shared in an IEO about a venture from an honest, reputable signaler with the power to enforce market disciplinary mechanisms ought to help reduce information asymmetry (Karasek & Bryant, 2012; Spence, 1973). In the absence of such an intermediary, potential investors would likely turn to social media to gather information (Conrado et al., 2016; Karasek & Bryant, 2012). Hence, ventures seeking investments through ICOs ought to be more dependent on additional eWOM information in terms of social media volume (i.e., amount of information) and valence (i.e., sentiment) (Chen et al., 2011) in an attempt to reduce information asymmetry underlying their fundraising success compared to IEOs.

Finally, a larger *volume* of eWOM serves as an effective signal to overcome information asymmetry, because it increases observability of information for the receiver (Spence, 1975). Put differently, if a topic is covered more extensively on social media, the likelihood is higher that it is being noticed by a receiving observer (Aggarwal et al., 2012). Such observability, in turn, represents a signal that can help to effectively overcome information asymmetry (Spence, 1975). For example, Lundmark et al. (2017) found that an increase in eWOM volume provides additional information about a venture seeking to raise capital for potential investors and can therefore be used to predict the success of IPOs in traditional capital markets. Guske and Bendig et al. (2018) and Bendig et al. (2018) suggest that the same effect may also be applicable to ICOs. Applied to the context of the whole suite of blockchain-based token offerings, we consider that a larger volume of eWOM helps to reduce information asymmetry but that this effect is less pronounced in IEOs than ICOs due to their comparatively unregulated nature. Similarly, eWOM *valence* serves as an impactful source of information for investors. For example, Li et al. (2014) have shown that the sentiment of Twitter messages discussing individual companies influences the decision making process of prospective investors, impacts market prices through information leakage (Sprenger et al., 2014a, b), and predicts daily stock price changes (Smailović et al., 2013; Sprenger et al., 2014a, b). This is particularly true for negative sentiment, which attracts more human attention than positive one (Baumeister et al., 2001) and, thus, has likely a stronger effect on fundraising outcomes (Sprenger et al., 2014a, b). eWOM valence can therefore help compensate for the relative lack of information in unregulated ICOs compared to the self-regulated IEOs. In conclusion, we hypothesize that eWOM valence and volume impact the performance of token fundraising as follows:

Hypothesis 2a: eWOM volume has a greater impact on the fundraising performance of ICOs than IEOs.
Hypothesis 2b: eWOM valence has a greater impact on the fundraising performance of ICOs than IEOs.

Empirical study

Sample collection, data pre-processing, and operationalization

To test our hypotheses, we analyzed the performance of 321 blockchain-based fundraising projects, which included 247 ICOs and 74 IEOs. We initially collected a complete list of all 608 token offerings (i.e., 477 ICOs and 131 IEOs) listed on the "ICODrops" website as of April 6, 2020. We cleaned all data to ensure comparability, excluding those token offerings that lacked information regarding the amount raised, was canceled or consisted of private offerings, as well as those that received less than 50% of their funding objective, or less than US$1 million. Furthermore, we removed all token offerings with ambiguous names (e.g., HOLD) to avoid noise in the data and excluded one IEO that was

mentioned more often than all others combined (i.e., Bittorrent). This process resulted in a sample of 321 token offerings (i.e., 247 ICOs and 74 IEOs) with comparable dropout rates (51.78% for ICOs and 57.25% for IEOs). Our subsequent analysis identified 16 outliers with disproportional leverage according to the cook distances ($D_i > 4/N$ with $N = 321$) (Cook, 1977; Hair et al., 2009). Complemented by a visual inspection of the leverage and normalized residual squared errors, we removed the 13 ICO (1.05%) and 3 IEO (1.04%) outliers, which resulted in a final sample of 305 token offerings (i.e., $n_1 = 234$ ICOs and $n_2 = 71$ IEOs).

In a second step, we collected relevant secondary data to understand the parameters of each token offering, using "ICODrop's," "Cryptorank.io," "Coinmarketcap.com," "LinkedIn," official websites of the ventures attempting to raise capital, or published white papers. Specifically, we collect the number of *Crypto News* mentions (i.e., articles that mention a token offering prior to its launch) using relevant news websites with over 500,000 visits per month between January 1, 2015 and the launch of the token offering (Chanson et al., 2020) (Table 7 in Appendix 2); *Duration* (i.e., number of days from the start to end date of a token offering) (Fisch, 2019); *Venture Age* (i.e., number of months a venture existed prior to its token offering); oversubscription (dummy coded, whether the funding target of could be reached) (Chanson et al., 2020); *Market Sentiment* (i.e., price of Ether in USD when token offering was launched) (Borri, 2019); *Min Cap* (i.e., minimum investment amount in USD required for an investor to participate); *Max Cap* (dummy coded, whether a cap on funding by individual investors existed) (Chanson et al., 2020); *Pre-Sale* (dummy coded, whether the venture raised capital in a pre-sale prior to the public token offering) (Breznitz et al., 2018); and *Pre-Sale Funding* (i.e., total amount of private funding a venture received prior to the public launch of a token offering) (Chanson et al., 2020). We addressed the right-skewed distribution of the pre-sale funding by $\ln(x+1)$-transforming the variable for the subsequent regression analyses (D'Agostino et al., 1990; Hair et al., 2009; Royston, 1992), which needs to be considered to avoid blindly interpreting the coefficients (Wooldridge, 2015).

In a third step, we conducted a keyword search of the specific project names and tickers on Reddit yielding 3,968 submissions (i.e., opening statement of a new Reddit thread) and 7,533 comments (i.e., answers to the first post of an individual Reddit thread). We decided to focus on Reddit activities, since they have consistently been linked to ICO success as opposed to, for example, Twitter (Chanson et al., 2018a, b; Chanson et al., 2020). While a conclusive understanding of the relationship between social media activities and token offering fundraising performance is missing (Albrecht et al., 2020; Ante et al., 2018), posts on Reddit are assumed to require more effort to compose and hence constitute a more effective signal compared low-effort Twitter posts (Chanson et al., 2018a, b; Chanson et al., 2020; Mai et al., 2018). Thus, the Reddit data enabled us to meaningfully assess *eWOM volume* through *Mentions* (i.e., number of submissions or comments including the name of a token offering within 30 days prior to launch). Following Chanson et al. (2020), we restricted the search space for mentions to subreddits that (i) had at least 100,000 subscribers, (ii) focused on a topic associated with cryptocurrencies, and (iii) included discussions about token offerings. This process resulted in the selection of ten subreddits listed in Table 8 in Appendix 2. After downloading all content as .txt files, we used the Python Natural Language Toolkit to prepare the text for analysis, which involved lemmatizing and tokenizing all text, conversion to lowercase, and removing stop words, whitespace, numbers, HTML tags, and URLs. To accommodate the skewed distribution of the eWOM volume, we conducted a square-root transformation of the count data that includes 0 values for the subsequent regression analyses (Davidson & MacKinnon, 1993). Square-root transformation is the type of Box-Cox transformation that is specialized for left-skewed count data that include 0 values, but would require further transformations to make the coefficients directly interpretable (Wooldridge, 2015).

In a fourth step, we used the rule-based sentiment analysis tool VADER, which is tailored toward the sentiment analysis of social media texts (Hutto & Gilbert, 2014), to classify the sentiment of mentions as either positive, negative, or neural. Given the informational value of emotional valence in social media for investment decisions (Risius et al., 2015) and given the differential impact of positive and negative online emotions for investment decisions (Sprenger et al., 2014a, b), we followed Steinert and Herff (2018) to account for the direction of *eWOM Valence* by dividing the number of positive mentions by the sum of positive and negative mentions for each venture. To account for the skewed distribution of the valence ratio score that ranges between 0 and 1, we conducted an arcsine transformation for the subsequent regression analyses (Davidson & MacKinnon, 1993). An arcsine transformation makes skewed percentage data appear normally distributed but should not be directly interpreted as that required further transformations (Bellemare & Wichman, 2020).

