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ICO vs. IPO: Empirical Findings, Information Asymmetry, and the Appropriate Regulatory Framework

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ABSTRACT

Initial coin offerings (ICOs) are a new form of fundraising whereby blockchain-related ventures raise public capital in exchange for newly issued digital tokens. In recent years, ICOs have been a prominent focus of legal and economic studies, which analyze their characteristics and determinants of their success. In this Article, we systematically review these studies and identify key ICO success factors. We then offer theoretical explanations for our findings, and in certain cases, connect the empirical results with the IPO and crowdfunding literatures. The results of our analysis are important for two reasons. First, there is no single formal data source, and there is evidence of inconsistencies across the different data sources available. Second, our results show in what circumstances ICO investors and initiators behave like IPO investors and initiators, and hence contribute to the literature on tokens as securities. In the second part of this Article, based on our analysis, we show that a high degree of information asymmetry exists in ICOs, identify three sources of informational asymmetries, and discuss the role of signaling theory and rating websites in mitigating these asymmetries. Finally, we discuss the regulatory implications of our findings, and propose specific disclosure requirements tailored to ICOs.

Keywords: Initial Coin Offerings (ICO), Initial Public Offering (IPO), Cryptocurrency, Digital Tokens, Securities Regulation
JEL Classification: K22, G14, G18, G23, G28

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TABLE OF CONTENTS

I. INTRODUCTION

Initial coin offerings (ICOs) are a new form of fundraising whereby blockchain-related ventures raise public capital in exchange for newly issued digital tokens. The issued tokens may represent a variety of rights, ranging from financial rights, such as dividend and voting rights, to consumptive rights, such as the right to access a service or a product that the issuer will provide. After the fundraising ends, the issued tokens are generally traded on the secondary market.

ICOs have quickly emerged as a popular fundraising method. While the idea of an ICO was first applied in 2013,[1] by 2017, over $10 billion was raised by over one thousand firms,[2] and by October 2018, over $21 billion was raised by over three thousand firms.[3] This rapid growth can be explained by various factors. From investors' perspectives, cryptocurrencies are perceived as a "hedge against volatile local currencies and geopolitical risk," and their growth might be related to a continuing distrust in the traditional banking sector since the 2008 financial crises.[4] Additionally, growing media

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1. *See* Laura Shin, *Here's The Man Who Created ICOs And This Is The New Token He's Backing*, FORBES (Sept. 21, 2017), https://www.forbes.com/sites/laurashin/2017/09/21/heres-the-man-who-created-icos-and-this-is-the-new-token-hes-backing/#7ec40f611839 [https://perma.cc/RKE9-2TPT] (archived Nov. 10, 2019) (discussing the background surrounding the creation of the first ICO).

2. *See ICO Market Analysis 2018*, ICOBENCH 4, https://icobench.com/reports/ICO_Market_Analysis_2018.pdf (last visited Nov. 8, 2019) [https://perma.cc/G7JZ-LR9B] (archived Nov. 8, 2019) (providing quantitative data related to ICOs for 2017 and 2018).

3. *See* Paul P. Momtaz, Kathrin Rennertseder & Henning Schröder, *Token Offerings: A Revolution in Corporate Finance?*, 49 CAPCO INST. J. FIN. TRANSFORMATION 32, 33 (2019) (describing "the evolution of the token offering market.").

4. Ryan Clements, *Assessing the Evolution of Cryptocurrency: Demand Factors, Latent Value, and Regulatory Developments*, 8 MICH. BUS. & ENTREPRENEURIAL L. REV. 73, 78 (2018).

attention,[5] combined with astronomic returns for early investors—with returns on investment (ROIs) exceeding fifty thousand percent[6]—have attracted investor interest. From ventures' perspectives, an ICO is an attractive alternative source of funding, because it may reduce transaction costs compared to traditional financing methods, it has a global outreach, and it enables ventures to establish a customer base during the fundraising.[7]

Despite their rapid growth, many aspects of ICOs remain unclear. First, the terminology around the ICO phenomenon is yet unsettled and different scholars and regulators tend to use different terms for identical concepts. Second, very few studies analyze the valuation of ICOs, which therefore remains unclear. Third, tokens vary dramatically in their nature. They may represent a wide range of rights, from financial rights to consumptive rights, and hence their regulatory status is unclear. Complicating matters further, various jurisdictions have adopted a range of approaches, from banning ICOs to a crypto-friendly approach. Against that background, empirical and theoretical studies have analyzed various issues related to ICOs, trying to reduce the uncertainty associated with the market. This Article contributes to the growing literature on ICOs by providing thorough analysis of two specific key areas: determinants of ICO success and information asymmetry.

Determinants of ICO success. Since its boom in 2017, the ICO phenomenon has attracted legal and economic empirical studies, which have analyzed determinants of ICO success.[8] Their findings have often been inconsistent, however. One possible reason is that there are no official data sources, and there is evidence of inconsistencies across

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5. *See id.* at 75 (introducing media attention as one of the factors driving unprecedented growth in the cryptocurrencies market during 2017).

6. *See* Coin and Crypto, *Early Investors are Making 50,000% Returns on ICOs*, HACKER NOON (Dec. 3, 2017), hackernoon.com/investors-are-making-50-000-returns-on-icos-32432bc741d1 [https://perma.cc/E68G-CXBB] (archived Nov. 10, 2019) (introducing the concept of ICO and its return on investment trends); *Top 10 ICOs with the Biggest ROI*, COINTELEGRAPH, cointelegraph.com/ico-101/top-10-icos-with-the-biggest-roi#10-qtum--9225-roi (last visited Nov. 8, 2019) [https://perma.cc/PPU6-AE6V] (archived Nov. 10, 2019) (explaining that 2017 was a very profitable year for ICOs and introducing the most successful ICO campaigns at the time of publication).

7. *See* Saman Adhami, Giancarlo Giudici & Stefano Martinazzi, *Why Do Businesses Go Crypto? An Empirical Analysis of Initial Coin Offerings*, 100 J. ECON. & BUS. 64, 65 (2018) (setting forth the reasons why the increasing success of ICOs is relevant to business activity); Jiri Chod & Evgeny Lyandres, A Theory of ICOs: Diversification, Agency, and Information Asymmetry 3 (July 18, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3159528 [https://perma.cc/ZV8V-TQTY] (archived Nov. 10, 2019) (arguing that ICOs are the preferred source of financing for under-diversified venture capital investors when the venture payoff is highly uncertain, because ICO financing increases the entrepreneurs' options to retain cash and increase the required return).

8. See *infra* Part III.

various data sources.[9] To address this, the Article provides an overview of the empirical literature. It aggregates empirical studies using different data sources and methodologies to identify factors that affect ICO success. Subsequently, it compares the results with empirical studies in the context of initial public offerings (IPOs) and crowdfunding, and then offers theoretical explanations for the findings.

The results in this part are important for two reasons. First, by combining empirical results from a large number of empirical studies, using different data sources and methodologies, this Article provides a comprehensive and accurate meta-analysis of factors that affect ICOs. This analysis is especially important given the absence of a formal data source. Second, this Article compares determinants of ICO success with determinants of IPO success, and thus shows in what circumstances ICO investors and initiators behave like IPO investors and initiators.[10] As such, it contributes to the literature that discusses the classification of tokens as securities.

Information asymmetry. The second part of the analysis focuses on information asymmetry. Information asymmetry is one of the most important sources of market friction. It is a condition associated with financial markets, wherein potential investors lack information required to assess the true quality of the financial product.[11] Potentially, this may create a market for lemons, where high-quality

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9. *See* Evgeny Lyandres, Berardino Palazzo & Daniel Rabetti, Do Tokens Behave Like Securities? An Anatomy of Initial Coin Offerings 9 (Apr. 2019) (unpublished manuscript) (on file with SSRN), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3287583 [https://perma.cc/EU5U-FCEU] (archived Nov. 10, 2019) (documenting substantial inconsistencies across data sources—especially for the following variables: amount raised, hard cap, the number of tokens available for sale, and the overall number of project-related tokens issued); Lauren Rhue, Trust is All You Need: An Empirical Exploration of Initial Coin Offerings (ICOs) and ICO Reputation Scores 23 (May 16, 2018) (unpublished manuscript) (on file with SSRN), papers.ssrn.com/sol3/papers.cfm?abstract_id=3179723 [https://perma.cc/92QH-P7Z6] (archived Nov. 10, 2019) (finding that reputation scores are inconsistent across different data sources).

10. For a similar approach, *see generally* Lyandres et al., *supra* note 9, at 7–30 (comparing ICOs data to typical securities' outcomes to determine whether ICOs should be deemed a type of securities for regulatory purposes).

11. *See* Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J. FIN. ECON. 305, 354–55 (1976) (discussing the value of monitoring tools as a source of information to investors and its potential reflection on portfolio returns); Paul P. Momtaz, Entrepreneurial Finance and Moral Hazard: Evidence from Token Offerings 6–7 (Apr. 4, 2019) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3343912 [https://perma.cc/G6HG-GX29] (archived Nov. 10, 2019) [hereinafter Moral Hazard] (discussing the effect of information asymmetry in token sales).

companies will be deterred from entering the market.[12] Following a growing body of literature in the context of IPOs,[13] venture capitalists (VC),[14] and crowdfunding,[15] recent empirical studies document significant evidence for information asymmetry and poor disclosure in the ICO realm.

Against that background, this Article outlines three sources of informational asymmetries—the absence of standard disclosure requirements, investors' lack of fundamental technical knowledge, and projects' early stages of development during the offering[16]—and discusses the role of signaling theory and rating websites in mitigating these asymmetries.

Signaling Theory examines how high-quality ventures can distinguish themselves from low-quality firms by sending signals about the venture's true quality.[17] Given the severe information asymmetry associated with the market, coupled with the high variation in ICOs' quality, the Article argues that high-quality ICOs are incentivized to send signals about the true quality of ventures, and examines whether they can signal quality through voluntary disclosure and technological capabilities. The analysis presented in this Article suggests that the effect of providing more extensive information in white papers is unclear, which implies that the effectiveness of signaling in mitigating informational asymmetries in the ICO context is limited.

Rating websites study ICOs and make recommendations on their tokens. Considering the information asymmetry associated with the

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12. *See* George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488, 488 (1970) (introducing the issue of a decreased average quality of products and size of the market in those markets which use market statistics to determine the quality of future purchases).

13. *See, e.g.*, Boyd D. Cohen & Thomas J. Dean, *Information Asymmetry and Investor Valuation of IPOs: Top Management Team Legitimacy as a Capital Market Signal*, 26 STRATEGIC MGMT. J. 683, 683–85 (2005) (introducing the issues created by information asymmetry in the IPO context).

14. *See, e.g.*, Ronald J. Gilson, *Engineering a Venture Capital Market: Lessons from the American Experience*, 55 STAN. L. REV. 1067, 1076–78 (2003) (highlighting the role of information asymmetry in venture capital investments that involve technology and cutting-edge science).

15. *See, e.g.*, Gerrit K.C. Ahlers, Douglas Cumming, Christina Günther & Denis Schweizer, *Signaling in Equity Crowdfunding*, 39 ENTREPRENEURSHIP THEORY & PRAC. 955, 959 (2015) (discussing how information asymmetry between investors and entrepreneurs in the crowdfunding context may result in a lack of funding for high-performing ventures).

16. These sources were initially identified by Christian Fisch. *See* Christian Fisch, *Initial Coin Offerings (ICOs) to Finance New Ventures*, 34 J. BUS. VENTURING 1, 6 (2019); *see also* Moral Hazard, *supra* note 11, at 6–7 (exploring the sources of information asymmetry in the context of token sales).

17. *See* Brian L. Connelly, S. Trevis Certo, R. Duane Ireland & Christopher R. Reutzel, *Signaling Theory: A Review and Assessment*, 37 J. MGMT. 39, 40 (2011) (providing examples of the use of the signaling theory across different spectrums, including, for example, recruiting or corporate governance).

market, the Article argues that these websites play a vital intermediary role. The absence of traditional underwriters—who play a critical intermediary role in the IPO market[18]—coupled with the complexity of this new technology, increase the demand for information. Analysts may screen ICOs' information disclosure and signaling and make it more accessible to unsophisticated investors, for whom conducting due diligence on each ICO might be too costly. However, the Article demonstrates major drawbacks with regard to their ratings, such as inconsistency, inaccuracy, and lack of reference to the source code—which is the *de facto* business model of the project. Therefore, the Article argues that the effectiveness of analyst rating in mitigating the information asymmetry associated with the market is limited as well.

These findings suggest that ICO investors are not entirely rational, and hence that we cannot fully rely on the competitive forces of an economy in this case. Therefore, the Article argues that regulators should address the sources of informational asymmetries discussed in this Article—which are a source of investors' irrationality—by mandatory disclosure provisions. To this end, based on the empirical analysis, this Article proposes specific disclosure requirements tailored to the unique characteristics of ICOs. By doing so, this Article contributes to the discussion on optimal ICO regulation.

The remainder of this Article is organized as follows. Part II provides a comprehensive overview of the foundations of blockchain and ICOs. Part III provides an analysis of the empirical literature related to ICO characteristics. The first subpart presents a brief overview of the market, and the subsequent subparts analyze the association between ICO characteristics and success. Part IV focuses on information asymmetry; it discusses three sources of informational asymmetries and examines the role of signaling theory and rating websites in mitigating these asymmetries. Part V discusses the regulatory implications of the findings of this study and proposes specific disclosure requirements tailored to ICOs.

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18. *See* Jongsub Lee, Tao Li & Donghwa Shin, The Wisdom of Crowds and Information Cascades in FinTech: Evidence from Initial Coin Offerings 1, 6–7, 16, 27 (May 2018) (unpublished manuscript) (on file with author), https://www.fdic.gov/bank/analytical/cfr/bank-research-conference/annual-18th/17-li.pdf [https://perma.cc/BAL2-82CG] (archived Nov. 10, 2019) (introducing the role of underwriters in IPOs and contrasting it to the operational framework surrounding ICOs).