Finally, we assessed the *performance* of each token offering, using the total fundraising amount as our dependent variable (i.e., the total capital raised in a token offering in million USD). We followed the well-established precedence of prior research exploring the financial performance of fundraising mechanisms (Amsden & Schweizer, 2018; Benedetti & Kostovetsky, 2021; Chanson et al., 2018a, b; Fisch et al., 2019; Jin et al., 2017; Perez et al., 2020; Roosenboom et al., 2020; Thies et al., 2022; Wang et al., 2022), which has high informational value

Table 1 Descriptive statistics for ICO sample

Variable	Mean	Median	Min.	Max.	Std.	Total
Dependent variable						
Funding performance (million USD)	27.61	20.5	2.67	300.00	28.57	6,460.73
Independent variables						
Volume	41.12	15.00	0.00	451.00	72.69	9,622.00
Valence	0.73	0.91	0.00	1.00	0.38	-
Control variables						
Crypto news	36.09	2.00	0.00	895.00	130.23	8,445.00
Oversubscribed	0.70	1.00	0.00	1.00	0.46	-
Market sentiment (ETH opening price)	534.29	473.28	45.22	1,397.48	283.08	-
Duration (days)	17.76	9.00	1.00	144.00	21.17	-
Venture age (months)	21.57	17.00	4.00	109.00	16.89	-
Min cap (USD)	81.33	0.00	0.00	1740.22	204.5	-
Max cap	0.36	0.00	0.00	1.00	0.48	-
Pre-sale	0.43	0.00	0.00	1.00	0.5	-
Pre-sale funding (million USD)	2.1	0.00	0.00	97.00	8.24	491.18

Notes. $n_1 = 234$ ICOs; dummy coded: mechanism (ICO = 0, IEO = 1), oversubscribed (yes = 1, no = 0), max cap (present = 1, absent = 0), and pre-sale (present = 1, absent = 0)

as a continuous variable. The total fundraising amount represents the most relevant dependent variables in the wider context of entrepreneurial finance research (e.g., Aggarwal et al., 2012; Mollick, 2014). We obtained data points for the total fundraising amount from "ICODrops." We alleviated the highly significant right-skewed distribution of the funding performance by $\ln(x+1)$-transforming the variable for the subsequent regression analyses ($\chi^2_{\text{adjusted}} = 6.52$, $p = 0.0383$) (D'Agostino et al., 1990; Hair et al., 2009; Royston, 1992). Accordingly, our subsequent analysis explores the proportional and not additive changes in fundraising performance, which needs to be considered when interpreting the coefficients (Wooldridge, 2015).

Results

Descriptive analysis

Descriptive statistics are available in Tables 1 and 2, which provide an overview of the results for all variables

Table 2 Descriptive statistics for IEO sample

Variable	Mean	Median	Min.	Max.	Std.	Total
Dependent variable						
Funding performance (million USD)	11.59	6.84	1.38	72.00	12.47	822.88
Independent variables						
Volume	8.15	3.00	0.00	45.00	10.27	579.00
Valence	0.51	0.67	0.00	1.00	0.48	-
Control variables						
Crypto news	62.58	4.00	0.00	1,290	206.85	4,443.00
Oversubscribed	0.7	1.00	0.00	1.00	0.46	-
Market sentiment (ETH opening price)	201.15	187.5	110.41	336.96	46.41	-
Duration (days)	2.94	1.00	1.00	23.00	4.30	-
Venture age (months)	23.35	20.00	8.00	65.00	10.13	-
Min cap (USD)	145.46	0.00	0.00	1,000	240.64	-
Max cap	0.56	1.00	0.00	1.00	0.50	-
Pre-sale	0.79	1.00	0.00	1.00	0.41	-
Pre-sale funding (million USD)	5.19	1.26	0.00	46.20	8.91	368.72

Notes. $n_2 = 71$ IEOs; dummy coded: mechanism (ICO = 0, IEO = 1), oversubscribed (yes = 1, no = 0), max cap (present = 1, absent = 0), and pre-sale (present = 1, absent = 0)

investigated for the ICO and the IEO sample, respectively. Our findings indicate that the 234 ICO projects raised a total of US$ 6,460.73 m, while the 71 IEO projects secured a total of US$ 822.88 m funding. This implies that the average funding amount of US$ 27.61 m for ICOs is almost 2.5 times higher compared to that of US$ 11.59 m for IEOs.

The significantly stronger financial performance of ICOs also translates into eWOM volume and valence. Specifically, we found that ICOs are mentioned more often in relevant Reddit posting prior to their launch (41.12), compared to IEOs (8.15). But, also the valence of eWOM sentiment scores is more positive for ICOs (0.73) compared to IEO (0.51).

Focusing on our control variables, we found that market sentiment, as determined by the average ETH opening price on the starting date of a token offering, is significantly higher for ICOs (534.29) than IEOs (201.15). Also, the average duration of ICOs (17.76 days) differs substantially from the average duration of IEOs (2.94 days), with IEOs being discussed more frequently in relevant cryptocurrency articles (62.58) than ICOs (36.09).

Inferential statistics

We performed a sequence of stepwise multiple GLM regressions (Wooldridge, 2013) to test main and interaction effects (hypothesis 1) followed by a sub-group comparison of token offerings using comparable GLM regressions to explore the proposed moderator effects (hypothesis 2) (Altman et al., 2001; Burke et al., 2015; Wang & Ware, 2013) (Table 6). We applied GLM regressions to account for the non-linear relationships between the transformed variables. This is a slight adaptation of the precedence of applying OLS regressions in this context (Chanson et al., 2018a, b; Thies et al., 2022). The detailed equations of all the models are presented in Appendix 1. The "Controls" model 1 includes all control variables, "Base" model 2 explores the individual impact of eWOM mentions and valence, while the "Full" model 3 simultaneously considers the proposed moderating effects proposed in the full research model concurrently. There is no indication of multicollinearity between independent and control variables, as the highest variance inflation factor was 1.27 in the ICO models and 1.91 in the IEO models. In addition, we evaluated the normality and linearity of the ICO and IEO models through a visual inspection of a normality and residual Q-Q plot, which indicated that the error terms are reasonably normally distributed. Moreover, both White test and a Breusch-Pagan test were conducted for all models to check for heteroscedasticity. As there was an indication of heteroscedasticity, all models used heteroscedasticity-robust standard errors (HC1).

Table 3 OLS regressions with robust standard errors on token fundraising performances

Variable	Controls	Base model	Full model
Volume	-	0.064 (0.012)***	0.04 (0.012)***
Valence	-	0.089 (0.074)	0.166 (0.075)*
Mechanism	-	-	-0.719 (0.192)***
Volume*mechanism	-	-	0.066 (0.084)
Valence*mechanism	-	-	-0.369 (0.193)†
Crypto news	0.001 (0.001)***	0.001 (0.001)***	0.001 (0.001)***
Oversubscribed	0.157 (0.106)	0.21 (0.106)*	0.193 (0.094)*
Market sentiment	0.001 (0.001)***	0.001 (0.001)***	0.001 (0.001)†
Duration	0.006 (0.002)*	0.007 (0.002)**	0.002 (0.002)
Venture age	-0.002 (0.003)	-0.001 (0.002)	0.001 (0.002)
Min cap	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Max cap	-0.136 (0.096)	-0.121 (0.092)	-0.051 (0.085)
Pre-sale	-0.443 (0.097)***	-0.347 (0.092)***	-0.241 (0.087)**
Pre-sale funding	0.201 (0.05)***	0.185 (0.05)***	0.218 (0.047)***
Intercept	2.329 (0.156)***	1.86 (0.164)***	2.333 (0.161)***
N	305	305	305
AIC	730.49	698.55	656.76
BIC	767.69	743.19	712.57

Notes. Please consider the following data transformations when interpreting the coefficients: financial performance (ln), pre-sale funding (ln), volume (square-root), valence (arcsine); dummy coded: mechanism (ICO = 0, IEO = 1), oversubscribed (yes = 1, no = 0), max cap (present = 1, absent = 0), pre-sale (present = 1, absent = 0); sample: $n_1 = 234$ ICOs, $n_2 = 71$. IEOs; unstandardized coefficients are reported; robust standard errors of b in parentheses, *AIC*, Akaike information criterion; *BIC*, Bayesian information criterion. Significance. $^{\dagger}p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

The results of our GLM regression analyses provide partial support for hypothesis 1 (Table 3). The model fit scores (AIK, BIC) indicate better fit for the hypothesized research model. This indicates that the consideration of eWOM characteristics in combination with fundraising mechanisms offers meaningful explanatory value for the fundraising performance of ICOs and IEOs (Wooldridge, 2013). On the one hand, larger *eWOM volume* consistently leads to significantly better fundraising performance in model 2 ($b_{\text{Volume1}} = 0.064$, $t = 5.26$, $p = 0.000$) and model 3 ($b_{\text{Volume2}} = 0.04$, $t = 3.35$, $p = 0.001$). Given that the results do not show a significant interaction with the fundraising mechanism ($b_{\text{Volume*Mechanism}} = 0.066$, $t = 0.79$, $p = 0.431$), eWOM volume appears to have an overall positive effect on token offering fundraising performance (hypothesis 1a).

On the other hand, patterns for *eWOM valence* (*hypothesis 1b*) are more intricate. Our findings indicate the hypothesized significant positive effect of the sentiment of Reddit postings on the fundraising performance in conjunction with all other variables in model 3 ($b_{\text{Valence2}} = 0.166$, $t = 2.21$, $p = 0.027$) and not for model 2 ($b_{\text{Valence2}} = 0.089$, $t = 1.21$, $p = 0.226$). The effect of valence does not appear to be as universal as the main effect of volume. Instead, a closer inspection of the marginally significant interaction effect ($b_{\text{Valence*Mechanism}} = -0.369$, $t = -1.91$, $p = 0.056$) suggests that valence has a stronger positive effect for ICOs than for IEOs (Fig. 4).

While the marginally significant valence*mechanism interaction term, together with the increase in the model fit (AIC 698.55 to 656.76 and BIC 743.19 to 712.57), supports the assumed explanatory power of group differences, the non-significant interaction of volume*mechanism ($b_{\text{Valence*Mechanism}} = 0.066$, $t = 0.79$, $p = 0.431$) could be related to the varying sample sizes (Wang & Ware, 2013). To explore whether the eWOM effects indeed vary significantly between the two pre-defined subpopulations of ICOs and IEOs (hypothesis 2), we conducted a sub-group moderator analysis (also called "randomized controlled trials") (Altman et al., 2001; Burke et al., 2015; Wang & Ware, 2013). Specifically, we replicated the previous GLM regressions separately for the sample of ICOs and IEOs and tested for the statistical significance of differences of parameters between subgroups (Clogg et al., 1995; Fletcher, 2007; Paternoster et al., 1998). Table 4 provides an overview.

The regression analyses provide partial support for our hypothesized relationships (Table 4). The results indicate significantly positive effects of eWOM volume ($b_{\text{Volume}} = 0.04$, $t = 3.23$, $p = 0.001$) and valence ($b_{\text{Valence}} = 0.167$, $t = 2.22$, $p = 0.023$) for the financial performance of ICOs but not of IEOs ($b_{\text{Volume}} = 0.087$, $t = 0.95$, $p = 0.302$; $b_{\text{Valence}} = -0.172$, $t = -0.89$, $p = 0.332$). Interestingly, for IEOs, the parameter-sensitive model fit scores even slightly increase through the addition of eWOM regressors (AIC from 177.69 to 180.15 and BIC from 200.32 to 207.3) indicating poorer model fit through the addition of eWOM characteristics. It needs to be noted, however, that the effect for valence does not reach full significance on the conservative, Bonferroni adjusted error probability $p_B = 0.0125$ ($p_B = \alpha/s$ with $\alpha = 5\%$ and $s = 4$ as the number of tested regressors (i.e., $b_{\text{ICOVolume}}$, $b_{\text{ICOValence}}$, $b_{\text{IEOVolume}}$, and $b_{\text{IEOValence}}$)) that aims to avoid multiplicity issues of α-inflation (Wang & Ware, 2013).

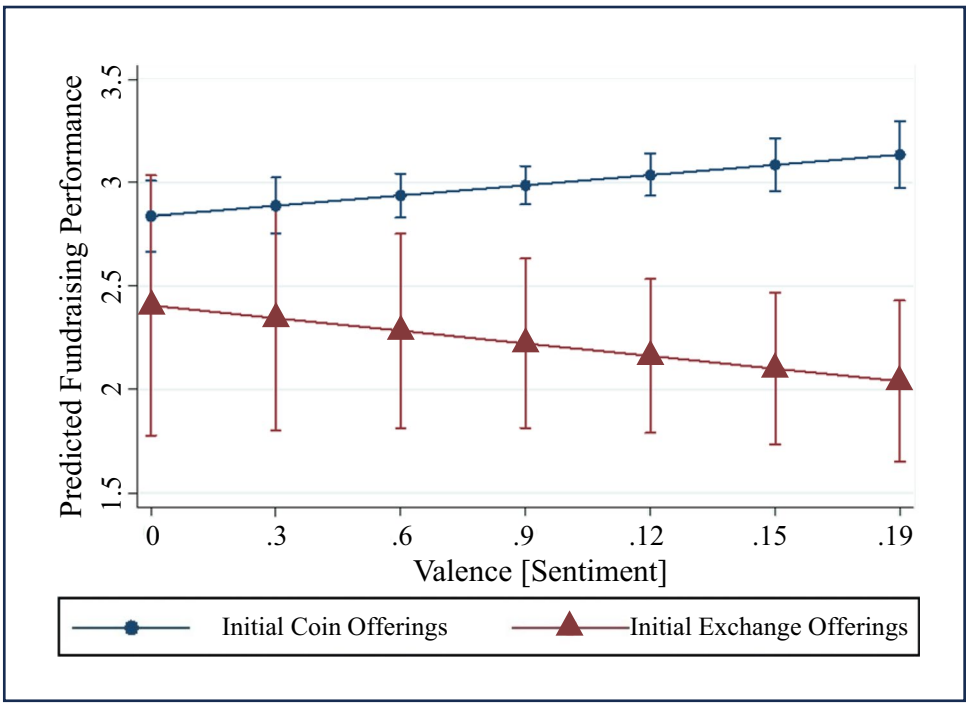

Fig. 4 eWOM valence effects on fundraising performance of ICOs and IEOs

Table 4 OLS regressions with robust standard errors for individual token fundraising performances

Variable	ICO controls	ICO full model	IEO controls	IEO full model
Volume	-	0.04 (0.012)***	-	0.087 (0.084)
Valence	-	0.167 (0.073)*	-	-0.172 (0.177)
Crypto news	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)**	0.001 (0.001)***
Oversubscribed	0.116 (0.103)	0.156 (0.102)	0.309 (0.233)	0.363 (0.233)
Market sentiment	0.001 (0.001)*	0.001 (0.001)*	-0.005 (0.002)*	-0.005 (0.002)*
Duration	-0.001 (0.002)	0.001 (0.002)	0.027 (0.029)	0.024 (0.028)
Venture age	0.002 (0.002)	0.002 (0.002)	0.006 (0.011)	0.005 (0.011)
Min cap	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)*	0.001 (0.001)*
Max cap	-0.064 (0.088)	-0.054 (0.086)	-0.085 (0.197)	-0.161 (0.202)
Pre-sale	-0.326 (0.089)***	-0.304 (0.085)***	0.287 (0.29)	0.299 (0.287)
Pre-sale funding	0.189 (0.053)***	0.182 (0.053)***	0.246 (0.093)*	0.202 (0.099)*
Intercept	2.835 (0.158)***	2.399 (0.169)***	1.974 (0.607)**	2.024 (0.593)**
N	234	234	71	71
AIC	490.4	470.89	177.69	180.15
BIC	524.95	512.35	200.32	207.3

Notes. Please consider the following data transformations when interpreting the coefficients: financial performance (ln), pre-sale funding (ln), volume (square-root), valence (arcsine); dummy coded: mechanism (ICO = 0, IEO = 1), oversubscribed (yes = 1, no = 0), max cap (present = 1, absent = 0), pre-sale (present = 1, absent = 0); sample: $n_1 = 234$ ICOs, $n_2 = 71$ IEOs; unstandardized coefficients are reported; robust standard errors of b in parentheses, *AIC*, Akaike information criterion; *BIC*, Bayesian information criterion. Significance. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Table 5 Group comparison of regression coefficients

eWOM	Volume		Valence	
	β	SE	β	SE
ICO	0.228	0.069	0.139	0.061
IEO	0.164	0.159	-0.135	0.14
Test statistic	$Z = 0.373$, $p = 0.356$		$Z = 1.8$, $p = 0$ .0359	

Notes. $n_{ICO} = 234$ ICOs, $n_{IEO} = 71$ IEOs; β, standardized coefficients; *SE*, robust standard errors of β

To address concerns regarding low power for IEOs and uneven sample balances, we (1) re-calculated the full GLM model for 10 randomly drawn samples of 71 ICOs and (2) re-calculated the GLM without any covariates for the 71 IEOs. Our (1) analysis mostly replicates the findings from our full sample where we find statistically (high) significance ($p < 0.05$–0.001) in seven samples for volume and in six samples for valence (we found only one sub-sample where both predictors failed statistical significance, with valence reaching marginal significance ($p = 0.08$) and volume being non-significant). The (2) analysis without any covariates did not yield statistically significant effects (valence $p = 0.219$, volume $p = 0.066$). This further suggests that valence and volume are more decisive for ICOs than IEOs (Table 5).

Finally, to test whether the explanatory power of eWOM characteristics differs between the subgroups of ICOs and IEOs (Fletcher, 2007), we conducted a group comparison of their standardized coefficients (Clogg et al., 1995; Paternoster et al., 1998). Further substantiating the pattern of findings expressed by the interaction terms in the pooled sample, we found that the positive effects of eWOM valence (hypothesis 2b) are significantly stronger for ICOs ($\beta_{ICOValence} = .139$) than for IEOs ($\beta_{IEOValence} = -.139$). These group differences do not translate into significant differences regarding eWOM Volume (hypothesis 2a). Table 6 summarizes our findings (Tables 7, 8 in Appendix).