II. AN OVERVIEW OF THE FOUNDATIONS OF BLOCKCHAIN AND ICOS

The terminology around blockchain technology is yet unsettled and hence often confusing. Different scholars and regulators tend to use different terms for identical concepts.[19] To avoid inconsistency, as a preliminary matter, the Article provides a general overview of the fundamental terms associated with the blockchain phenomenon. The technical aspects of blockchain and cryptocurrencies will not be discussed in greater detail in the Article, since they are not necessary to understand the main arguments developed in the Article.

A. *Blockchain*

Blockchain is a decentralized database hosted by a network of computers (called nodes)[20] that communicate with each other via the internet.[21] It is generally used to track and record the ownership information about any asset to which a unique identifier can be

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19. *See* Angela Walch, *The Path of the Blockchain Lexicon (and the Law)*, 36 REV. BANKING & FIN. L. 713, 728–35 (2017) (describing the inconsistency associated with the blockchain's underlying vocabulary and suggesting that it reflects the uncertainty around this new phenomenon); Juri Mattila, *The Blockchain Phenomenon: The Disruptive Potential of Distributed Consensus Architectures* 2 (Res. Inst. of the Finnish Econ. (ETLA), Working Paper No. 38, 2016), www.etla.fi/wp-content/uploads/ETLA-Working-Papers-38.pdf [https://perma.cc/Z3S8-8FRN] (archived Nov. 10, 2019) (stating that "the terminology around the whole phenomenon is still heavily in flux"); *see also* APOLLINE BLANDIN ET AL., CAMBRIDGE CENT. FOR ALT. FIN., GLOBAL CRYPTOASSET REGULATORY LANDSCAPE STUDY 15 (2019), https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2019-04-ccaf-global-cryptoasset-regulatory-landscape-study.pdf [https://perma.cc/D8E3-Z9PE] (archived Nov. 10, 2019) (explaining that lack of clear terminology in the cryptoasset and blockchain technology functions as an impediment to policy-making initiatives).

20. *See* FIN. CONDUCT AUTH., DISCUSSION PAPER DP17/3: DISCUSSION PAPER ON DISTRIBUTED LEDGER TECHNOLOGY 10 (Apr. 2017), www.fca.org.uk/publication/discussion/dp17-03.pdf [https://perma.cc/L263-4AVK] (archived Nov. 10, 2019) (defining nodes as "participants on a distributed ledger. Different nodes may have different rights to read, write and/or delete data.").

21. For a general overview of blockchain technology, *see* Randolph A. Robinson II, *The New Digital Wild West: Regulating the Explosion of Initial Coin Offerings*, 85 TENN. L. REV. 897, 908–919 (2018) (explaining what is the blockchain and how it works); Aaron Wright & Primavera De Filippi, Decentralized Blockchain Technology and the Rise of Lex Cryptographia 4–8 (Mar. 12, 2015) (unpublished manuscript) (on file with Internet Governance Forum), https://www.intgovforum.org/cms/wks2015/uploads/proposal_background_paper/SSRN-id2580664.pdf [https://perma.cc/39MS-YV6E] (archived Nov. 10, 2019) (providing an overview on the concept and importance of blockchain technology). For a comprehensive overview of the technological aspects of blockchain, *see* ARVIND NARAYANAN, JOSEPH BONNEAU, EDWARD FELTEN, ANDREW MILLER & STEVEN GOLDFEDER, BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION (2016).

issued.[22] The asset itself can be either digital or physical.[23] For example, a unique cryptocurrency (identifier) that represents a physical car can be issued on top of the blockchain, enabling independent parties to track and transfer their ownership.

The blockchain itself is designed as a peer-to-peer network that is neither maintained by a central entity nor located at a specific physical location.[24] Instead, a copy of the database is stored on every computer in the network and all copies are updated simultaneously after any addition to the database.[25] To ensure that all copies are updated identically, the system relies on inherent incentives that shape the nodes' behavior.[26]

The process of adding new data to the shared database is governed by a predefined protocol (known as a consensus mechanism) which defines "(1) how information is added to a blockchain; and (2) how disparate members of a blockchain-based network come to periodic agreement about the current state of the shared database."[27] This protocol allows anyone to add to the shared database, and at the same time, ensures that the newly added information is valid.[28]

Regarding its structure, the blockchain is comprised of blocks which contain, *inter alia*, a data record (for example, a set of transactions), and each block contains a reference to the previous one: Together, the blocks form a chain that consists of all the transactions

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22. *See* Mattila, *supra* note 19, at 10 (explaining blockchain technology capabilities, and in particular, the ability to create records of ownership).

23. *See id.* (emphasizing blockchain technology's ability to create records of ownership regarding both digital and physical assets).

24. *See* Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, 2017 HARV. BUS. REV. 118, https://hbr.org/2017/01/the-truth-about-blockchain [https://perma.cc/2UWU-6X24] (archived Nov. 10, 2019) (comparing blockchain to technology underlying e-mail exchange); Robinson II, *supra* note 2121, at 911 (introducing the costs connected to centralized intermediaries in the traditional system through an example).

25. *See* Iansiti & Lakhani, *supra* note 24 (explaining how blockchain functions),; Wright & De Filippi, *supra* note 21, at 6–7 (describing blockchain as "a chronological database of transactions recorded by a network of computers. . . . [and] stored on every in computer in the network . . . [which] periodically synchronize to . . . have the same shared database.").

26. *See* Shaanan Cohney, David Hoffman, Jeremy Sklaroff & David Wishnick, *Coin-Operated Capitalism*, 119 COLUM. L. REV. 591, 602 (2019) (clarifying that blockchain technology does not need to rely on the trustworthiness of actors within the system because it relies "on economic incentives and code-based controls" modelling the network's behavior).

27. Jonathan Rohr & Aaron Wright, *Blockchain-Based Token Sales, Initial Coin Offerings, and the Democratization of Public Capital Markets*, 70 HASTING L. J. 463, 470–71 (2019).

28. *See* Mattila, *supra* note 19, at 10 (introducing the benefits of applying blockchain technology to financial instruments, asset registries, and marketplaces).

in a specific network.[29] Once a new block is added to the chain (the shared database), it becomes "immutable and censorship-resistant."[30] The links between the blocks make it (nearly) impossible to alter newly added data.

The blockchain can be designed as either permissioned/private or permissionless/public.[31] Permissioned blockchains act as closed and private ecosystems, "where users are not freely able to join the network."[32] Instead, predefined permissions are set to control who can access the database, execute the consensus mechanism, or maintain the database (store a copy of the database). Conversely, in permissionless blockchains, such as bitcoin,[33] all users have equal rights: everyone can submit transactions, maintain the database, and participate in the validation process.[34]

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29. *See* Rohr & Wright, *supra* note 27, at 471 (discussing the concept of proof of work and its role in altering data within a blockchain-based mechanism).

30. Mattila, *supra* note 19, at 10.

31. *See generally* Elyes Ben Hamida, Kei Leo Brousmiche, Hugo Levard & Eric Thea, *Blockchain for Enterprise: Overview, Opportunities and Challenges*, *in* ICWMC, THE THIRTEENTH INTERNATIONAL CONFERENCE ON WIRELESS AND MOBILE COMMUNICATIONS 83, 86 (Carlos Becker Westphall et al. eds., 2017) (describing the successful use of blockchain technology in data exchanges and processes automation); Vitalik Buterin, *On Public and Private Blockchains*, ETHEREUM BLOG (Aug. 6, 2015), blog.Ethereum.org/2015/08/07/on-public-and-private-blockchains/ [https://perma.cc/2FWW-EGSF] (archived Nov. 10, 2019) (introducing "three categories of blockchain-like database applications": public, consortium, and fully private, and explaining their characteristics).

32. Daniel Dob, *Permissioned vs Permissionless Blockchains: Understanding the Differences*, BLOCKONOMI (July 17, 2018), https://blockonomi.com/permissioned-vs-permissionless-blockchains/ [https://perma.cc/JKW9-H4QD] (archived Nov. 10, 2019). Permissioned/private blockchains can generally be classified into two categories: private and consortium blockchains. The distinction between the two lies primarily in the governance scheme; while in private blockchains one authority governs the whole system, in consortium blockchains the authority is shared among different parties. *See* Buterin, *supra* note 31 (enumerating the distinguishing features of each privacy setting); Hamida et al., *supra* note 311, at 93 ("[i]n private chains, one participant rules the whole system whereas members of consortium blockchains share the authority among them."). For the sake of simplicity, this Article assumes that the term permissioned/private blockchain encompasses both categories.

33. For more information, *see* Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, BITCOIN (2008), bitcoin.org/bitcoin.pdf [https://perma.cc/KN8U-FTYY] (archived Nov. 10, 2019) (introducing the Bitcoin system and its functionality).

34. For a comparison between permissioned and permissionless blockchains, *see* Hamida et al., *supra* note 31, at 94 (highlighting differences in blockchain architecture between public and private blockchain, including differences in data structure, network and privacy, security and scalability, forks and responsiveness, and forks and updates); *see also* Zibin Zheng et al., *An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends*, *in* IEEE, INTERNATIONAL CONGRESS ON BIG DATA 557, 559–60 (2017) (comparing a number of items among the three categories of blockchain-like database applications); Praveen Jayachandran, *The Difference Between Public and Private Blockchain*, IBM THINK BLOG (May 31, 2017), www.ibm.com/blogs/blockchain/2017/05/the-difference-between-public-and-private-blockchain/ [https://perma.cc/7SPY-S2JB] (archived Nov. 10, 2019) (addressing

B. *Smart Contracts*

A smart contract is a self-execution agreement written in a computer code that can be utilized on blockchain technology.[35] The smart contract concept was first proposed by Nick Szabo in 1997,[36] years before the invention of the blockchain.[37] Szabo envisioned that many kinds of contractual agreements can be embedded into software codes and performed automatically, without human intervention.[38] His primary example was the vending machine:

> [A] vending machine performs two critical functions. First, it directly effectuates performance by taking in money and . . . [dispensing] products. Second, it incorporates enough security to make the cost of breach (breaking into the machine) exceed the potential rewards. For all practical purposes, the vending machine is the entire contractual environment for its transactions.[39]

Szabo's ideas were ahead of their time and remained isolated from the e-commerce world for years.[40] That, however, has changed with the development of the blockchain. The blockchain allowed independent parties to "confirm that an event or condition has in fact occurred

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similarities and distinctions of public and private blockchains); Mattila, *supra* note 19, at 7–8 (defining permissioned and permissionless ledgers).

35. For a discussion on the legal implications of smart contracts, *see* Karen E.C. Levy, *Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and the Social Workings of Law*, 3 ENGAGING SCI., TECH. & SOC'Y. 1, 2 (2017) (describing the relationship between smart contracts and blockchain); Reggie O'Shields, *Smart Contracts: Legal Agreements for the Blockchain*, 21 N.C. BANKING INST. 177, 177–78 (2017) (describing the potential merits of smart contracts); Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305, 309–11 (2017) (providing a definition of smart contract); Kevin Werbach & Nicolas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 314, 330–38 (2017) (discussing possible applications of this technology to present business models).

36. *See* Nick Szabo, *The Idea of Smart Contracts* (1997), www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/idea.html [https://perma.cc/P8SB-G79Z] (archived Nov. 10, 2019) (discussing the possibility of adding embedded contracts to valuable property capable of being controlled through digital means, as a security measure against use of the property by a non-owner).

37. *See* O'Shields, *supra* note 35, at 179 (suggesting that the appearance of blockchain technology has revitalized the concept of smart contracts). For a primer on the evolution of digital agreements, *see* Werbach & Cornell, *supra* note 35, at 320–24.

38. *See* Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, FIRST MONDAY (Sept. 1, 1997), https://firstmonday.org/ojs/index.php/fm/article/view/548 [https://perma.cc/4KYR-Q4AV] (archived Nov. 10, 2019) (introducing the idea that contractual clauses can be embedded into hardware and software equipped in purchased goods to make subsequent breaches of contract expensive to the breacher).

39. *Id.*; Werbach & Cornell, *supra* note 35, at 323.

40. *See* Werbach & Cornell, *supra* note 35, at 324 (explaining that Szabo's ideas were only embraced by "cypherpunks").

without the need for a third party,"[41] and thus it enabled the creation of *enforceable* smart contracts.[42] It allowed independent parties "to coordinate their actions and trust that their commitments to each other will be fulfilled."[43] This development gave rise to new uses of smart contracts[44] and attracted significant attention from both academic and industrial researchers.

Another important development in the evolution of smart contracts is the creation of the Ethereum platform. Ethereum is a decentralized blockchain founded in 2014 with the goal of "allowing anyone to write smart contracts and decentralized applications where they can create their own arbitrary rules for ownership, transaction formats and state transition functions."[45] To this end, Ethereum has developed a programming language that enabled the creation of sophisticated smart contracts.[46] Using Ethereum's programming language, ventures could create their own digital tokens—which can be assigned with various rights (e.g., economic, voting, and consumptive rights)—and offer them to the public through an ICO

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41. Wright & De Filippi, *supra* note 21, at 10.

42. *See* Werbach & Cornell, *supra* note 35, at 33 (describing how Bitcoin works as a guarantee mechanism, completing Szabo's conception of smart contracts as a security device).