Table 6 Overview of empirical results of tested hypotheses

#	Hypothesis	Empirical support
H1a	eWOM volume has a significant main effect on the fundraising performance of token offerings.	Supported
H1b	eWOM valence has a significant main effect on the fundraising performance of token offerings.	Not supported
H2a	eWOM volume has a greater impact on the fundraising performance of ICOs than IEOs.	Not supported
H2b	eWOM valence has a greater impact on the fundraising performance of ICOs than IEOs.	Supported

Discussion

The objective of this study was to identify the differential effects of social media signals on ICO and IEO fundraising performances. In doing so, we introduced and investigated IEO into the narrative currently dominated by studies investigating ICOs as a blockchain-based fundraising mechanisms (Fig. 5). We applied signaling theory in our work, which provided the necessary theoretical underpinnings to explain that the performance of IEO fundraising is less dependent on additional social media eWOM information than is the case for ICOs. The performance changes of ICOs are comparatively stronger affected by the changes in valence of social media information. We expected this, because the crypto exchange platform administering an IEO fundraising process reduces information asymmetry through its role as a reputable signaler. Importantly, when this study was conducted, no fraud from within the inner-workings of a crypto exchange platform (i.e., pre FTX) had been reported. As such, our findings contradict some previous work in the domain by suggesting that established intermediaries do, in fact, play an important role in decentralized markets.

Theoretical implications

Our work makes important contributions to the IS literature in general, and work investigating fintech services in particular (Breidbach et al., 2020). For one, we offer the, to the best of our knowledge, first empirical study of the still-emerging IEO fundraising mechanism. Highlighting the role of third-party intermediaries (Risius & Spohrer, 2017), the compensatory function of eWOM within ICO and IEOs also contributes a novel perspective to the discourse on technological determinism (Sarker et al., 2019) and the code-as-law philosophy predominant in the context of blockchain technologies (De Filippi & Wright, 2018). Ultimately, we content that the sentiment expressed in Reddit forums (eWOM valence), as well as the number of mentions (eWOM volume) are effective signals in reducing information asymmetry that affect the performance of blockchain-based token offerings. However, contrary to the commonly held belief that eWOM affects the performance of *all* fundraising mechanisms (Risius et al., 2015), our findings suggest that this assumption should be reconsidered the context of ICOs and IEOs. While these blockchain-based fundraising mechanisms' performances benefit equally from eWOM volume, our analysis has found that eWOM valence is significantly more impactful for ICO than for IEO performance. This finding is striking for two reasons.

First, blockchain is a decentralized technology that is commonly associated with its ability to disintermediate markets and reduced dependency on third-party intermediaries (Glaser, 2017). However, we have shown that investors in such a decentralized context value the information provided by cryptocurrency exchange platforms who are third-party intermediaries for IEOs. The shift from ICO to IEO models that we described in our work might have been accompanied by a change in the type of signals, which are effective in reducing information asymmetry. Following this rationale, the reputation of a cryptocurrency exchange platform could has replaced the discourse in decentralized blockchain communities (i.e., eWOM). In addition, novel signals emitted by cryptocurrency exchange platforms prior to an IEO might have emerged. For example, cryptocurrency exchange platforms have begun to publish technical information to create more transparency for potential investors (Binance, 2020). Consequently, these novel types of signals emitted from a trusted intermediary might be more effective than eWOM signals in reducing the information asymmetry prior to IEO's.

Second, in traditional financial service contexts, eWOM is so meaningful that, for example, the NYSE offers eWOM

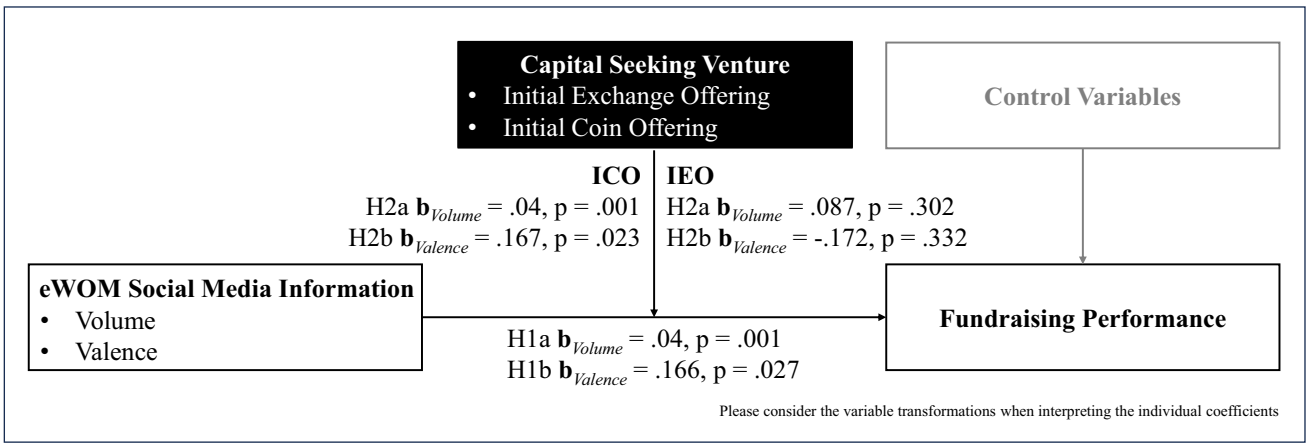

Fig. 5 Summary of findings from sub-group OLS regression analyses comparing the relative impact of eWOM signals on the fundraising performances of ICOs and IEOs

statistics to inform investor decision-making (NYSE, 2014). However, in the context of IEOs, investors rely less on eWOM, but on signals emitted by cryptocurrency exchange platforms. This could be the result of cultural differences between traditional and emerging investment markets, variations in investor types and their motivations, or impacted by prior ICO frauds (Iurina, 2017). It can be proposed that the composition of the investor audience interested in token offerings has changed, and with that the types of communication channels needed Fisch et al. (2019) has shown that retail investors participated in ICOs due to high short-term returns that could be generated in secondary cryptocurrency markets. However, cryptocurrency markets experienced diminishing returns in the aftermath of a major correction in 2018 (Chu et al., 2019). Similarly, the descriptive analysis in our study shows a nearly threefold reduction in the average funding amount per token offering. This trend is confirmed by more comprehensive statistics for the entire blockchain-based fundraising market, which indicate a drastic reduction in the average number of token offerings per month during the same period (PWC, 2020). Thus, we suggest that many retail investors previously seeking short-term returns are no longer active in token markets and interested in IEOs. This is important because these retail investors likely assessed the quality of a previous token offering based on easy-interpretable signals such as the volume of mentions in discussion forums. Conversely, those investors that remained in the token offering market post-2018 and participated in IEO investment opportunities, likely relied on communication channels emitting more sophisticated signals than discussion forums.

In conclusion, the ability of any venture attempting to raise capital and benefit from blockchain-based fundraising is contingent on their ability to overcome information asymmetry, and to disseminate positive signals among potential investors to attract capital. The same challenge applies to cryptocurrency exchange platforms. Importantly, our insight that the performance of IEOs is less affected by eWOM is novel and provides, in our opinion, an important and complementary perspective to our disciplines current understanding into the effects of signaling factors and their ability to reduce information asymmetry in traditional trading (Risius et al., 2015). Our work thereby represents an important starting point for future research broadly aligned with either entrepreneurial finance or blockchain-based ventures, as well for managerial practice.

Managerial implications

Our present study provides several important guidelines for investors, ventures seeking to raise capital through token offerings, but also regulators.

First, we encourage investors to seek information from trusted third-party intermediaries as well as social media. The signals that social media sources like Reddit emit hold selective informational power when making financial decisions. The eWOM content from Reddit and other social media sources better predicts ICO than IEO success. Predicting the performance of any investment has always been challenging, but making financial decisions based on signals from social media alone is likely not in the best interest of any future investor. The information cryptocurrency exchanges provide more reliable pathway to overcome information asymmetry and assess the suitability of an upcoming IEO for an individual investment portfolio.

Second, ventures seeking to raise capital through token offerings mechanisms should consider which strategy to promote an ICO or IEO offerings to prospective investors may be best suited for their individual needs and position in the market. While Momtaz (2019) encourages the self-promotion of ICOs on social media, this may no longer be the most suitable strategy when establishing a partnership with a renowned cryptocurrency exchange can increase legitimacy due to the reputational signal these organizations can display prior to an IEO (Ozturk, 2019). Though partnerships with cryptocurrency exchange platforms likely increases the cost of raising new capital, such an expenditure can likely be well-justified among organizational decision-makers given that launching IEOs via cryptocurrency exchanges likely enables organizations to target more suitable investors. At the same time, IEO investors need to be cautious considering the recent FTX scandal. Our findings suggest that IEOs might not just benefit from a good reputation, but also suffer from a poor reputation of cryptocurrency exchanges. This would be more difficult for them to overcome, as additional information in terms of eWOM valence is less impactful for them compared to ICOs.