43. *Id.*

44. For example, smart contracts have been created to automatically execute financial derivatives. *See* Wright & De Filippi, *supra* note 21, at 11 & n.51 ("smart contracts have mostly been created to automatically execute derivatives, futures, swaps, and options."); *see also* Jesus Rodriguez, *The Programmable Short: Four Crypto Derivative Protocols You Should Know About*, HACKER NOON (Oct. 14, 2019), https://hackernoon.com/the-programmable-short-four-crypto-derivative-protocols-you-should-know-about-b0b4ecad9e95 [https://perma.cc/3XJR-C8KC] (archived Nov. 10, 2019 (discussing the use of smart contracts in programmable derivatives). Smart contracts have also been created to facilitate the sale of goods and services between independent parties on the Internet without the need for a centralized middleman. *See How does OpenBazaar work?*, OPEN BAZZAR, https://openbazaar.zendesk.com/hc/en-us/articles/207982443-How-does-OpenBazaar-work (last visited Nov. 9, 2019) [https://perma.cc/S6P4-QXY9] (archived Nov 10, 2019) (explaining the use of online commerce software designed to avoid the middleman); Wright & De Filippi, *supra* note 21, at 11 (highlighting the versatility of smart contracts). Finally, smart contracts allow musicians to automatically collect royalties on their songs each time they are downloaded. *See generally Frequently Asked Questions*, UJO MUSIC, https://ujomusic.com/faq (last visited Nov. 9, 2019) [https://perma.cc/ZT4B-CBS4] (archived Nov. 10, 2019).

45. Vitalik Buterin, *Ethereum White Paper: A Next Generation Smart Contract & Decentralized Application Platform*, ETHEREUM BLOG 13 (2013), http://blockchainlab.com/pdf/Ethereum_white_paper-a_next_generation_smart_contract_and_decentralized_application_platform-vitalik-buterin.pdf [https://perma.cc/85C6-ER4M] (archived Nov. 10, 2019) [hereinafter Buterin, *Ethereum Paper*].

46. *See* Wright & De Filippi, *supra* note 21, at 12 (describing a number of open source projects that have contributed to the evolution of smart contracts).

(through the use of smart contrasts), thus bypassing traditional VCs and the process of an IPO.[47]

C. *Cryptocurrencies, Coins, Digital Currencies, and Tokens*

The vocabulary used to describe the different currencies associated with the blockchain is confusing. There are "virtual currencies," "digital currencies," "crypto-coins," "crypto-assets," "tokens," etc.[48] This subpart explains what cryptocurrencies are and provides an overview of different types of cryptocurrencies and tokens.

1. What are Cryptocurrencies?

Cryptocurrency is basically a digital representation of value that can be transmitted through the network that hosts it. Merriam-Webster defines cryptocurrency as "any form of currency that only exists digitally, that usually has no central issuing or regulating authority but instead uses a decentralized system to record transactions and manage the issuance of new units, and that relies on cryptography to prevent counterfeiting and fraudulent transactions."[49] Cryptocurrencies typically function as a medium of exchange by certain parties on a certain network, and their value is normally determined by market supply and demand.

The main differences between a cryptocurrency and a fiat currency are as follows. First, unlike fiat currencies that can be printed by central banks, cryptocurrencies are created in accordance with a predefined computer protocol.[50] Second, cryptocurrencies typically run on a decentralized network, which means that there is no central authority that governs it.[51] No central authority can manipulate the supply of Bitcoins, for example. Third, in contrast to fiat currencies—

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47. *See* Robinson II, *supra* note 21, at 920 (discussing the ability of developers to create new investment by issuing their own crypto-tokens); Rohr & Wright, *supra* note 27, at 474 (introducing the concept of application tokens).

48. BLANDIN ET AL., *supra* note 19; Walch, *supra* note 19, at 721.

49. *Cryptocurrency*, MERRIAM-WEBSTER (2019), https://www.merriam-webster.com/dictionary/cryptocurrency [https://perma.cc/9XYP-WV9Z] (archived Nov. 10, 2019).

50. *See Virtuelle Währunger [Virtual Currency (VC)]*, BUNDESANSTALT FÜR FINANZDIENSTLEISTUNGSAUFSICHT (BAFIN) [FEDERAL FINANCIAL SUPERVISORY AUTHORITY], trans. (Apr. 28, 2016), www.bafin.de/EN/Aufsicht/FinTech/VirtualCurrency/virtual_currency_node_en.html [https://perma.cc/942Q-8W64] (archived Nov. 10, 2019) (defining virtual currency).

51. *See* Dong He et al., *Virtual Currencies and Beyond: Initial Considerations* 9, SND/16/03 (Jan. 2016), https://www.jdcoin.us/images/sdn1603.pdf [https://perma.cc/LR8Z-FC2H] (archived Nov. 10, 2019) (describing virtual currency's cryptography techniques, which include a decentralized administration framework).

whose value is backed by the creditworthiness of central banks and governments—the value of cryptocurrencies typically derive "solely from the expectation that others would also value and use them."[52] Fourth, the records of cryptocurrency ownership on top of the blockchain are encrypted (hence their name).[53]

Cryptocurrencies are also different from money, which traditionally serves as a medium of exchange, a unit of account, and a store of value.[54] While cryptocurrencies like Bitcoin and Ether act as a medium of exchange between certain parties, their fluctuating demand and inflexible supply impede their ability to serve as an adequate store of value.[55] Additionally, it is arguable that most cryptocurrencies cannot serve as a unit of account, because they "do not measure the value of goods and services directly; they represent the value of goods and services measured in fiat currency based on an exchange rate."[56]

Furthermore, since a cryptocurrency does not represent a monetary claim against a legal entity, it is also different from electronic money, defined in the E-Money Directive, Art. 2(2) as "electronically, including magnetically, stored monetary value as represented by a claim on the issuer which is issued on receipt of funds for the purpose of making payment transactions."[57]

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52. *Id.*

53. *See id.* (arguing that most virtual currency systems are "pseudo-anonymous.").

54. *See id.* at 17 (studying, *inter alia*, whether cryptocurrencies fulfill the economic roles associated with money and concluding that they currently do not); *see also* David Yermack, *Is Bitcoin a Real Currency? An Economic Appraisal* 1, 4 (Nat'l Bureau of Econ. Res., Working Paper No. 19747, 2013), https://www.nber.org/papers/w19747.pdf [https://perma.cc/L3DH-CV8T] (archived Nov. 10, 2019) (examining whether bitcoin performs the functions of money and concluding that it "behave[s] more like a speculative investment than a currency"). *See generally* Saifedean Ammous, *Can Cryptocurrencies Fulfil the Functions of Money?*, 70 Q. REV. ECON. & FIN. 38 (2018) (analyzing the monetary characteristics of five cryptocurrencies to assess whether they can fulfil the functions of money).

55. *See* Iris M. Barsan, *Legal Challenges of Initial Coin Offerings (ICO)*, 3 REV. TRIMESTRIELLE DE DROIT FIN. 54, 57 (2017) (arguing that the "high price volatility" of cryptocurrencies hinders their ability to serve as a store of value); Ammous, *supra* note 54, at 50 (concluding that fluctuating demand and inflexible supply make cryptocurrency an inadequate unit of account); He et al., *supra* note 51, at 17 (discussing high price volatility of virtual currencies); Yermack, *supra* note 54, at 13–18 (comparing Bitcoin's performance as a store of value to the performance of other currencies and concluding that its excessive volatility is more consistent with a speculative investment than a currency).

56. Barsan, *supra* note 55, at 57; *see also* He et al., *supra* note 51, at 17 (discounting the ability of virtual currency to currently operate as an independent unit of account).

57. Council Directive 2009/110, art. 2(2), 2009 O.J. (L267) 7 (EC); *see* Philipp Hacker & Chris Thomale, *Crypto-Securities Regulation: ICOs, Token Sales and Cryptocurrencies under EU Financial Law*, 15 EUR. CO. & FIN. L. REV. 645, pincite (arguing that currency tokens are in different from electronic money because currency tokens do not embody a claim to pay) .

2. A Technical Classification of Cryptocurrencies—Coins and Tokens

From a technical perspective, cryptocurrencies can be divided into coins and tokens (or, alternatively, protocol tokens and app tokens).[58] The difference between the two is that coins run on an independent blockchain, whereas tokens are built on an existing blockchain. In the former, the underlying blockchain platform is primarily designed to create and transfer the coin, and the coin is generally being used "to compensate parties for participation in some activity that contributes to the maintenance of the blockchain and its network."[59] Examples are Bitcoin—which was designed to act as a "purely peer-to-peer version of electronic cash [that] would allow online payments to be sent directly from one party to another without going through a financial institution"[60]—and Ether.

Unlike coins—which run on an independent blockchain—tokens reside on top of another blockchain, most prominently on the Ethereum blockchain.[61] Tokens tend to have more specific objectives compared to coins, and they are typically intended to be used solely on their platforms.[62] Coins, on the other hand, often can be used as a means of payment for goods or services outside the platform.[63] For example, in the Ethereum ICO, investors offered bitcoin and received Ether in return.[64]

Understanding the nature of the Ethereum platform may help to understand the differences between coins and tokens. Ethereum is a decentralized blockchain founded in 2014.[65] Unlike Bitcoin, which was designed to provide a platform for cryptocurrencies exchange, the Ethereum platform was created with the goal of "allowing anyone to write smart contracts and decentralized applications where they can create their own arbitrary rules for ownership, transaction formats and state transition functions."[66] Using smart contracts, any entrepreneur—including unexperienced software developers—can

58. *See* Rohr & Wright, *supra* note 27, at 470–85 (discussing the characteristics of protocol and app tokens).

59. *Id.* at 470.

60. Nakamoto, *supra* note 33, at 1.

61. See *infra* Part III.C.1.

62. *See* Rohr & Wright, *supra* note 27, at 475 (comparing protocol tokens to app tokens, and declaring the latter as more specific and narrow).

63. *See* Hacker & Thomale, *supra* note 57 (explaining that tokens can be used to pay for items that are outside the platform).

64. *See id.* (discussing currency tokens).

65. For an overview of the Ethereum platform, *see* Robinson II, *supra* note 21, at 919–24.

66. Buterin, *Ethereum Paper*, *supra* note 45, at 13.

create on top of the Ethereum blockchain a new token that can be assigned financial, voting, participation, and consumptive rights.[67]

To facilitate the process of creating new tokens on top of the Ethereum blockchain, Ethereum has created the ERC20, a "token standard [that] describes the functions and events that an Ethereum token contract has to implement."[68] The ERC20 simplifies the process of issuing a new token, enabling anyone to issue a new token using less than one hundred lines of code.[69] Additionally, it ensures the interoperability of different tokens; tokens issued under this protocol can interact with smart contracts on the Ethereum platform and with every wallet that supports Ethereum-based tokens.[70]

Back to coins and tokens: Ether acts as the "main internal crypto-fuel of Ethereum, and is used to pay transaction fees."[71] Any operation of smart contracts on top of the Ethereum blockchain requires a per-function fee (called "gas") that must be paid using Ether.[72] As such, Ether is a coin (or a protocol token). It runs on a native blockchain platform, it is used to fuel the platform, and it can be used as a means of payment for goods or services outside the platform (for example, in an ICO investors can buy new app tokens with Ether). The cryptocurrencies that build on top of the Ethereum platform, on the other hand, are tokens (or app tokens).

3. A Functional Classification of Cryptocurrencies—Digital Currencies and Digital Tokens

Alternatively, cryptocurrencies can be divided into digital currencies[73] and digital tokens based on the function they serve. This

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67. *See* Rohr & Wright, *supra* note 277, at 474 & n.54 (explaining that smart contracts are a simple tool for software developers to create secure tokens with attached rights).

68. *ERC20*, BITCOINWIKI, https://en.bitcoinwiki.org/wiki/ERC20 (last visited Nov. 7, 2019) [https://perma.cc/J4WU-PPNN] (archived Nov. 10, 2019); *see also* Amy Castor, *Ethereum 'Tokens' Are All the Rage. But What Are They Anyway?*, COINDESK (June 17, 2017), www.coindesk.com/Ethereums-erc-20-tokens-rage-anyway/ [https://perma.cc/4BNC-J2HV] (archived Nov. 10, 2019) (explaining the "ERC20 token standard" and its importance to developers working with tokens).

69. *See* Rohr & Write, *supra* note 27, at 474 (describing the "ERC20 token standard").

70. *See* Robinson II, *supra* note 21, at 958 & n.349 (declaring that most ICOs within Ethereum use the ERC20 standard and that specific safeguards could be included in the protocol, operating across the board of ICOs).

71. Buterin, *Ethereum Paper*, supra note 45, at 13.

72. *See id.* at 14 (describing "GASPRICE" as a fee that is paid per every computation step of code execution); *see also* Cohney et al., *supra* note 26, at 603 (explaining the operation of Ethereum as opposed to Bitcoin, and in particular its payment of a "per-function fee").

73. Different regulators often use the terms "Digital Currency" and "Virtual Currency" interchangeably. To avoid inconsistency, in this Article, we will use the term "Digital Currency."

classification has been adopted by most regulators around the world,[74] and accordingly we have decided to use this classification in the Article.

In this classification, a digital token can be defined as "any digital representation of an interest, which may be of value, a right to receive a benefit or perform specified functions or may not have a specified purpose or use."[75] And, on the other hand, a digital currency can be defined as "a type of . . . [cryptocurrency] that is meant to be used as a means of payment or exchange for goods or services that are external to the . . . [blockchain] ecosystem on which they are built."[76] Examples of digital currencies are Bitcoin and Ether. Both can be used by potential investors to purchase tokens during ICOs, and hence they are meant to function as a means of payment external to the platform.[77]

4. Different Types of Tokens

The previous subparts explained what cryptocurrencies are and what the differences between digital currencies and digital tokens are. Against this background, this subpart examines the differences between different types of tokens. While tokens may represent a wide range of rights, they generally can be divided into two major categories: security and utility tokens.[78]

Security tokens is a broad category that consists of all tokens that grant their holders financial rights, such as dividends and voting rights;[79] debt-like rights—paying interest on money and redeeming the

74. For an overview, *see generally* BLANDIN ET AL., *supra* note 19 (performing a comparative analysis of the regulatory landscapes of cryptocurrency).

75. *Advice: Initial Coin Offerings and Crypto-Assets*, EUROPEAN SEC. & MKTS. AUTH. 42 (Jan. 9, 2019), https://www.esma.europa.eu/sites/default/files/library/esma50-157-1391_crypto_advice.pdf [https://perma.cc/T26S-DUK2] (archived Nov. 10, 2019).

76. *Id.* at 43 (ESMA uses this definition for the term "Payment-type crypto-asset").

77. *See supra* note 73 and accompanying text.

78. For a similar classification, *see* Hacker & Thomale, *supra* note 57, n.48 (describing the traditional classification of tokens); *see also* Alexis Collomb et al., *Blockchain Technology and Financial Regulation: A Risk-Based Approach to the Regulation of* ICOs, 10 EUR. J. RISK REG. 263, 279–81 (2019) (suggesting that tokens can be divided into four groups: (1) utility tokens, which can be exchanged for goods or services; (2) participation tokens, which give rights to participate in the governance of a specific distributed process; (3) investment tokens, which give rights to financial returns, based on the profits generated by a project; and (4) asset-backed tokens, which give rights of ownership of an underlying asset).

79. Some sources refer to security tokens as investment tokens. *See, e.g.*, Collomb et al., *supra* note 78, at 280–81; Rohr & Wright, *supra* note 27, at 476 ("*investment tokens*—are different from *utility tokens* and are not only functional in nature but provide holders with economic rights, such as a share of profits generated by a project or organization.").

debt after a certain period;[80] and under certain circumstances, tokens that represent ownership of an underlying asset,[81] or a right to participate in the cash flow generated by the underlying asset, for example, real estate.[82] Another important characteristic of security tokens is liquidity on the secondary market—the fact that a token is traded on cryptocurrency exchanges with significant liquidity suggests that the token is transferable and negotiable and thus bears resemblance to securities.[83]

Utility tokens, on the other hand, provide access to a service or a product the issuer will provide. Unlike digital currencies, which act as a means of payment that is external to the token platform, utility tokens grant rights to a certain platform where the service is provided.[84] Unlike most securities tokens, utility tokens generally do not grant ownership rights. Utility tokens vary dramatically in their nature and may therefore be divided into three subcategories as follows (a token may, of course, comprise of elements from some or all these subcategories):

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80. *See* Barsan, *supra* note 55, at 58 (discussing that tokens can incorporate "share-like features" such as paying interest); *see also* New Zealand Financial Market Authority (FMA)'s statement, according to which "a token linked to the value of a dollar or commodity could be a debt security if: investors can purchase a token with money; investors holding the token have the right to redeem that token for money; and an investor holding the token is not the beneficial owner of funds from which redemption proceeds are paid." Kelly Buchanan, *Regulatory Approaches to Cryptoassets: New Zealand*, LIBRARY OF CONGRESS (Apr. 2019) (citing Fin. Mrk. Auth. (N.Z.) *Initial Coin Offers* (Feb. 11, 2019). An example for this type of token would be Steem Blockchain Dollar. *See Steem: An Incentivized, Blockchain-based, Public Content Platform*, at 8 (Aug. 2017), steem.io/steem-whitepaper.pdf [https://perma.cc/L276-QGDU] (archived Nov. 10, 2019) ("Steem [Blockchain] Dollars are created by a mechanism similar to convertible notes. . . . In the start-up world, convertible notes are short-term debt instruments that can be converted to ownership at a rate determined in the future, typically during a future funding round. . . . The terms of the convertible note allow the holder to convert to the backing token with minimum notice at the fair market price of the token.").

81. For example, the DGX token represents one gram of gold, and it can be managed and transferred on top of the Ethereum blockchain. *See* Anthony C. Eufemio, Kai C. Chng & Shaun Djie, *Digix's Whitepaper: The Gold Standard in Crypto-Assets*, DIGIX (Jan. 2016), digix.global/whitepaper.pdf [https://perma.cc/DC7E-K7NJ] (archived Nov. 10, 2019).

82. *See* Dirk A. Zetzsche et al., *The ICO Gold Rush: It's a Scam, It's a Bubble, It's a Super Challenge for Regulators* 7 (Univ. of Lux., Law Working Paper No. 2017–011; Univ. of New S. Wales, Law Research Paper No. 83; Univ. of H.K., Faculty of Law Research Paper No. 2017/035; European Banking Inst., Working Paper Series 2018 no. 18, 2018), papers.ssrn.com/sol3/papers.cfm?abstract_id=3072298 [https://perma.cc/WD9L-6C57] (archived Nov. 10, 2019) (enumerating a series of possible rights that can be attached to a token).

83. *See* Hacker & Thomale, *supra* note 57 (linking liquidity of actively-traded tokens to negotiability).

84. For the definition proposed by Hacker & Thomale, *see id.* (arguing tokens provide utility "in the form of access to a product that the developers . . . are creating.").

(1) *Usage Token*: A token that a user must hold in order to gain access to services a specific platform provides.[85] An example is Ether: to use the Ethereum network—create or execute smart contracts—a user must pay fees that can be paid solely with Ether.[86] Another example would be Filecoin, a "decentralized storage network that turns cloud storage into an algorithmic market."[87] This network runs on a blockchain and has a native token called FIL.[88] To gain access to the decentralized storage network and store or distribute data, users must pay with FIL.[89]

(2) *Work token:* A work token gives the right to contribute to a platform, and be compensated in exchange for this work, usually with a native token.[90] An example is Augur's Reputation (REP) token.[91] Augur is "a trustless, decentralized oracle and platform for prediction markets."[92] It allows anyone to create prediction markets in a decentralized manner.[93] A prediction market can be created, for example, to determine whether Donald Trump will be elected president of the United States in 2020. After the election ends, Augur will come to consensus about whether Trump won with the help of REP token holders, who can stake their tokens to report on a market's possible outcome. If the report is "true" (i.e.,

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85. *See* Zetzsche et al., *supra* note 82, at 7 (defining usage tokens as those representing "a license to use a software program.").

86. *See* Buterin, *Ethereum Paper*, *supra* note 45, at 20 (highlighting a feature of Ethereum that is lacking in bitcoin: ability to pay transaction fees directly in the currency); Rohr & Wright, *supra* note 27, at 473 (describing Ether "as a form of 'crypto fuel' necessary for the network to function").

87. *See* Filecoin & Protocol Labs, *Filecoin: A Decentralized Storage Network*, at 1 (July 19, 2017), filecoin.io/filecoin.pdf [https://perma.cc/78PP-DAJY] (archived Nov. 10, 2019).

88. *See id.* (introducing the Filecoin system's properties).

89. For an overview of Filecoin, *see generally* Sabrina T. Howell, Marina Niessner & David Yermack, *Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales* 17–21 (European Corp. Governance Inst. (ECGI), Finance Working Paper No. 564/2018, 2018), https://ecgi.global/sites/default/files/working_papers/documents/finalhowellniessneryermack.pdf [https://perma.cc/7LK3-7YPZ] (archived Nov. 10, 2019) (showing how a successful ICO works through the case study of Filecoin).

90. For a discussion of work tokens, *see generally* Anjan Vinod, *Stake to Play Token Economics: Exploring Work Tokens*, BLOCKCHAIN AT BERKELEY (Apr. 12, 2019), https://medium.com/blockchain-at-berkeley/stake-to-play-token-economics-exploring-work-tokens-7e1b30ec53dc [https://perma.cc/4DA4-57JN] (archived Nov. 10, 2019).

91. For a short overview about Augur's token as a work token, *see* Howell et al., *supra* note 89, at 14–15.

92. *See* Jack Peterson et al., *Augur: A Decentralized Oracle and Prediction Market Platform*, AUGUR 1 (July 12, 2018), www.augur.net/whitepaper.pdf [https://perma.cc/FWN4-FFEA] (archived Nov. 10, 2019).

93. *See id.* (claiming Augur seeks to reduce prediction markets' risks and limitations by decentralizing them).

consistent with the consensus reached by the other token holders) the reporter will receive her REP tokens back, plus a portion of the settlement fees from the platform.[94] If the report is not consistent with the consensus, then the reporter will be financially penalized.[95] Therefore, REP is a work token; it gives users the right to contribute to the platform (report on a market's outcome) and be compensated for it (if the report is accurate).

(3) *Pure utility token*: a utility token that is neither a usage nor a work token.

D. *Initial Coin Offering (ICO)*

The last subpart in this Part focuses on ICOs. It explains what ICOs are, what the benefits of ICOs are, how ICOs work, and how ICOs are different from IPOs. Understanding these features of ICOs is essential both for analyzing determinants of ICO success and for designing an optimal regulation regime.

1. What Are ICOs?

Though there is no one official and widely accepted definition for ICO (sometimes called "token sale" or "token generating event" (TGE)),[96] it is basically a new form of fundraising wherein blockchain-related ventures raise public capital (in the form of either fiat currencies or cryptocurrencies) in exchange for newly issued digital tokens.[97] After the initial offering, the tokens can generally be either exchanged among investors or converted into other cryptocurrencies (or fiat currencies) on the secondary market, in cryptocurrency exchanges.

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94. *See id.* at 9–10 (claiming that true outcomes are rewarded with fifty percent more REP, making REP holders disputing false outcomes come ahead in their returns); Howell et al., *supra* note 89, at 15 (explaining how Augur's REP returns work).

95. *See* Peterson et al., *supra* note 92, at 3 (introducing Augur's reporting system).

96. In this Article, we use the term ICO because it is the most accepted one. However, it should be noted that this term might be misleading since most ICOs fix in advance the maximum token supply, and thus there is no subsequent offerings. *See* Moral Hazard, *supra* note 11, at 2 & n.1 (explaining the terms token sales and ICO are often used interchangeably).

97. For other definitions, *see* Adhami et al., *supra* note 7, at 64 (defining ICOs as "calls for funding promoted by organizations, companies, and entrepreneurs to raise money through cryptocurrencies, in exchange for a 'token' that can be sold on the Internet or used in the future to obtain products or services and, at times, profits."); Fisch, *supra* note 16, at 3 (defining ICOs broadly as "a mechanism used by new ventures to raise capital by selling tokens to a crowd of investors," implying that ICOs utilize a crowdfunding approach); Moral Hazard, *supra* note 11, at 2 (defining ICOs as "smart contracts programmed on distributed ledger technology (DLT), which are designed to raise external finance without the need for an intermediary by issuing tokens or coins that can be publicly traded.").

2. What Are the Benefits of ICOs?

The idea of ICO was first applied by J.R. Willet to launch the Mastercoin in 2013.[98] Four years later, in 2017, over $10 billion was raised by over one thousand firms,[99] and by October 2018, over $21 billion was raised by over three thousand firms.[100] Against that background, this subpart discusses the benefits associated with ICOs—both from investors' perspectives and from firms' perspectives—which may partially explain this rapid growth.

From firms' perspectives, there are four major benefits associated with ICOs. First, when an issuer issues a utility token (e.g., a token that grants the right to access a future service), it can create a user base during the ICO itself.[101] In such cases, token holders become not only investors who help to fund the service but also future users of this very service,[102] and hence they are likely to be more engaged in the project. They can help the issuer, for example, to test earlier versions of its service and assess whether additional adjustments are required,[103] information that can be very valuable to ICO's issuers given the immaturity of the ICO industry. Additionally, in such cases, the ICO provides the issuer "with an early signal about consumer demand, which enables better informed investments in building the platform."[104]

Second, and related to the previous point, issuers conducting an ICO potentially can benefit from a network effect. Lin William Cong *et al.* developed a theoretical model with respect to this matter, according to which when a platform has a native token (coin), investors (users) join the platform not only to enjoy its utility, but also to benefit from the rising token price as a result of the growing network size.[105] Since the value of the issued tokens is determined (at least partially) by the network size of its users, issuers have an incentive to attract as many

98. Shin, *supra* note 1.
99. *ICO Market Analysis 2018*, *supra* note 2, at 4.
100. Momtaz et al., *supra* note 3, at 33.
101. Howell et al., *supra* note 89, at 7.
102. Collomb et al., *supra* note 78, at 287.
103. *Id.*
104. Howell et al., *supra* note 89, at 7; *see also* Christian Catalini & Joshua S. Gans, *Initial Coin Offerings and the Value of Crypto Tokens* 32–34 (MIT Sloan Sch. Working Paper No. 5347–18, 2018), papers.ssrn.com/sol3/papers.cfm?abstract_id=3137213 [https://perma.cc/J6AB-MEDC] (archived Nov. 11, 2019) (discussing how consumer demand is estimated).
105. Lin William Cong, Ye Li & Neng Wang, *Tokenomics: Dynamic Adoption and Valuation* 28–29 (Colum. Bus. Sch. Res. Paper No. 18–46, Sept. 2018), papers.ssrn.com/sol3/papers.cfm?abstract_id=3153860 (last visited Nov. 11, 2019) [https://perma.cc/9FYD-YFAD] (archived Nov. 11, 2019).

users as possible,[106] and investors have an incentive to prejoin the ICO—to benefit from the value appreciation.[107]

Third, using the ICO mechanism, firms can raise capital from the public without diluting their holdings in the company. Tokens can represent a variety of rights and obligations and can be defined to embody utility-like rights only.[108] Indeed, empirical evidence suggests that the majority of ICOs do not confer ownership rights.[109]

Last, the ICO mechanism provides firms with benefits in terms of global outreach and transaction costs. The process of creating a new token can be very simple and cheap using the ERC20 standard.[110] Potential issuers can download the code for the token from Ethereum's website and then easily adjust the code to set parameters like the total amount of tokens that they want to create.[111] Similarly, the launch of the ICO itself is very simple and cheap compared to IPOs.[112] The issuer simply creates an address to which investors' funds will be sent, and after investors send their funds to the address, they receive tokens in accordance with a predefined exchange ratio (e.g., 1 Ether = 500 Tokens). On top of that, ICO operates as a "worldwide crowdfunding event,"[113] which means that issuers may easily obtain a global outreach.

From investors' perspectives, the ICO mechanism offers a twofold benefit. First, investors may enjoy liquidity in early stages of the company. Most ICO projects are launched at the idea stage,[114] and their tokens become tradeable on average between 18.5–93 days after the ICO ends.[115] This means that investors can easily sell their

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106. Paul P. Momtaz, Initial Coin Offerings 9 (July 7, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3166709 [https://perma.cc/V9NT-VUUG] (archived Nov. 11, 2019) [hereinafter Momtaz, Initial Coin Offerings].