Third, the regulation of cryptocurrencies and token offerings still represent a substantial challenge for policymakers. In fact, the challenges are amplified by national differences—which necessarily collide with the global and decentralized nature of blockchain-venturing. For example, while the narrative in the USA is centered around whether regulation of financial services is desirable *at all*, other countries like Australia have taken a significantly tougher stance after multiple scandals impacted the financial sector (Breidbach et al., 2022). Combined with the rapid technological change, as evidenced in the shift from ICOs to IEOs, any regulation of financial services will likely remain incomplete and not adequately address technological advances associated with token offering fundraising mechanisms. Even though we see potential that the self-imposed attempts by cryptocurrency exchanges to self-regulate IEOs point in the right direction, given the current absence of enforceable and adequate legal frameworks, regulators may want to explore ways how to apply existing regulatory tools on token offering fundraising. For example, regulators could

attempt to trace biased signals and ensure that not a single source (such as a cryptocurrency exchange advertising one of their IEOs) manipulates the market (e.g., pump-and-dump schemes (Siering, 2019)), which might help to better protect investors (Momtaz, 2021).

Finally, cryptocurrency exchange platforms should critically assess whether their signals complement or make existing eWOM redundant. Strengthening their market position may be achieved through service innovations like offerings provided by the NYSE (NYSE, 2014), which provides investors eWOM statistics in an attempt to enable better decision making and to establish the NYSE as a single source of reference. Ultimately, to achieve this, cryptocurrency exchange platforms need to recognize that eWOM represents an important—yet under-utilized source of information that can provide considerable value in market conditions characterized by high information asymmetry like IEOs.

Limitations and future research

Our present work addressed important gaps in knowledge and responded to calls for research at the intersection of cryptocurrencies and blockchain-based fundraising (Brochado & Troilo, 2021). As with all empirical research, our work is subject to certain limitations that, subsequently, provide avenues for future research.

First, the representativeness of our sample may be limited. The ICOs and IEOs investigated represent necessarily only a subset of all token offerings available. We followed best practices and the precedence of Chanson et al. (2020) when selecting our sample from "ICODrops" but, as is the case for *all* empirical studies investigating token offerings (Momtaz, 2021), cannot exclude that potential sample selection bias restricts the generalizability of our findings. We attempted to address the imbalanced sample sizes in our empirical analysis. However, future research would benefit from an expanded IEO sample size. Resolving the currently unresolvable challenge of selection bias when conducting empirical research on token offerings would require establishing independent and comprehensive databases—a fruitful area for future research. Furthermore, "ICODrops" itself allows and provides some categorization of data; for example, by distinguishing between segments like "gaming" or "protocols." While we did not differentiate between these, future research could investigate if, how, or to what extent the eWOM effect is segment dependent. Similarly, we have to consider potentially biasing effects of endogeneity. For example, a project that is performing well could attract additional attention, fostering improved eWOM. Similarly, the crypto market might have been so good for ICOs that it did not really demand trust and transparency. Importantly, we collected data before at a time when no major cryptocurrency exchange scandal had occurred. Hence, we can assume a positive impact of the intermediary's reputation on the IEO performance. Following the recent FTX scandal, however, future research should seek to substantiate our claims. For example, future work could explore whether a negative reputation of an intermediary has adverse effects—which also ought to be more difficult to overcome via additional eWOM information—for IEOs. We believe these factors ought to be considered in future research that aims at comparing the fundraising performance among different types of blockchain-based token offerings. In addition, we collected data from multiple sources, including data from the ventures attempting to raise capital. While we took great care to cross-check all data points, multiple data sources may have introduced biases, which further emphasizes the need for independent, comprehensive databases of token offering fundraising attempts. Furthermore, we explained the innate differences between ICOs and IEOs and highlight that these may induce a sample bias. For example, there is an emerging body of literature that provides preliminary insights on investor motivations in the context of ICOs (i.e., Chen, 2018; Zetzsche et al., 2017), which suggests token offerings may differ in their appeal to certain groups of investors. However, to the best of our knowledge, no empirical study to date provided comprehensive classifications of token types for IEOs, and we thus call on future scholars to provide comprehensive identification and comparison of token and investor types across the field.

Second, we encourage others to build on our present work and to advance insights into the performance of token offering fundraising mechanisms using new sources of data and methods. For example, topic modeling using Latent Dirichlet Allocation (LDA) is increasingly recognized to analyze large bodies of unstructured qualitative data sets (Antons et al., 2023). Topic modeling with LDA could therefore help future research in the domain to investigate innovation mechanisms of token offerings by analyzing white papers published in association of ICO or IEOs, but also webpages or social media postings (Antons & Breidbach, 2018). Such novel methodological pathway would likely help create an overview of the topics surrounding a specific token offering, which could reveal which characteristics of a venture seeking to raise capital through an IEO, but could also reveal if, and to what extent, the publication of whitepapers mitigates the effect of eWOM. This would also be of high managerial relevance, as it enables the venture itself to take a more strategic approach and to signal exactly those qualities it aims to communicate to others. Besides focusing on the investor audience, LDA could also help explore the characteristics and perception of the cryptocurrency exchange platforms launching IEOs. In particular, the reputation of a cryptocurrency exchange platform may be an effective signal prior to an IEO. While reputation could be operationalized by analyzing the number of followers, volume of mentions, or

the sentiment expressed about a particular cryptocurrency exchange platform across a variety of different social media channels (i.e., beyond Reddit or Twitter), applications of LDA might lead to even more fine-grained insights. We hope to inspire more respective research that considers these various factors when seeking to explain differences in fundraising performances within ICOs or IEOs and analyzing the general efficacy of social media signals.

Third, the financial performance of token offerings may also be affected by variables associated with signaling theory, as well as characteristics of the venture seeking funding that we did not include in our analyses. For example, signaling theory proposes properties of the signal (e.g., erosion, consistency, and scope), signaler (sending multiple signals and size), receiver (e.g., experience and culture), or the environment (e.g., distortion) as potentially impactful (Lins & Sunyaev, 2017), while the characteristics of the venture attempting to raise capital, investor characteristics, and characteristics pertaining to the fundraising platforms where the exchange occurs (i.e., size of user base, identity, or reputation/trust) could also be factors influencing fundraising outcomes. Indeed, while we highlighted that the characteristics of the venture attempting to raise capital have already been explored as success factors in extant research investigating ICOs (Roosenboom et al., 2020), we did not include these as variables in our present study, as it is unrelated to our hypothesized effects and might artificially inflate the fit of our model. We also followed the existing precedent for measuring fundraising performance. This could be further enhanced by considering more sophisticated performance measures such as buy-and-hold abnormal returns post-fundraising or the ratio of funding to estimated funding prior to the token offering. Furthermore, we assumed that the number of Reddit users mentioning a given token offering might play an important role. This is because the eWOM literature suggests that multiple posts by individual users might indicate an advocate "fan base" (if the sentiment is positive), or an adversary "hate group" (if message sentiment is negative) (Risius & Beck, 2015). Instead, we focused on the effects of Reddit, given prior research established the relevance of this platform for token offering performance (Chanson et al., 2018a, b). However, there might be platform dependencies, as well as other platforms that emerge in the future, which could replace Reddit. We therefore invite future research to explore the differential role of variables such as social media topics, platforms, social media groups, or project characteristics on the financial performance of ICOs as well as IEOs.

Fourth, the COVID-19 pandemic may have impacted the fundraising amounts observed when collecting data in April 2020. However, we cannot be certain whether the pandemic increased or decreased the amounts raised, considering that prior research suggests cryptocurrencies are used to hedge against economic uncertainty (Wieczner, 2018). While we, in this study, argue that the relation between eWOM and the financial performance of token-based fundraising mechanisms is not biased, we nevertheless highlight that COVID-19 may have impacted data collection, and that future research should aim to explore the link between the global pandemic and performance of token offering fundraising mechanisms.

Lastly, future research should also consider the negative implications of IEOs. The introduction of intermediaries and self-regulation also led to some of the same disadvantages that traditional fundraising methods experience. These include high economic rents cryptocurrency exchanges attempt to extract from entrepreneurs (Vitáris, 2020) and barriers to IEO success, which result from the fact that investors need to open an exchange account before buying native cryptocurrency tokens, which might exclude certain investors from participating in an IEO, thus reducing the size of the overall investor-base compared to ICOs (Tran, 2019). Finally, we examined IEOs and ICOs as independent fundraising mechanisms. Both approaches should not be viewed as disparate mechanisms where IEOs inspire trust and ICOs generally do not. Instead, we propose a continuum-based view on which, for example, ventures performing ICOs could provide additional information to establish the same level of trust themselves. There might be instances where organizations pursued both pathways, which raises the question as to whether interdependencies exist. For example, we imagine scenarios where an organization might pursue an IEO after a failed ICO. This raises new questions pertaining to the ability to raise subsequent funds—if any.