107. Howell et al., *supra* note 89, at 8.

108. ORG. ECON. COOPERATION & DEV., INITIAL COIN OFFERINGS (ICOS) FOR SME FINANCING 46 (2019), http://www.oecd.org/finance/ICOs-for-SME-Financing.pdf [https://perma.cc/3CXP-5XK2] (archived Nov. 11, 2019) [hereinafter OECD]; Collomb et al., *supra* note 78, at 287–88.

109. *See infra* Part III.C.1.

110. *See* Momtaz, Initial Coin Offerings, *supra* note 106, at 10 (explaining that the process of creating a token is straightforward and may be completed within minutes).

111. *Id.*

112. *Id.*

113. Rohr & Write, *supra* note 27, at 478.

114. ERNST & YOUNG, EY RESEARCH: INITIAL COIN OFFERINGS 16 (Dec. 2017), https://www.ey.com/Publication/vwLUAssets/ey-research-initial-coin-offerings-icos/$File/ey-research-initial-coin-offerings-icos.pdf [https://perma.cc/V2CQ-XPWZ] (archived Nov. 11, 2019) [hereinafter EY 2017].

115. Hugo Benedetti & Leonard Kostovetsky, Digital Tulips? Returns to Investors in Initial Coin Offerings 19 (May 20, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3182169 [https://perma.cc/EU4C-3HFW] (archived Nov. 11, 2019) (finding that the average time is thirty-one days and the median time is 16 days). They also find that some ICOs were listed prior to the end of the ICO. *Id.*; Lee et al., *supra* note 18, at 25 (finding that the

holdings in the early stages of the firm. Second, investing in ICOs is easy and cheap. In order to invest in a foreign company through an IPO, a potential investor will probably need to use the services of a broker.[116] In ICOs, on the other hand, potential investors need only to have access to the internet.[117] This means that, from an investor's perspective, investing in ICOs is often easier and less costly compared to IPOs.

3. How Do ICOs Work?

This subpart outlines the process that a venture undergoes during the ICO. The ICO process can be divided into three stages: pre-ICO, ICO launch, and post-ICO.[118]

Pre-ICO: At the first stage, ICOs are generally announced on the internet, mainly in cryptocurrency forums (such as BitcoinTalk).[119] The announcements usually include executive summaries presenting the idea of the project,[120] and their objectives are to attract interest and obtain feedback from the community.[121] After the announcement, the venture typically publishes a white paper that discloses information about the project, like a prospectus for an IPO.[122] As the ICO market is yet unregulated, the information disclosed in the white paper is unaudited and hence limited and often misleading.[123]

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average time from ICO completion to listing is 18.5 days); Momtaz, Initial Coin Offerings, *supra* note 106, at 17 (finding that the average time from the end of ICO to first listing is ninety-three days).

116. *ICO Vs IPO: Key Differences*, COINTELEGRAPH, https://cointelegraph.com/ico-101/ico-vs-ipo-key-differences#utility-investors-profit (last visited Nov. 11, 2019) [https://perma.cc/C5XJ-EG42] (archived Nov. 11, 2019).

117. *Id.*

118. For other descriptions of the ICO process, *see* Thomas Bourveau, Emmanuel T. De George, Atif Ellahie & Daniele Macciocchi, Initial Coin Offerings: Early Evidence on the Role of Disclosure in the Unregulated Crypto Market 56–57 (July 9, 2018) (unpublished manuscript) (on file with Univ. of S. Cal., Marshall Sch. of Bus.) (providing the detailed steps of the ICO process); Collomb et al., *supra* note 78, at 276–279 (defining the process as (i) prior to, (ii) during, and (iii) after the contribution period); Howell et al., *supra* note 89, at 9–14.

119. Lee et al., *supra* note 18, at 8.

120. *Discussion Paper on Initial Coin Offerings (ICOs)*, AUTORITÉ DES MARCHÉS FINANCIERS (AMF) 2, (Oct. 26, 2017), www.amf-france.org/en_US/Publications/Consultations-publiques/Archives?docId=workspace%3A%2F%2FSpacesStore%2Fa2b267b3-2d94-4c24-acad-7fe3351dfc8a (last visited Nov. 11 , 2019) [https://perma.cc/S7V4-SBYM] (archived Nov. 11, 2019) [hereinafter "AMF Discussion Paper"].

121. *See id.* (explaining the objectives of announcing an ICO); Lee et al., *supra* note 18, at 26.

122. Bourveau et al., *supra* note 118, at 57; Lee et al., *supra* note 18, at 7.

123. While white papers vary dramatically, they generally include information about: (1) the business model; (2) the technical aspects and the source code; (3) the issued token—the rights and obligations attached to it; (4) the token supply, allocation, and

With regard to the marketing process, issuers of an ICO generally communicate directly with potential investors through social media platforms. Lauren Rhue found that every ICO has a median of eight social media links on its website,[124] and Sabrina T. Howell *et al.* found that 87 percent (97 percent) of ICOs have a Telegram group (Twitter account) with an average of over five thousand (22,200) members (followers).[125] Social media channels play an important role in ICOs' marketing, allowing the issuers to provide ongoing updates about the project and respond to investors' questions and queries.[126]

As a part of the marketing process, some ventures also execute bounty programs and airdrops.[127] The former is a program in which a venture offers rewards (generally in the form of the issued digital tokens) in exchange for performing certain tasks.[128] For example, an

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distribution; (5) how the capital collected will be used; (6) the issuing entities; (7) the law applicable to the ICO and its regulatory status; (8) the launch of the ICO—the duration, hard and soft cap, and which currencies will be accepted during the token sale; and (9) the project's course of development (often called roadmap). This list is not exhaustive and its sole purpose is to illustrate the nature of the content. For further information on that matter, see AMF Discussion Paper, *supra* note 137, at 2 (explaining the information included in ICO publications); *Summary of Replies to the Public Consultation on Initial Coin Offerings (ICOs) and Update on the UNICORN Programme*, AUTORITÉ DES MARCHÉS FINANCIERS (AMF) 11–17 (2018), www.amf-france.org/en_US/Publications/Consultations-publiques/Archives?docId=workspace%3A%2F%2FSpacesStore%2Fa9e0ae85-f015-4beb-92d2-ece78819d4da [https://perma.cc/4F2N-542P] (archived Nov. 11, 2019) (detailing debate over the information to be included in an ICO); Bourveau et al., *supra* note 118, at 3 (listing the content provided in ICO publications and the associated risk of misinformation) For papers that show that the disclosed information is often limited and misleading, *see* Cohney et al., *supra* note 26, at 597–98 (comparing the promises made in the disclosure documents with the actual functionality of the digital tokens for the top fifty ICOs that raised the most capital in 2017 and finding that many have failed to meet their promises); Thomas Bourveau, Emmanuel T. De George, Atif Ellahie & Daniele Macciocchi, Information Intermediaries in the Crypto-Tokens Market 2–3 (May 2019) (unpublished manuscript) (on file with author) [hereinafter Information Intermediaries] (specifying that the process is self-regulated, which has risks for investors); Zetzsche et al., *supra* note 82, at 32 (examining over 1000 ICO white papers and found that most lack vital information required to assess the ICO's financial potential as well as its legal status).

124. Rhue, *supra* note 9, at 14.

125. Howell et al., *supra* note 89, at 24; *see also* David Florysiak & Alexander Schandlbauer, The Information Content of ICO White Paper 21 (June 21, 2019) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3265007 [https://perma.cc/8YDH-WW3K] (archived Nov. 11, 2019) (finding that the most common channels are Twitter (ninety-six percent), Facebook (eighty-nine percent), and Telegram (eighty-five percent)).

126. *See* OECD, *supra* note 108, at 10 (explaining that Twitter, Facehook, and Github are used to market and promote the ICOs); Bourveau et al., *supra* note 118, at 36 (finding that successful issuers have higher social media activity than unsuccessful issuers).

127. OECD, *supra* note 108, at 10.

128. *See* Genson Glier, *What Are ICO & Token Sale Bounty Programs?*, BLOCKTOKEN (May 16, 2018), https://medium.com/blocktoken/what-are-ico-token-sale-bounty-programs-9d1c39fa3685 [https://perma.cc/4QUP-Q72Q] (archived Nov. 17, 2019).

ICO may reward rating websites for writing an article about the ICO, or individuals for translating their documents into different languages or fixing bugs in the underlying code.[129] The latter is a program in which the venture distributes digital tokens to investors entirely for free.[130] Sometimes, in order to receive the "free" tokens, investors are required to follow the venture on social media.[131] The rationale here is to raise awareness of the project and encourage the token's adoption (network effect).[132]

Normally, ventures also disclose their underlying code on an online code repository (mainly GitHub),[133] enabling potential investors to preassess their code before the ICO.[134] Publishing the underlying code provides a "powerful form of transparency," and it also "leverages the wisdom of the crowd to identify bugs and improve quality."[135]

Additionally, ICOs generally conduct private and public presales prior to the launch.[136] The purpose of the early funding is twofold.

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129. *Id.* For examples, *see* COBINHOOD's and COTI's bounty programs: COBINHOOD, *Bug and Security Breach Bounty Program Get COB rewards for Reporting Platform Issues*, MEDIUM (Nov. 10, 2017); COTI, *COTI Launches Bounty Program in Partnership with Bounty0x (15/4 Update)*, STEEMIT (Nov. 30, 2017), https://steemit.com/cryptocurrency/@cotinetwork/coti-launches-bounty-program-in-partnership-with-bounty0x-15-4-update [https://perma.cc/FB4T-UL6J] (archived Nov. 11, 2019).

130. *See* OECD, *supra* note 108, at 11.

131. When this is the case, the tokens are not entirely free. Instead, they are distributed in exchange for investors' personal data. *See* Zax, *Is Personal Data the New Currency?* MIT TECH. REV. (2011) (explaining that Facebook and other social networks make money off of data collection), www.technologyreview.com/s/426235/is-personal-data-the-new-currency (last visited Nov. 11, 2019) [https://perma.cc/ZWZ8-GRGY] (archived Nov. 11, 2019); Jonathan Klinger, *The ICO Handbook Chapter: Six, Airdrops*, STEEMIT (Feb., 2018), steemit.com/ico/@jonklinger/chapter-six-airdrops (last visited Nov. 11, 2019) [https://perma.cc/6Q5C-KRUX] (archived Nov. 11, 2019) (highlighting that tokens may be distributed based on interaction with social media accounts and the value of this data collection may be quantifiable).

132. *See* Brady Dale, *So Long ICOs, Hello Airdrops: The Free Token Giveaway Craze Is Here*, COINDESK (Mar. 16, 2018), www.coindesk.com/long-icos-hello-airdrops-free-token-giveaway-craze/ [https://perma.cc/R9XL-EBQS] (archived Nov. 9, 2019) (explaining that tokens are provided to potential users for joining the network to increase the value of the network).

133. *See infra* Part III.B.2.

134. *See* Adhami et al., *supra* note 7, at 4, 7 (explaining that the disclosure helps investors determine the technical value of the idea and prior work of the team).

135. Howell et al., *supra* note 89, at 24.

136. Adhami et al., *supra* note 7, at 9 (finding that thirty-eight percent of the sample organized presales); Benedetti & Kostovetsky, *supra* note 115, at 44 (finding that forty percent of the sample had a presale); Fisch, *supra* note 16, at 14 (finding that sixty-four percent of the sample had a presale); Howell et al., *supra* note 89, at 12, (finding that forty-five percent of the sample had a presale); Momtaz, Initial Coin Offerings, *supra* note 106, at 9 (finding that forty-four percent of the sample had a presale); Zetzsche et al., *supra* note 82, at 7 (finding that twenty-two percent of the sample

First, to finance the costs of promoting the ICO in the preliminary stage. Second, analogous to the book-building process in IPOs, early investments rounds provide an indication of the demand for the token, thus helping to determine an appropriate price for the launch.[137] The presale targets larger investors, mainly institutional investors, and VCs,[138] and offers them discounts or bonuses in exchange for taking more risk (investing at an early stage).[139]

The Launch of the ICO: During the main sale, the venture issues digital tokens for a predefined period. The contribution period can be either fixed in time or capped by a predetermined threshold.[140] The venture generally specifies a hard cap, which is the maximum amount of capital they aim to collect, and a soft cap, which is the minimum amount of funds required for the ICO to process as planned.[141] An ICO is considered successful if it reaches its soft cap during the contribution period; otherwise, the funds are usually returned to the investors.[142] If the hard cap is reached, the token sale ends.[143]

The contribution during the token sale is made through the project website. Investors are required to transfer money (either crypto or fiat currencies) to a smart contract address, which in return transfers a predefined amount of tokens to the sender.[144] The sale itself operates as a "worldwide crowdfunding event."[145] However, due to regulatory concerns, ICOs often exclude residents of certain countries (mainly China and the United States).[146]

The pricing mechanisms by which ICOs sell their tokens are usually announced to the public prior to the token sale and include a few different schemes. Most ICOs sell their tokens during the launch, on a fixed price and "first-come, first-served" basis;[147] others establish dynamic pricing mechanisms, in which the price changes during the sale in a predefined way or in a way that reflects the demand of the token;[148] and some ICOs use an auction mechanism.[149] Gnosis, for example, used a reverse Dutch auction, in which the portion of tokens sold and their price depended on how long the sale took to finish.[150]

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organized a presale, but suggest that the actual number is higher, given the information asymmetry associated with ICOs).

137. Howell et al., *supra* note 89, at 12.
138. Usually a minimum contribution threshold is specified for the presales.
139. Howell et al., *supra* note 89, at 12.
140. Collomb et al., *supra* note 78, at 277.
141. *See* Lee et al., *supra* note 18, at 40.
142. *Id.* at 8.
143. *Id.*
144. Rohr & Wright, *supra* note 27, at 473–75
145. *Id.* at 478.
146. *See infra* Part III.C.2.
147. Howell et al., *supra* note 89, at 11.
148. *Id.*
149. *Id.* at 12.
150. Vitalik Buterin, *Analyzing Token Sale Models*, VITALIK BUTERIN'S WEBSITE (June 9, 2017), vitalik.ca/general/2017/06/09/sales.html (last visited Nov. 9, 2019)

Post-ICO: After the token sale ends, ICOs generally list their tokens in crypto exchanges, and the issued tokens are then traded on the secondary market.[151] A portion of the tokens received during the main token sale is usually reserved for founders, employees, and platform development, and/or for incentivizing future network contributors.[152] These tokens are generally locked in smart contracts for a specific period or until certain development milestones have been achieved. Such lock-up mechanisms prevent founders from dumping their tokens after the ICO ends and may increase investors' confidence and certainty about the use of proceeds.[153]

4. How is an ICO Different from an IPO?

In an ICO, like in an IPO, a company issues a share (a token) in order to raise public capital, and this share (token) is then traded on the secondary market. Nevertheless, there are major differences between the two methods.[154]

First, the rights conferred to investors of an ICO are considerably different from those of an IPO.[155] In an IPO, shareholders get ownership rights in the company, dividend rights, and voting rights depending on the type of the shares issued.[156] In an ICO, by contrast, the issued tokens can represent a variety of rights and obligations and can be defined to embody utility-like rights only. This difference implies that issuers of an ICO can raise public capital without diluting their ownership over the company, thus overcoming a major impediment associated with an IPO.[157]

[https://perma.cc/5LQ9-AL4L] (archived Nov. 9, 2019). Commentators have criticized this pricing mechanism, as well as any other mechanism that benefits early investors, for creating a "fear of missing out". *See* Alyssa Hertig, *ICO Insanity? $300 Million Gnosis Valuation Sparks Market Reaction*, COINDESK (Apr. 25, 2017) (explaining that Gnosis priced tokens so that the tokens would get less expensive over time to encourage later investment), https://www.coindesk.com/ethereum-ico-irrationality-300-million-gnosis-valuation-sparks-market-concerns (last visited Nov. 11, 2019) [https://perma.cc/32AD-RJBR] (archived Nov. 11, 2019).

151. *See infra* Part III.E.1.

152. Howell et al., *supra* note 89, at 11.

153. Bourveau et al., *supra* note 118, at 36–38.

154. For a comparison between IPOs and ICOs, see OECD, *supra* note 108, at 24–26; Collomb et al., *supra* note 78, at 293–300; Lee et al., *supra* note 18, at 51.

155. OECD, *supra* note 108, at 25 (detailing that IPOs confer ownership rights and ICOs do not); Collomb et al., *supra* note 78, at 287 (explaining that an IPO is concerned with issuance of stock that will dilute the ownership for existing shareholders, whereas an ICO refers to tokens that may not be directly tied to a company).

156. OECD, *supra* note 108, at 25.

157. *See id.* (explaining that ICOs may be advantageous to entrepreneurs who do not want to give away any ownership.

Second, and related to the previous point, documentation requirements are different. While a company that launches an IPO faces disclosure and registration requirements imposed by the securities regulator, ICOs' disclosure requirements are unclear and depend on their function as well as on the governing jurisdiction.[158] Most ICOs generally publish a white paper that outlines the business model of the project, a technical white paper that features the technological aspects of the project, and the source code of the project.[159] However, unlike IPOs' documentation, ICOs' documentation format is not standard and the documents disclosed tend to be poor and often misleading.[160] This absence of standard disclosure requirements exacerbates the information asymmetries between token issuers and investors.[161]

Third, ICOs are launched at a lower level of maturity compared to IPOs.[162] In order to initiate an IPO, a potential issuer will have to "demonstrate a proper (and stable) amount of revenues, which can only be achieved after a company has reached a certain level of maturity."[163] This is partially due to the listing requirements of exchanges and the tendency of investment banks (which act as underwriters) to select IPOs that have the potential to perform well after.[164] ICOs, on the other hand, allow firms to raise public capital outside of the traditional capital market—without the involvement of underwriters and traditional exchanges—and thus they can be launched at a very early stage. Indeed, empirical evidence suggests that the majority of ICOs are launched at the idea stage.[165] This difference between ICOs' and IPOs' levels of maturity is important because it translates into different degrees of risk and information asymmetries.[166]

Fourth, ICOs' marketing process is significantly different from IPOs' marketing process. While in an IPO an underwriter conducts a book-building process, ICOs' marketing is done primarily through social media channels.[167] In contrast with IPOs, which generally use social media to raise awareness for the project, ICOs use social media to publish vital information like launch announcements and to

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158. Lee et al., *supra* note 18, at 7; OECD, *supra* note 108, at 26. For an overview of the top twenty-five ICO jurisdictions in market capitalizations and their comparative regulatory responses, *see generally* Wulf A. Kaal, *Initial Coin Offerings: The Top 25 Jurisdictions and Their Comparative Regulatory Responses*, 1 STAN. J. BLOCKCHAIN L. & POL'Y 41 (2018).

159. *See infra* Part III.B.

160. *See* Information Intermediaries, *supra* note 123, at 1–3.

161. Fisch, *supra* note 16, at 6.

162. Collomb et al., *supra* note 78, at 296–297.

163. *Id.*

164. *Id.* at 297.

165. EY 2017, *supra* note 114, at 16 (finding that most ICOs are in the idea stage, and their platforms/services are expected to be launched in a year or more after the ICO).

166. Collomb et al., *supra* note 78, at 296 & n.102; Fisch, *supra* note 16, at 6.

167. *See infra* Part III.B.3.

communicate directly with potential investors.[168] This difference in the way firms market their launches and communicate with their investors translates into different investor–investee relationships, and is important since it affects the way by which firms can reduce uncertainty about their projects.

III. ICO CHARACTERISTICS—REVIEW AND ANALYSIS OF THE EMPIRICAL LITERATURE

ICO is a relatively new concept, and accordingly the literature on ICOs is still in its infancy. Many aspects of this newly innovative market—such as terminology, token typology, regulation, and token valuation—have remained unclear. This Part focuses on the growing body of empirical literature on ICO characteristics and determinants of ICO success and returns. It systematically reviews over twenty empirical studies, most of which were conducted during 2018–2019, and identifies key success factors. Subsequently, it offers theoretical explanations, and in certain cases, connects the empirical results with the IPO and crowdfunding literatures. The analysis presented in this Part is important, because there is no single formal data source, and there is evidence of inconsistencies across the different data sources available.

A. *A General Overview*

The idea of ICOs was first applied in 2013.[169] Four years later, in 2017, over $10 billion was raised by over one thousand firms;[170] by October 2018, over $21 billion was raised by over three thousand firms.[171] Similarly, while the largest ICO in 2016, Wave, raised around $16 million,[172] the largest ICO in 2018, EOS, raised $4.2 billion.[173]

The rapid growth of the crypto market and ICOs in particular can be explained by several factors. First, cryptocurrencies are perceived

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168. Mathieu Chanson et al., Initial Coin Offerings (ICOs): The Role of Social Media for Organizational Legitimacy and Underpricing 6 (Oct. 2018) (unpublished manuscript) (on file with Research Gate).

169. Shin, *supra* note 1.

170. *ICO Market Analysis 2018*, *supra* note 2.

171. Momtaz et al., *supra* note 3, at 33.

172. For an overview of the top ICOs completed in 2016 and 2017, *see* Bourveau et al., *supra* note 118, at 51.

173. *See* Daniele Pozzi, *ICO Market 2018 vs 2017: Trends, Capitalization, Localization, Industries, Success Rate*, COINTELEGRAPH (Jan. 5, 2019), https://cointelegraph.com/news/ico-market-2018-vs-2017-trends-capitalization-localization-industries-success-rate [https://perma.cc/LS7E-KJUE] (archived Mar. 3, 2020).

by investors as a "hedge against volatile local currencies and geopolitical risk," and their growth might be related to a continuing distrust in the traditional banking sector since the 2008 financial crisis.[174] Second, in the aftermath of the global financial crisis, conventional banks and VC firms became more selective when granting loans, thus pushing start-ups to seek for an alternative source of finance.[175] Third, as previously discussed, ICOs are attractive for ventures due to low transaction costs and potential global outreach.[176] Fourth, the increased media attention,[177] combined with astronomic returns for early investors—with ROIs exceeding 50,000 percent[178]—and a network effect,[179] have attracted new investors and ventures.

1. Fundraising Success Rate

Empirical studies suggest that while the ICOs' fundraising success rate was considerably higher in the early days of the market, it has been decreasing since the second half of 2017. Jongsub Lee *et al.* found that the fundraising success rate in the first quarter of 2018 was approximately 50 percent, down from 90 percent in the second quarter of 2017.[180] Ernst & Young found that "in November 2017, less than 25% hit goals, compared with more than 90% in June."[181] Hugo Benedetti and Leonard Kostovetsky analyzed 2,390 ICOs that occurred between January 2017 and March 2018 and found that only 48 percent had "non-zero and non-missing values for capital raised" and that only 26 percent "have listed their tokens on an exchange."[182] Conversely, Saman Adhami *et al.* analyzed a sample of 253 ICOs that occurred from 2014 to August 2017 and found that 81 percent of ICOs were successful.[183] This sharp deterioration in fundraising success may be

174. Clements, *supra* note 4, at 78.

175. *See* Joern H. Block, Geertjan De Vries & Philipp Sandner, *Venture Capital and the Financial Crisis: An Empirical Study across Industries and Countries*, *in* THE OXFORD HANDBOOK OF VENTURE CAPITAL 43–48 (Douglas Cumming ed., 2012) (finding that VC activity slowed down after the 2008 crisis).

176. *See infra* Part II.D.2.

177. Clements, *supra* note 4, at 86.

178. *See Top 10 ICOs with the Biggest ROI*, COINTELEGRAPH, cointelegraph.com/ico-101/top-10-icos-with-the-biggest-roi#10-qtum--9225-roi (last visited Nov. 11, 2019) [https://perma.cc/U5HU-BKTC] (archived Nov. 11, 2019); Coin and Crypto, *Early Investors Are Making 50,000% Returns on ICOs*, HACKER NOON (Dec. 5, 2017), hackernoon.com/investors-are-making-50-000-returns-on-icos-32432bc741d1 (last visited Nov. 11, 2019) [https://perma.cc/N5Q3-UYYT] (archived Nov. 11, 2019) (providing examples of high ROIs).

179. Clements, *supra* note 4, at 77.

180. *See* Lee et al., *supra* note 18, at 15, 36.

181. EY 2017, *supra* note 114, at 8.

182. Benedetti & Kostovetsky, *supra* note 115, at 15.

183. Adhami et al., *supra* note 7, at 8–10.

due to increased regulation, or, alternatively, to the lemons problem: the "hot" market has attracted low-quality ICOs.[184]

2. Gross proceeds

Empirical studies suggest that during 2015–2018 the average number of funds raised by an ICO was between $13–$16 million.[185] For example, according to a 2018 report by ICOBench, the average number of funds raised by an ICO during 2017 was $14.1 million.[186] Similarly, a report by Tokendata and Fabric Ventures suggests that the average number of funds raised in 2017 was $13 million.[187] Other recent empirical studies—which analyze a dataset of ICOs conducted primarily between 2015 and 2018—find that the average number of funds raised in an ICO is around $15–$16 million.[188] These results are interesting, because most ICOs are launched at a very early stage and provide little information for investors, but yet manage to raise a large amount of funds. All these empirical studies also find a big difference between the average and the median indicator, indicating that the amount raised in an ICO is skewed toward large ICOs.

3. The Geography of ICOs

According to ICOBench, the most comprehensive database to date, the top country in the number of ICOs is the United States, followed by Singapore, the United Kingdom, and Russia.[189] The United States

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184. Lee et al., *supra* note 18, at 15–16; *see generally* Akerlof, *supra* note 12 (explaining the incentive to market poor quality merchandise when returns for good quality merchandise affect the whole market instead of the individual seller).

185. *ICO Market Analysis 2018*, *supra* note 2.

186. *ICO Market Analysis 2018*, *supra* note 2, at 4.

187. Fabric Ventures & TokenData, *The State of the Token Market A Year in Review & an Outlook for 2018*, at 7 (2018), https://static1.squarespace.com/static/5a19eca6c027d8615635f801/t/5a73697bc8302551711523ca/1517513088503/The+State+of+the+Token+Market+Final2.pdf (last visited Nov. 9, 2019) [https://perma.cc/V5VW-WCJJ] (archived Nov. 9, 2019).

188. *See, e.g.*, Ryan Amsden & Denis Schweizer, Are Blockchain Crowdsales the New 'Gold Rush'? Success Determinants of Initial Coin Offerings 54 (Apr. 16, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3163849 [https://perma.cc/3L9B-RQUP] (archived Nov. 11, 2019) (finding that the average (median) number of funds raised in an ICO is $15.24 million); Lyandres et al., *supra* note 9, at 16 (finding that the average number of funds raised in an ICO is $15 million and the median funds raised is $5 million); Momtaz, Initial Coin Offerings, *supra* note 106, at 2. (finding that the average number of funds raised in an ICO is $15.1 million and the median number of funds raised is $5.8 million).