Appendix 1

OLS regressions with robust standard errors on blockchain-based token fundraising performance

$$Funding_i = \alpha + \beta_{CryptoNews} CryptoNews_i + \beta_{dOversubscribed} dOversubscribed_i + \beta_{MarketSentiment} MarketSentiment_i + \beta_{Duration} Duration_i + \beta_{VentureAge} VentureAge_i + \beta_{MinCap} MinCap_i + \beta_{dMaxCap} dMaxCap_i + \beta_{dPreSale} dPreSale_i + \beta_{PreSaleFunding} PreSaleFunding_i + \varepsilon_i$$

$$Funding_i = \alpha + \beta_{Volume} Volume + \beta_{Valence} Valence_i + \beta_{CryptoNews} CryptoNews_i + \beta_{dOversubscribed} dOversubscribed_i + \beta_{MarketSentiment} MarketSentiment_i + \beta_{Duration} Duration_i + \beta_{VentureAge} VentureAge_i + \beta_{MinCap} MinCap_i + \beta_{dMaxCapd} MaxCap_i + \beta_{dPreSaled} PreSale_i + \beta_{PreSaleFunding} PreSaleFunding_i + \varepsilon_i$$

$$Funding_i = \alpha + \beta_{Volume} Volume + \beta_{Valence} Valence_i + \beta_{Mechanism} dMechanism_i + \beta_{Mechanism*Volume} dMechanism_i * Volume_i + \beta_{Mechanism*Valence} dMechanism_i * Valence_i + \beta_{CryptoNews} CryptoNews_i + \beta_{dOversubscribed} dOversubscribed_i + \beta_{MarketSentiment} MarketSentiment_i + \beta_{Duration} Duration_i + \beta_{VentureAge} VentureAge_i + \beta_{MinCap} MinCap_i + \beta_{dMaxCap} dMaxCap_i + \beta_{dPreSale} dPreSale_i + \beta_{PreSaleFunding} PreSaleFunding_i + \varepsilon_i$$

Please note to consider the following variable transformations when interpreting the coefficients: financial performance (ln), pre-sale funding (ln), volume (square-root), and valence (arcsine).

Please note the following variable dummy coding: mechanism (ICO = 0, IEO = 1), oversubscribed (yes = 1, no = 0), max cap (present = 1, absent = 0), and pre-sale (present = 1, absent = 0).

Appendix 2

Discussion forums

Crypto news websites

Table 7 Selected crypto news websites

Crypto news websites	Average monthly visits (in millions)[a]
Coindesk	8.6
Cointelegraph	7.3
news.bitcoin.com	2.3
newsBTC	1.9
Bitcoinist	1.7
BitcoinMagazine	0.8
Cryptovest	0.6
BTCManager	0.5
TheMerkle	0.5

[a]This study chose the same crypto news websites as Chanson et al. (2020). The average monthly visits represent data that was collected on the 12.12.2018 from similarweb.com

Table 8 Selected discussion forums

Web location	Subscribers[a]
www.reddit.com/r/Bitcoin	1'356'845
www.reddit.com/r/Cryptocurrency	992'991
www.reddit.com/r/ethereum	456'852
www.reddit.com/r/litecoin	212'913
www.reddit.com/r/btc	290'817
www.reddit.com/r/Ripple	211'861
www.reddit.com/r/ethtrader	228'057
www.reddit.com/r/Cryptomarkets	207'497
www.reddit.com/r/dogecoin	152'150
www.reddit.com/r/iota	114'855
Sum Reddit	**4'224'838**

[a]The subscribers data was collected on the 06.04.2020 from redditmetrics.com

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References

Ackermann, E., Bock, C., & Bürger, R. (2020). Democratising entrepreneurial finance: the impact of crowdfunding and initial coin offerings (ICOs). In A. Moritz, J. Block, S. Golla, & A. Werner (Eds.), *Contemporary developments in entrepreneurial finance. An Academic and Policy Lens on the Status-Quo, Challenges and Trends* (pp. 277–308). Springer.

Adhami, S., Giudici, G., & Martinazzi, S. (2017). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business, 100*, 64–75.

Aggarwal, R., Gopal, R., Gupta, A., & Singh, H. (2012). Putting money where the mouths are: the relation between venture financing and electronic word-of-mouth. *Information Systems Research, 23*(3), 976–992.

Aiken, K. D., Liu, B. S., Mackoy, R. D., & Osland, G. E. (2004). Building internet trust: signalling through trustmarks. *International Journal of Internet Marketing and Advertising, 1*(3), 251–267.

Albrecht, S., Lutz, B., & Neumann, D. (2020). The behavior of blockchain ventures on Twitter as a determinant for funding success. *Electronic Markets, 30*(2), 241–257.

Altman, D. G., Schulz, K. F., Moher, D., Egger, M., Davidoff, F., Elbourne, D., Gøtzsche, P. C., Lang, T., & Group, C. (2001). The revised CONSORT statement for reporting randomized trials: explanation and elaboration. *Annals of internal medicine, 134*(8), 663–694.

Amsden, R., & Schweizer, D. (2018). Are blockchain crowdsales the new'gold rush'? Success determinants of initial coin offerings. *SSRN*, 1–66. https://doi.org/10.2139/ssrn.3163849

An, J., Duan, T., Hou, W., & Xu, X. (2019). Initial coin offerings and entrepreneurial finance: the role of founders' characteristics. *The Journal of Alternative Investments, 21*(4), 26–40.

Ante, L., & Fiedler, I. (2020). Cheap signals in security token offerings. *Quantitative Finance and Economics, 4*(4), 608–639.

Ante, L., Sandner, P., & Fiedler, I. (2018). Blockchain-based ICOs: pure hype or the dawn of a new era of startup financing? *Journal of Risk and Financial Management, 11*(4), 1–19.

Antons, D., & Breidbach, C. F. (2018). Big data, big insights? Advancing service innovation and design with machine learning. *Journal of Service Research, 21*(1), 17–39.

Antons, D., Breidbach, C. F., Joshi, A. M., & Salge, T. O. (2023). Computational literature reviews: method, algorithms, and roadmap. *Organizational Research Methods, 26*(1), 107–138.

Arnold, L., Brennecke, M., Camus, P., Fridgen, G., Guggenberger, T., Radszuwill, S., Rieger, A., Schweizer, A., & Urbach, N. (2019). Blockchain and initial coin offerings: blockchain's implications for crowdfunding. In H. Treiblmaier & R. Beck (Eds.), *Business transformation through blockchain* (pp. 233–272). Springer.

Bachmann, N. M., Drasch, B., Fridgen, G., Miksch, M., Regner, F., Schweizer, A., & Urbach, N. (2022). Tarzan and chain: exploring the ICO jungle and evaluating design archetypes. *Electronic Markets, 32*(3), 1725-1748. https://doi.org/10.1007/s12525-021-00463-6

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is Stronger than Good. *Review of General Psychology, 5*, 323–370.

Beck, R., Stenum Czepluch, J., Lollike, N., & Malone, S. (2016). Blockchain-the gateway to trust-free cryptographic transactions. In *24th European Conference on Information Systems (ECIS, İstanbul*.

Bellemare, M. F., & Wichman, C. J. (2020). Elasticities and the inverse hyperbolic sine transformation. *Oxford Bulletin of Economics and Statistics, 82*(1), 50–61.

Bendig, D., Brettel, M., & Guske, N. (2018). Skin in the game: an agency perspective on information asymmetry in initial coin offerings. *Academy of Management Global Proceedings, Tel Aviv, Israel*(2018), 1-2. https://doi.org/10.5465/amgblproc.telaviv.2018.0088.abs

Benedetti, H., & Kostovetsky, L. (2021). Digital tulips? Returns to investors in initial coin offerings. *Journal of Corporate Finance, 66*, 1–20.

Binance. (2020). *Binance launchpad*. Retrieved January 5, 2022 from https://launchpad.binance.com/

Boreiko, D., & Sahdev, N. K. (2018). To ICO or not to ICO–empirical analysis of initial coin offerings and token sales. *SSRN*, 1–33. https://doi.org/10.2139/ssrn.3209180

Borri, N. (2019). Conditional tail-risk in cryptocurrency markets. *Journal of Empirical Finance, 50*, 1–19.