189. *Stats*, ICOBENCH, icobench.com/stats (last visited Nov. 11, 2019) [https://perma.cc/K3UY-2WKE] (archived Nov. 11, 2019) (as of Oct. 24, 2019, the database consists of 5607 ICOs. 706 in the US, 575 in Singapore, 498 in the UK, and 328

is also the top country in capital raised, followed by Singapore, British Virgin Islands, and Switzerland.[190] These results are interesting as the market shares of countries with relatively small capital markets and economics (e.g., Singapore, Switzerland, and British Virgin Islands) are significantly high.[191] This could be due to their crypto-friendly regulatory approach,[192] and it implies that a regulatory arbitrage exists in the market. Consistent with this interpretation, an empirical report by Token Data and Fabric Ventures shows a significant difference between the leading countries from a legal domicile perspective and the leading countries from founders' location perspective.[193] For example, it shows that in 2017, legal entities located in Switzerland raised $1.06 billion compared to the $177 million raised by founders from Switzerland.[194]

A few empirical studies analyzed the geography of ICOs, trying to answer the question of why ICOs are more prevalent in some countries relative to others. Winifred Huang *et al.*, for example, found that ICOs are more likely to take place in countries that actively present their regulatory intentions, instead of banning ICOs or taking no action, and that tax level had no significant effect.[195] They also found that ICOs occur more frequently in countries with developed financial markets, and where information and communication technology is more advanced.[196] A possible explanation for the former result is that a well-

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in Russia); *see also* Amsden & Schweizer, *supra* note 188, at 32 (finding that the top country in the number of ICOs is the US, followed by Russia, and that the dominant country in amounts raised is the U.S. ($2.4 billion), followed by Switzerland ($1.1 billion)); Bourveau et al., *supra* note 118, at 25 (finding that the top countries in the number of ICOs are the US, Russia, and Singapore); Adhami et al., *supra* note 7, at 2 (finding that the top countries in the number of ICOs are the US, Russia, and Switzerland); Howell et al., *supra* note 89, at 23–24 (finding that the top countries in the number of ICOs are the US China, Russia, and Switzerland, and in amounts raised, the US, Switzerland, Singapore, and Russia); Zetzsche et al., *supra* note 82, at 14 (finding that the top countries in the number of ICOs are the US, Singapore, and UK, and in amounts raised, the US, Singapore, China, and UK).

190. *Stats*, ICOBENCH, *supra* note 190 ($7.3 billion in the US, $2.5 billion in Singapore, $2.4 billion British Virgin Island, and $1.8 billion in Switzerland).

191. For example, while the market capitalization of listed companies in the United States in 2018 was over forty times larger than Singapore and twenty times larger than Switzerland, the market capitalization of ICOs in the Unites States was less than three times larger than Singapore and five times larger than Switzerland. *See Market capitalization of listed companies in current prices*, KNEOMA, https://knoema.com/atlas/topics/Economy/Financial-Sector-Capital-markets/Market-capitalization (last visited Nov. 11, 2019) [https://perma.cc/9HR8-KMDR] (archived Nov. 11, 2019); Zetzsche et al., *supra* note 82, at 11–12.

192. Winifred Huang, Michele Meoli & Silvio Vismara, *The Geography of Initial Coin Offerings* SMALL BUS. ECON. 6 (2019) (finding that ICOs are more pervasive in countries with ICO-friendly regulations, such as Singapore and Switzerland).

193. Fabric Ventures & TokenData, *supra* note 187, at 9.

194. *Id.*

195. Huang et al., *supra* note 192, at 18.

196. *Id.* The former finding is consistent Haddad and Hurnuf who found that Fintech startup formations occur more frequently in countries with well-developed

developed financial market offers greater potential to change existing business models through innovative services and that, in a more elaborated financial system, entrepreneurs have better access to the capital required to fund their business.[197] An explanation for the latter result is that the development of information and communication technology embraces "well-functioning infrastructure facilities and tech-skilled human capital [that] can accelerate the demand for digital entrepreneurship."[198] Benedetti and Kostovetsky found that listed ICOs are more likely to take place in "countries that are 0.2 points higher in their Rule of Law rating[199] and have about $4,000 more in GDP per capita, relative to the entire sample."[200]

B. *Pre-ICO Practices*

1. White Paper Disclosure

White paper disclosure—focus on quality: Most ICOs disclose a white paper that features the business and technical model of the project prior to launch.[201] Empirical studies analyze the relation between disclosing a white paper and ICO success. On the one hand, Howell *et al.* found that disclosing a white paper is positively associated with liquidity, which is a proxy of ICO success and volatility.[202] On the other hand, Thomas Bourveau *et al.* found that more unsuccessful (88 percent) than successful issuers (78 percent) disclose a white paper,[203] and Adhami *et al.* and Dmitri Boreiko and

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economies and capital markets. *See* Christian Haddad & Lars Hornuf, *The Emergence of the Global Fintech Market: Economic and Technological Determinants*, 53 SMALL BUS. ECON. 81 (2019).

197. Haddad & Hornuf, *supra* note 196, at 82–83; Huang et al., *supra* note 192, at 3.

198. Huang et al., *supra* note 192, at 6.

199. They rely on World Bank Rule of Law rating, which captures "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence." Daniel Kaufmann, Aart Kraay & Massimo Mastruzzi, *The Worldwide Governance Indicators: Methodology and Analytical Issues*, 3 HAGUE J. ON THE RULE OF LAW 220, 223 (2011).

200. Benedetti & Kostovetsky, *supra* note 115, at 17–18. These results are consistent with Haddad and Hurnuf who found that GDP per capita is significant in explaining the number of financial technology (fintech) startups in a country and with Rau who found that the Rule of Law ranking is significantly and positively related to crowdfunding volume within a country. *See* Raghavendra Rau, Law, Trust, and the Development of Crowdfunding 25 (June 20, 2017) (unpublished manuscript) (on file with Soc. Sci. Research Network); Haddad & Hornuf, *supra* note 196, at 92.

201. Howell et al., *supra* note 89, at 38 (finding that eighty-one percent of ICOs disclosed a white paper).

202. *Id.* at 3.

203. Bourveau et al., *supra* note 118, at 42.

Gioia Vidusso found that there is no significant association between disclosing a white paper and ICO success.[204] These results suggest that the quality of the white paper matters and that simply disclosing a white paper is not enough. As discussed above, the information disclosed in white papers is unaudited and often misleading, and hence these results are not surprising.

Consistent with these results, empirical studies found that proxies of the quality of a white paper are associated with success. Evgeny Lyandres *et al.*, for example, found that the number of unique words in the white paper (identified by natural language processing (NLP)) is positively and reliably associated with the amount raised and with the probability of listing.[205] Ryan Amsden and Denis Schweizer, Bourveau *et al.*, and Christian Fisch found that the length of the white paper is positively associated with the amount raised.[206] However, the length of the white paper does not necessarily signal quality. In fact, in the context of equity crowdfunding, Kim *et al.* found that offering too much information about the idea undermines entrepreneurs' chances of fully securing the resources they need;[207] but, given the information asymmetry associated with the market, it is possible that longer white papers are perceived by investors as a valuable signal. Bourveau *et al.* found that white paper opacity is negatively associated with the amount raised and with liquidity and positively associated with low returns (negative 75 percent) in the long term.[208] They also found that having an informative white paper (dummy variable according to ICOBench) reliably predicts ICO success,[209] but when they manually analyze the association between disclosure practices (ICO team information, token allocation information, founder tokens vesting period, use of proceeds, white paper opacity, and white paper length) and ICO success, they found no significant association.[210]

Information about regulatory status: Adhami *et al.* found that only in 19 percent of ICOs, the white paper specifies the jurisdiction that

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204. Dmitri Boreiko & Gioia Vidusso, *New Blockchain Intermediaries: Do ICO Rating Websites Do Their Job Well?*, 21 J. ALTERNATIVE INV. 67 (2019); Adhami et al., *supra* note 7, at 8.

205. Lyandres et al., *supra* note 9, at 23.

206. Amsden & Schweizer, *supra* note 188, at 19; Bourveau et al., *supra* note 118, at 46 (finding that log USD raised is positively correlated with white paper length. However, they also find that having a longer white papers is associated with future crash risk); Fisch, *supra* note 16, at 15 (finding that white paper length has a positive effect on the amount of funds raised ($p<1\%$)).

207. *See generally* Phillip H. Kim, Mickaël Buffart & Grégoire Croidieu, *TMI: Signaling Credible Claims in Crowdfunding Campaign* Narratives, 41 GROUPS & ORG. MGMT. 717 (2016); Fisch, *supra* note 16, at 15.

208. Bourveau et al., *supra* note 118, at 51 (white paper opacity is "[T]he Gunning Fog index for the whitepaper calculated as (words per sentence + percent of complex words) × 0.4").

209. *Id.*

210. *Id.*

regulates the ICO.[211] Nevertheless, the vast majority of ICOs have been successful.[212] Similarly, Dirk A. Zetzsche *et al.* found that only 32.7 percent of ICOs specify the applicable law and that most white papers do not provide information about the regulatory status of an ICO.[213] As most ICOs in their samples have been successful, these results suggest that potential investors are insensitive to regulatory issues.[214] An alternative interpretation for these results is that ICO initiators—especially in the early days of the market—have been unable to specify the applicable law and jurisdiction due to regulatory uncertainty.

Focus on technical aspects: While investors are insensitive to regulatory issues, empirical evidence suggests that potential investors are very sensitive to technological aspects. Adhami *et al.* found that specifying the jurisdiction that regulates the token sale has a much smaller influence on an ICO's success compared to source code disclosure.[215] Consistent with these results, Paul P. Momtaz found that the market uncertainty derived from technical issues—for example, the hacks of Parity Wallet[216]—has a much stronger negative effect on ICO returns than regulatory actions, such as China's and Korea's bans.[217] Lyandres *et al.* found that the probability of listing increases proportionately to the technical language in the white paper.[218] Fisch found that having a technical white paper strongly and significantly ($p<1$ percent) affects the amount raised.[219] He suggested that investors might interpret a technical white paper as a strong predictor of a venture's underlying technological capabilities.[220] Chen Feng *et al.* found that the amount of technical language in white papers predicts

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211. Adhami et al., *supra* note 7, at 6–8

212. *Id.*

213. Zetzsche et al., *supra* note 82, at 11.

214. *Id.*

215. Adhami et al., *supra* note 7, at 10.

216. On the Parity Wallet hack, see: Rachel Rose O'Leary, *Parity Team Publishes Postmortem on $160 Million Ether Freeze*, COINDESK (Nov. 15, 2017), https://www.coindesk.com/parity-team-publishes-postmortem-160-million-Ether-freeze [https://perma.cc/Z4AE-P2ST] (archived Jan. 8, 2019).

217. Momtaz, Initial Coin Offerings, *supra* note 106, at 38. On South Korea's ban, see: Rachel Rose O'Leary, *South Korean Regulator Issues ICO Ban*, COINDESK (Sept. 29, 2017), www.coindesk.com/south-korean-regulator-issues-ico-ban [https://perma.cc/4A3B-KX6Z] (archived Jan. 8, 2019). On China's ban, *see Notice on the Prevention of Tokens*, PEOPLE'S BANK OF CHINA (Sept. 4, 2017), www.pbc.gov.cn/goutongjiaoliu/113456/113469/3374222/index.html [https://perma.cc/VL5K-9QJG] (archived Feb. 16, 2020). English translation is available at: Wolfie Zhao, *China's ICO Ban: A Full Translation of Regulator Remarks*, COINDESK (Sept. 5, 2017) https://www.coindesk.com/chinas-ico-ban-a-full-translation-of-regulator-remarks [https://perma.cc/3SGJ-ERNX] (archived Nov. 19, 2019).

218. Lyandres et al., *supra* note 9, at 23.

219. Fisch, *supra* note 16, at 12–14.

220. *Id.*

success only for high-quality ICOs.[221] A possible interpretation is that projects are more likely to provide technical discussions in the white paper when they are in more advanced stages.[222]

Use of proceeds disclosure: Firms conducting an IPO are required by securities regulators to include in their prospectuses the intended use of proceeds.[223] Empirical evidence shows that firms that disclose more (less) specific information about their intended use of proceeds have lower (higher) underpricing, suggesting that a more detailed use of proceed disclosure reduces *ex ante* uncertainty about the value of the firm.[224] In contrast with IPOs, companies that launch ICOs are not required to disclose information about their use of proceeds, and empirical studies found that the majority do not disclose information about the use of proceeds.[225] Empirical studies also analyzed the association between disclosing information about the use of proceeds and success and came up with contradictory results. On the one hand, Howell *et al.* found that disclosing information regarding the use of proceeds is positively associated with liquidity and volatility, suggesting that ICOs have a self-incentive to disclose such information.[226] On the other hand, Bourveau *et al.* found that disclosing information regarding the use of proceeds does not affect successful completion,[227] and Feng *et al.* found that it is negatively associated with success.[228]

Token allocation information disclosure: In their white papers, ICOs generally feature information about token allocation—the fraction of tokens allocated to founders, advisors, early investors, etc. On the one hand, Daniel Blaseg found that disclosing token allocation predicts success, suggesting that it reduces *ex ante* uncertainty.[229] On the other hand, however, Bourveau *et al.* found that disclosing

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221. Chen Feng, Nan Li, M.H. Franco Wong & Mingyue Zhang, Initial Coin Offerings, Blockchain Technology, and White Paper Disclosures 28 (Mar. 25, 2019) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3256289 [https://perma.cc/Q3KV-ZT5X] (archived Feb. 16, 2020).

222. *See Id.* at 6; Lyandres et al., *supra* note 9, at 23.

223. Anne Wyatt, *Is There Useful Information in the 'Use of Proceeds' Disclosures in IPO Prospectuses?*, 54 ACCT. & FIN. 625, 626 (2014).

224. *See, e.g.*, Andrew J. Leone, Steve Rock & Michael Willenborg, *Disclosure of Intended Use of Proceeds and Underpricing in Initial Public Offerings*, 45 J. ACCT. RES. 111, 141 (2007).

225. Bourveau et al., *supra* note 118, at 42–45 (finding that forty-five percent of failed and forty-nine percent of completed ICOs have disclosed information about use of proceeds); Adhami et al., *supra* note 7, at 7 (finding that only 30.8 percent of ICOs have disclosed information about use of proceeds).

226. Howell et al., *supra* note 89, at 29.

227. Bourveau et al., *supra* note 118, at 45.

228. Feng et al., *supra* note 221, at 5, 39.

229. Daniel Blaseg, Dynamics of Voluntary Disclosure in the Unregulated Market for Initial Coin Offerings 22 (Oct. 3, 2018) (unpublished manuscript) (on file with Soc. Sci. Research Network).

information about token allocation is negatively associated with the amount raised,[230] and Feng *et al.* found it to be negatively but insignificantly (in most specifications) associated with ICO success.[231] The former may indicate that token allocation is often not optimal, and hence if ventures disclose information about it, it negatively affects the fundraising. The latter result may indicate that investors do not value this type of disclosure.