Breidbach, C. F., Joshi, A. M., Maglio, P. P., von Briel, F., Twigg, A., Dickens, G., & Wünderlich, N. V. (2022). How everything-as-a-service enabled judo to become a billion-dollar bank without owning IT. *MIS Quarterly Executive, 21*(3), 197–219.

Breidbach, C. F., Keating, B. W., & Lim, C. (2020). Fintech: research directions to explore the digital transformation of financial service systems. *Journal of Service Theory and Practice, 30*(1), 79–102.

Breznitz, D., Forman, C., & Wen, W. (2018). The role of venture capital in the formation of a new technological ecosystem: evidence from the cloud. *MIS quarterly, 42*(4), 1143–1169.

Brochado, A., & Troilo, M. L. (2021). Initial coin offerings: an emergent research area. *Digital Policy, Regulation and Governance, 23*(2), 113–131.

Bruckner, M., Straub, A., & Veit, D. (2020). *Initial coin offerings, how do investors decide? A systematic literature review*. Americas Conference on Information Systems (AMCIS).

Burke, J. F., Sussman, J. B., Kent, D. M., & Hayward, R. A. (2015). Three simple rules to ensure reasonably credible subgroup analyses. *British Medical Journal, 351*(5651), 1–5. https://doi.org/10.1136/bmj.h5651

Certo, S. T. (2003). Influencing initial public offering investors with prestige: signaling with board structures. *Academy of management review, 28*(3), 432–446.

Chanson, M., Gjoen, J., Risius, M., & Wortmann, F. (2018a). Initial coin offerings (ICOs): the role of social media for organizational legitimacy and underpricing. In *39th International Conference on Information Systems (ICIS), San Francisco, USA*.

Chanson, M., Risius, M., & Wortmann, F. (2018b). Initial coin offerings (ICOs): an introduction to the novel funding mechanism based on blockchain technology. In *24th Americas Conference on Information Systems, New Orleans, USA*.

Chanson, M., Martens, N., & Wortmann, F. (2020). The role of user-generated content in blockchain-based decentralized finance.

In *28th European Conference on Information Systems (ECIS), Marrakech*.

Chen, K. (2019). Information asymmetry in initial coin offerings (ICOs): investigating the effects of multiple channel signals. *Electronic Commerce Research and Applications, 36*, 1–11.

Chen, Y. (2018). Blockchain tokens and the potential democratization of entrepreneurship and innovation. *Business Horizons, 61*(4), 567–575.

Chen, Y., Wang, Q., & Xie, J. (2011). Online social interactions: a natural experiment on word of mouth versus observational learning. *Journal of Marketing Research, 48*, 238–254.

Cheung, C. M. K., Xiao, B. S., & Liu, I. L. B. (2014). Do actions speak louder than voices? The signaling role of social information cues in influencing consumer purchase decisions. *Decision Support Systems, 65*, 50–58.

Chu, J., Zhang, Y., & Chan, S. (2019). The adaptive market hypothesis in the high frequency cryptocurrency market. *International Review of Financial Analysis, 64*, 221–231.

Clogg, C. C., Petkova, E., & Haritou, A. (1995). Statistical methods for comparing regression coefficients between models. *American journal of sociology, 100*(5), 1261–1293.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: a review and assessment. *Journal of management, 37*(1), 39–67.

Conrado, S. P., Neville, K., Woodworth, S., & O'Riordan, S. (2016). Managing social media uncertainty to support the decision making process during emergencies. *Journal of Decision Systems, 25*(sup1), 171–181.

Cook, R. D. (1977). Detection of influential observation in linear regression. *Technometrics, 19*(1), 15–18.

Corporation, S. (2023). *What is IEO?* Medium. Retrieved January 5, 2023 from https://medium.com/coinmonks/what-is-ieo-8879927645a7

D'Agostino, R. B., Belanger, A., & D'Agostino, R. B., Jr. (1990). A suggestion for using powerful and informative tests of normality. *The American Statistician, 44*(4), 316–321.

Davidson, R., & MacKinnon, J. G. (1993). Transforming the dependent variable. In *Estimation and inference in econometrics* (Vol. 63, pp. 480–510).

Davydiuk, T., Gupta, D., & Rosen, S. (2023). De-crypto-ing signals in initial coin offerings: evidence of rational token retention. *Management Science, Forthcoming*, 1-41. https://doi.org/10.1287/mnsc.2022.4631

De Filippi, P., & Wright, A. (2018). *Code as law. In Blockchain and the Law (pp. 193-204)*. Harvard University Press. https://doi.org/10.2307/j.ctv2867sp.15

Dell'Erba, M. (2018). Initial coin offerings. A primer. The first response of regulatory authorities. *NYU Journal of Law & Business, 14*, 1–28.

Fisch, C. (2019). Initial coin offerings (ICOs) to finance new ventures. *Journal of Business Venturing, 34*(1), 1–22. https://doi.org/10.1016/j.jbusvent.2018.09.007

Fisch, C., Masiak, C., Vismara, S., & Block, J. (2019). Motives and profiles of ICO investors. *Journal of Business Research, 125*, 564–576.

Fletcher, J. (2007). Subgroup analyses: how to avoid being misled. *British Medical Journal (BMJ), 335*(7610), 96–97. https://doi.org/10.1136/bmj.39265.596262.AD

Fridgen, G., Regner, Ferdinand, Schweizer, A., & Urbach, N. (2018) Don't slip on the initial coin offering (ICO) – a taxonomy for a blockchain-enabled form of crowdfunding. In *26th European Conference on Information Systems (ECIS), Portsmouth, UK* (pp. 1–18).

Glaser, F. (2017). Pervasive decentralisation of digital infrastructures: A framework for blockchain enabled system and use case analysis. In *50th Hawaii International Conference on System Sciences (HICSS)*, Waikoloa.

Guske, N., & Bendig, D. (2018). Cutting out the noise costly vs. costless signals in initial coin offerings. In *39th International Conference on Information Systems (ICIS)*.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis: a global perspective (7th ed.)*. Pearson.

Hobbs, J. E. (2004). Information asymmetry and the role of traceability systems. *Agribusiness: An International Journal, 20*(4), 397–415. https://doi.org/10.1002/agr.20020

Hrga, A., Benčić, F.-M., & Žarko, I. P. (2019). Technical analysis of an initial coin offering. In *15th International Conference on Telecommunications (ConTEL)*.

Huang, W., Meoli, M., & Vismara, S. (2020). The geography of initial coin offerings. *Small Business Economics, 55*(1), 77–102.

Hutto, C., & Gilbert, E. (2014). Vader: A parsimonious rule-based model for sentiment analysis of social media text. *Proceedings of the International AAAI Conference on Web and Social Media, 8*(1), 216–225. https://doi.org/10.1609/icwsm.v8i1.14550

Iurina, A. (2017). *Initial coin offering in Gibraltar-case study: Calidumcoin* [Thesis, Karelia University of Applied Sciences]. https://www.theseus.fi/bitstream/handle/10024/138654/Iurina_Alina.pdf?sequence=1&isAllowed=y

Jin, S., Ali, R., & Vlasov, A. (2017). Cryptoeconomics: Data application for token sales analysis. In *38th International Conference on Information Systems (ICIS), Special Interest Group on Big Data Proceedings*.

Kaal, W., & Dell'Erba, M. (2017). Initial coin offerings: Emerging practices, risk factors, and red flags. *SSRN*, 1–22. https://doi.org/10.2139/ssrn.3067615

Karasek, R., & Bryant, P. C. (2012). Signaling theory: Past, present, and future. *Academy of Strategic Management Journal, 11*, 91–113.

Li, Q., Wang, T., Li, P., Liu, L., Gong, Q., & Chen, Y. (2014). The effect of news and public mood on stock movements. *Information Sciences, 278*, 826–840.

Lins, S., & Sunyaev, A. (2017). Unblackboxing IT certifications: A theoretical model explaining IT certification effectiveness. In *38th International Conference on Information Systems (ICIS)*.

Lipusch, N. (2018). Initial coin offerings–A paradigm shift in funding disruptive innovation. *SSRN*, 1–21. https://doi.org/10.2139/ssrn.3148181

Liu, C., & Wang, H. (2019). Crypto tokens and token offerings: An introduction. In S. Goutte, K. Guesmi, & S. Saadi (Eds.), *Cryptofinance and mechanisms of exchange* (chapter 8, pp. 125–144). Springer.

Lundmark, L. W., Oh, C., & Verhaal, J. C. (2017). A little Birdie told me: Social media, organizational legitimacy, and underpricing in initial public offerings. *Information Systems Frontiers, 19*(6), 1407–1422.

Mai, F., Shan, Z., Bai, Q., Wang, X., & Chiang, R. H. L. (2018). How does social media impact Bitcoin value? A test of the silent majority hypothesis. *Journal of Management Information Systems, 35*, 19–52.

Mavlanova, T., Benbunan-Fich, R., & Koufaris, M. (2012). Signaling theory and information asymmetry in online commerce. *Information & Management, 49*(5), 240–247. https://doi.org/10.1016/j.im.2012.05.004

Mendelson, M. (2019). From initial coin offerings to security tokens: a US Federal Securities law analysis. *Stanford Technology Law Review, 22*(1), 52–94.

MN. (2019). *What is initial exchange offering (IEO)? — The evolution of IEO market.* medium. Retrieved January 5, 2023 from https://medium.com/@mario_15681/what-is-an-initial-exchange-offering-ieo-afc7ac87483c

Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing, 29*(1), 1–16.
Momtaz, P. P. (2019). Token sales and initial coin offerings: Introduction. *The Journal of Alternative Investments, 21*(4), 7–12.
Momtaz, P. P. (2021). Entrepreneurial finance and moral hazard: Evidence from token offerings. *Journal of Business Venturing, 36*(5), 1–24.
Muzellec, L., Ronteau, S., & Lambkin, M. (2015). Two-sided Internet platforms: A business model lifecycle perspective. *Industrial Marketing Management, 45*, 139–150.
Najaf, K., Subramaniam, R. K., & Atayah, O. F. (2022). Understanding the implications of FinTech peer-to-peer (P2P) lending during the COVID-19 pandemic. *Journal of Sustainable Finance & Investment, 12*(1), 87–102.
Nofer, M., Gomber, P., Hinz, O., & Schiereck, D. (2017). Blockchain. *Business & Information. Systems Engineering, 3*, 1–5.
NYSE. (2014). *Technologies and SMA announce agreement to distribute social media analysis data via SFTI*. Retrieved 27th August 2014 from http://www.nyse.com/press/1360840642983.html
Ooi, G. Y. (2018). *What is an initial exchange offering (IEO)?* Medium. Retrieved January 5, 2023 from https://medium.com/traceto-io/what-is-an-initial-exchange-offering-ieo-245a7cf72f28
Ozturk, H. S. (2019). *What is the meaning of initial exchange offering (IEO) and how does it work?* Medium. Retrieved January 5, 2023 from https://medium.com/swlh/what-is-the-meaning-of-initial-exchange-offering-ieo-and-how-does-it-work-32c22505586c
Paternoster, R., Brame, R., Mazerolle, P., & Piquero, A. (1998). Using the correct statistical test for the equality of regression coefficients. *Criminology, 36*(4), 859–866.
Perez, C., Sokolova, K., & Konate, M. (2020). Digital social capital and performance of initial coin offerings. *Technological Forecasting and Social Change, 152*, 1–14.
Purdy, J. (2019). *The evolution of crypto capital markets*. messari.io. Retrieved January 5, 2023 from https://messari.io/report/the-evolution-of-crypto-capital-markets
PWC. (2020). *6th ICO / STO report: global crypto fundraising - Switzerland as an attractive hub and tokenisation centre*. Price Waterhouse Coopers. Retrieved January 5, 2023 from https://www.pwc.ch/en/insights/fs/6th-ico-sto-report.html
Risius, M., Akolk, F., & Beck, R. (2015). Differential emotions and the stock market. The case of company-specific trading. *23rd European Conference on Information Systems (ECIS)*.
Risius, M., & Beck, R. (2015). Effectiveness of corporate social media activities in increasing relational outcomes. *Information & Management, 52*, 824–839.
Risius, M., & Spohrer, K. (2017). A blockchain research framework: what we (don't) know, where we go from here, and how we will get there. *Business & Information Systems Engineering, 59*(6), 385–409.
Robey, D., Anderson, C., & Raymond, B. (2013). Information technology, materiality, and organizational change: a professional odyssey. *Journal of the Association for Information Systems, 14*(7), 379–398.
Rohr, J., & Wright, A. (2018). Blockchain-based token sales, initial coin offerings, and the democratization of public capital markets. *Hastings Law Journal, 70*(2), 463–524.
Roosenboom, P., van der Kolk, T., & de Jong, A. (2020). What determines success in initial coin offerings? *Venture Capital, 22*(2), 161–183.
Royston, P. (1992). Comment on sg3.4 and an improved D'Agostino test. *Stata Technical Bulletin, 1*(3), 1–28 https://EconPapers.repec.org/RePEc:tsj:stbull:y:1992:v:1:i:3:sg3.5
Sarker, S., Chatterjee, S., Xiao, X., & Elbanna, A. (2019). The sociotechnical axis of cohesion for the IS discipline: Its historical legacy and its continued relevance. *MIS Quarterly, 43*(3), 695–720.
Seth, S. (2018). *80% of ICOs are scams: report*. Investopia. Retrieved February 8, 2021 from https://www.investopedia.com/news/80-icos-are-scams-report/
Siering, M. (2019). The economics of stock touting during Internet-based pump and dump campaigns. *Information Systems Journal, 29*(2), 456–483. https://doi.org/10.1111/isj.12216
Singer, P., Flöck, F., Meinhart, C., Zeitfogel, E., & Strohmaier, M. (2014). Evolution of Reddit: from the front page of the internet to a self-referential community? In *23rd International Conference on World Wide Web (IW3C2)*.
Smailović, J., Grčar, M., Lavrač, N., & Žnidaršič, M. (2013). Predictive sentiment analysis of tweets: a stock market application. In A. Holzinger & G. Pasi (Eds.), *Human-Computer Interaction and Knowledge Discovery in Complex, Unstructured, Big Data* (Vol. 7947, pp. 77–88). Springer. https://doi.org/10.1007/978-3-642-39146-0_8
Spence, A. M. (1975). The economics of internal organization: An introduction. *The Bell Journal of Economics, 6*(1), 163–172. https://doi.org/10.2307/3003219
Spence, M. A. (1973). Job market signaling. *Quarterly Journal of Economics, 87*(3), 355–374.
Sprenger, T. O., Sandner, P. G., Tumasjan, A., & Welpe, I. M. (2014a). News or noise? Using Twitter to identify and understand company-specific news flow. *Journal of Business Finance & Accounting, 41*, 791–830.
Sprenger, T. O., Tumasjan, A., Sandner, P. G., & Welpe, I. M. (2014b). Tweets and trades: the information content of stock microblogs. *European Financial Management, 20*, 926–957.
Srivastava, J., & Lurie, N. (2001). A consumer perspective on price-matching refund policies: effect on price perceptions and search behavior. *Journal of Consumer Research, 28*(2), 296–307.
Steinert, L., & Herff, C. (2018). Predicting altcoin returns using social media. *PloS One, 13*(12), e0208119.
Thies, F., Wallbach, S., Wessel, M., Besler, M., & Benlian, A. (2022). Initial coin offerings and the cryptocurrency hype-the moderating role of exogenous and endogenous signals. *Electronic Markets, 32*(3), 1691–1705. https://doi.org/10.1007/s12525-021-00460-9
Tiwari, M., Gepp, A., & Kumar, K. (2020). The future of raising finance-a new opportunity to commit fraud: A review of initial coin offering (ICOs) scams. *Crime, Law and Social Change, 73*(4), 417–441.
Tran, K. C. (2019). *What is an initial exchange offering (IEO)?* decrypt. Retrieved January 5, 2023 from https://decrypt.co/resources/initial-exchange-offering-guide-explainer
Vitáris, B. (2020). *What is an initial exchange offering (IEO) and how it differs from ICO?* CryptoPotato. Retrieved January 5, 2023 from https://cryptopotato.com/what-is-an-initial-exchange-offering-ieo-and-how-it-differs-from-ico/
Wang, R., & Ware, J. H. (2013). Detecting moderator effects using subgroup analyses. *Prevention Science, 14*(2), 111–120. https://doi.org/10.1007/s11121-011-0221-x
Wang, T., Zhao, S., & Zhou, M. (2022). Does soft information in expert ratings curb information asymmetry? Evidence from crowdfunding and early transaction phases of initial coin offerings. *Journal of International Financial Markets, Institutions and Money, 81*, 1–24.
Wieczner, J. (2018). *Why bitcoin may not be digital gold after all*. Yahoo! Finance. Retrieved June 4, 2018 from https://finance.yahoo.com/news/why-bitcoin-may-not-digital-235928422.html
Wooldridge, J. (2013). *Introductory econometrics: a modern approach (E. Joyner, Ed. 5 ed.)*. South-Western Cengage Learning.
Wooldridge, J. M. (2015). *Introductory econometrics: a modern approach*. Cengage learning.
Zetzsche, D. A., Buckley, R. P., Arner, D. W., & Föhr, L. (2017). The ICO gold rush: it's a scam, it's a bubble, it's a super challenge for regulators. *University of Luxembourg Law Working Paper* (11), 17–83. https://doi.org/10.2139/ssrn.3072298