Information about the initiators: A growing body of literature in the IPO context examines the role of the management team as a signal. The rationale for focusing on social indicators—such as information about the initiators—is that "investors who are unable to discern the venture's quality from economic disclosure turn to more social indicators."[232] Therefore, the focus on social indicators is greater in the presence of market uncertainty.[233] Empirical studies support the proposition regarding the management team's importance as a signal, showing a significant and positive relationship between management characteristics—such as management team legitimacy, team size, education, and prior industry experience—and venture financial performance.[234]

Considering the high market uncertainty in ICOs, we would expect team characteristics to be an important indicator. Several studies have examined the association between ICO success and information disclosed about (1) the team in general; (2) team members' reputations and experiences; and (3) team size. First, Bourveau *et al.* found that simply disclosing biographical information about the team is negatively associated with crash risks in the long term and with illiquidity and positively correlated with the amount raised.[235] Similarly, Blaseg found that simply disclosing the number of team members increased the probability of listing,[236] suggesting that investors value information about the team. However, Feng *et al.* found that disclosing the number of team members in the white paper does not affect ICO success.[237] Second, Bourveau *et al.* showed that investors value team members' reputations, finding that the number of team members previously involved in a successful ICO is associated

230. Bourveau et al., *supra* note 118, at 44.

231. Feng et al., *supra* note 221, at 49.

232. Cohen & Dean, *supra* note 13, at 684–686.

233. *See generally* Joel M. Podolny, *Market Uncertainty and the Social Character of Economic Exchange*, 39 ADMIN. SCI. Q. 458, 459 (1994) ("in order to avoid the problems posed by market uncertainty and forestall market failure, organizations adopt a more social orientation").

234. For an overview of this area of the empirical literature, see Cohen & Dean, *supra* note 13, at 685.

235. Bourveau et al., *supra* note 118, at 46.

236. Blaseg, *supra* note 229, at 20.

237. Feng et al., *supra* note 221, at 39.

with success.[238] In line with this result, Momtaz found that CEOs' prior experience in crypto-related projects is positively associated with first-day return, which suggests that investors are aware of founders' reputations.[239] Howell *et al.* found that entrepreneurial experience[240] is strongly associated with success, but they also found that experience in finance, crypto, or computer science is not.[241] Interestingly, Amsden and Schweizer found that having a well-connected CEO (i.e., a CEO with over five hundred links on LinkedIn) is positively associated with the amount raised.[242] Third, the size of the team is associated with success.[243] Overall, consistent with our expectations, these results suggest that team characteristics are important signals. Having said that, in practice, many ICOs provide misleading or no information about their initiators.[244]

2. Source Code Disclosure

Prior to launch, ventures generally disclose their underlying code on an online code repository (mainly GitHub).[245] Most empirical studies found that source code disclosure is positively and significantly associated with successfully completing the ICO,[246] with liquidity and

238. Bourveau et al., *supra* note 118, at 46.

239. *See* Moral Hazard, *supra* note 11, at 31. Interestingly, he also found that CEOs' prior experience in crypto-related projects is positively associated with project failure ("defined as events in which tokens are delisted from all exchange platforms") (*see id.* at 18). His suggested explanation "is that many CEOs had prior projects that failed, which might send a negative signal" (*see id.* at 31).

240. Howell et al., *supra* note 89, at 23 (a dummy variable that equals 1 if the founder claims on LinkedIn to have previously founded a company).

241. *Id.* at 3.

242. Amsden & Schweizer, *supra* note 188, at 64.

243. Abe De Jong, Peter Roosenboom & Tom van der Kolk, What Determines Success in Initial Coin Offerings? 18 (Sept. 15, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3250 [https://perma.cc/K79A-CRRH] (archived Feb. 16, 2020); Amsden & Schweizer, *supra* note 188; Bourveau et al., *supra* note 118, at 44; Lyandres et al., *supra* note 9, at 45. Burns & Moro find that team size is negatively associated with ROI, but positively associated with the amount raised. *See* Lauren Burns & Andrea Moro, What Makes an ICO Successful? An Investigation of the Role of ICO Characteristics, Team Quality and Market Sentiment 25 (Sept. 27, 2018) (unpublished manuscript) (on file with author), papers.ssrn.com/sol3/papers.cfm?abstract_id=3256512 [https://perma.cc/PK95-EZVC] (archived Feb. 16, 2020).

244. See Zetzsche et al., *supra* note 82, at 15.

245. *See generally* Amsden & Schweizer, *supra* note 188 (finding that forty-eight percent of ICOs disclosed their source-code on GitHub); Adhami et al., *supra* note 7 (finding that forty percent of ICOs disclosed their source code); Howell et al., *supra* note 89 (finding that sixty-six percent of ICOs disclosed their source code); Fisch, *supra* note 16 (finding that sixty-seven percent of ICOs disclosed their source code).

246. *See, e.g.*, Bourveau et al., *supra* note 118, at 46; Adhami et al., *supra* note 7, at 9.

volatility,[247] with the amount raised,[248] and with the probability of having tradable tokens after ICO completion.[249] Adhami *et al.* suggested that source code disclosure allows potential investors to preassess the technical validity of the project, and thus it is an important signal.[250] In contrast, Fisch found that source code disclosure does not predict success, but only the quality of the code (measured by the number of defect fixed in GitHub).[251] He suggested that high quality code signals high technological capabilities.[252] In line with this, Rhue found that the number of bugs in the token code, identified by Etherscan, is negatively and significantly associated with market cap;[253] Howell *et al.* found a negative relation between days from last commit (revision) and liquidity, which suggests that being active on GitHub is a positive signal for potential investors;[254] and Blaseg also found source code quality, measured in accordance with BetterCodeHub Guidelines on Maintainable Software, strongly predicts ICO success.[255]

Ironically, while investors tend to be highly sensitive to source code disclosure and quality, Shaanan Cohney *et al.* empirically showed significant mismatches between promises made in white papers and the actual code, and that the number of uncoded promises does not affect ICO success.[256] This implies that investors either do not review the source code or are unable to assess its quality. In the long term, however, they found a negative correlation between price appreciation and the number of uncoded promises,[257] suggesting that information asymmetry decreases as time goes by. A potential interpretation for these results is that when an ICO raises a large amount of money, it attracts attention from independent parties (or competitors), who assess its underlying code and then post their findings on social media.[258]

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247. *See, e.g.*, Howell et al., *supra* note 89, at 44.
248. *See, e.g.*, De Jong et al., *supra* note 243, at 4.
249. *See, e.g.*, Amsden & Schweizer, *supra* note 188, at 43.
250. Adhami et al., *supra* note 7, at 7.
251. Fisch, *supra* note 16, at 7–8.
252. *Id.*
253. Rhue, *supra* note 9, at 20.
254. Howell et al., *supra* note 89, at 39.
255. Blaseg, *supra* note 229, at 14.
256. *See generally* Cohney et al., *supra* note 26.
257. *Id.* at 613.
258. This interpretation corresponds with Bourveau et al, who found that source code disclosure is positively correlated with crash risks in the long term. They suggest that by disclosing the source code, ICOs enable other ventures to imitate their technology, and therefore may lose their competitive advantage. *See* Bourveau et al., *supra* note 118, at 40.

3. Social Media and Marketing

Social media platforms play a vital role in ICOs. While firms launching an IPO generally use social media to raise awareness for the project, in the case of ICOs vital information like launch announcements, or the start of trading, is often publicized on social media.[259] The importance of social media could be attributed to the information asymmetry associated with ICOs.[260] Presence on social media sites enables potential investors to communicate directly with the entrepreneurs, and thus reduces the uncertainty around the project.[261] Empirical studies show that most ICOs are indeed very active on social media platforms. Rhue found that every ICO has a median of eight social media links[262] and Howell *et al.* found that 87 percent (97 percent) of ICOs have a Telegram group (Twitter account) with an average of over five thousand (22,200) members (followers).[263]

Social media activity and presence predict ICO success: Empirical studies analyzed the relation between social media and different aspects of ICOs and found that social media presence and activity are among the major factors that influence ICO success. Bourveau *et al.* found that social media activity, an indicator measured by ICOBench, is negatively associated with illiquidity, and positively and reliably associated with successfully completing an ICO and with the amount raised for it.[264] Benedetti and Kostovetsky found a positive relationship between market capitalization and number of Twitter followers, and that Twitter accounts with a longer record are associated with success.[265] Amsden and Schweizer found that having a Telegram group is positively and significantly correlated with the probability of having tradable tokens after ICO completion and with the amount raised.[266] Howell *et al.* found that the number of followers on Twitter and Telegram is positively associated with liquidity, but only the former is significantly correlated with long-term returns.[267] Fisch found that a higher level of Twitter activity during the ICO is

259. Chanson et al., *supra* note 168, at 13.
260. *See id.*
261. *See id.*
262. Rhue, *supra* note 9, at 35.
263. Howell et al., *supra* note 89, at 24.
264. Bourveau et al., *supra* note 118, at 25.
265. Benedetti & Kostovetsky, *supra* note 115, at 29–33, 36 (finding that accounts with a longer record of activity are slightly more likely to be successful, with listed and successful ICOs having an average Twitter age of 9.4 months (median of 4 months) compared to unsuccessful ICOs with an average of 6.6 months. They also find that stronger activity before the ICO, and especially during the ICO, is correlated with success. However, increased tweeting during the ICO could be a result rather than the cause of ICO success, as entrepreneurs are more likely to share good news about strong token sales).
266. Amsden & Schweizer, *supra* note 188, at 33.
267. Howell et al., *supra* note 89, at 44.

associated with a higher amount of funding raised (p<5%).[268] Lauren Burns and Andrea Moro found that the number of Twitter followers on the ICO end date is positively correlated with ROI after four months (p<5%) and with the amount raised (p<1%); they also found that the growth in Twitter followers over the four-month period is positively correlated with ROI (p<1%).[269] Similarly, Blaseg found that the presence and activity of an ICO on social media, online forums (e.g., BitcoinTalk), and web traffic analytics platforms (e.g., Alexa rank) predict success;[270] and Boreiko and Vidusso found that the logarithm of total twitter followers before the start of the ICO campaign predicts ICO success.[271] Interestingly, Lyandres *et al.*, found that the level of Twitter activity during the ninety days prior to the ICO is much higher compared to the following ninety days after the end of the ICO.[272]

Content from news website is less important in ICOs: earlier studies have found that ventures can build legitimacy, which is necessary to acquire financial resources, through media coverage in secondary sources of information (e.g., newspapers).[273] In the context of IPOs, the volume of media information that a venture received was found to be negatively associated with underpricing.[274] This may imply that media coverage reduces *ex ante* uncertainty and increases a venture's legitimacy.[275] In contrast, in the case of ICOs, Mathieu Chanson *et al.* found that crypto news prior to ICOs has no significant effect on underpricing.[276] Similarly, Wolfgang Drobetz *et al.* found that news articles have only a minor effect on ICOs, and a much smaller influence compared to social media activity.[277] On the other hand, Burns and Moro found that the number of news articles which mention the token's name from two months prior to the ICO is positively and significantly associated with the amount raised in the ICO.[278] However, they also found it to be negatively and significantly (p<1%)

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268. Fisch, *supra* note 16, at 14.

269. Burns & Moro, *supra* note 243, at 25.

270. Blaseg, *supra* note 229, at 11.

271. Boreiko & Vidusso, *supra* note 204.

272. Lyandres et al., *supra* note 9, at 17.

273. *See generally* Timothy G. Pollock & Violina P. Rindova, *Media Legitimation Effects in the Market for Initial Public Offerings*, 46 ACAD. MGMT. J. 631 (2003).

274. *See id.* at 639 (found that the volume of media-provided information is negatively associated with underpricing and positively with stock turnover); Woan-Yuh Jang, *Media Exposure or Media Hype: Evidence from Initial Public Offering Stocks in Taiwan*, 20 J. MEDIA & ECON. 259, 259 (2007) (found that the "more media coverage a firm receives over a substantial period of time prior to its IPO, the smaller the degree to which its stock is underpriced").

275. *Id.*

276. Chanson et al., *supra* note 168, at 13.

277. *See generally* Wolfgang Drobetz, Paul P. Momtaz & Henning Schröder, *Investor Sentiment and Initial Coin Offerings*, 21 J. ALTERNATIVE INV. 41 (2019).

278. Burns & Moro, *supra* note 243, at 22.

correlated with the ROI after four months;[279] they suggest that this can be explained by Merton's investor recognition hypothesis.[280]

4. Presale

ICOs generally conduct private and public presales, which target mainly institutional investors and VCs, and offer them discounts or bonuses in exchange for taking more risk (investing in an early stage).[281] Empirical evidence shows that presales are a common practice,[282] and that including them is positively and reliably associated with liquidity and volatility,[283] with the amount raised, with the probability of the token becoming tradeable,[284] and with the likelihood of successfully completing the ICO (i.e., achieving the soft cap).[285] As presales are strongly related to the presence of sophisticated investors,[286] these results suggest that potential investors regard investments by sophisticated investors as a valuable signal.[287] To put

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279. *Id.* (However, they suggest that their result might be inaccurate as they did not divide news articles into positive and negative news). Block et al., for example, find that the type of information provided in updates plays an important role in the context of equity crowdfunding. *See* Jörn Block, Lars Hornuf & Alexandra Moritz, *Which Updates During an Equity Crowdfunding Campaign Increase Crowd Participation?* 50 SMALL BUS. ECON. 15 (2018).

280. Robert C. Merton, *A Simple Model of Capital Market Equilibrium with Incomplete Information*, 42 J. FINANCE 483 (1987); Burns & Moro, *supra* note 243, at 22. Merton Models informationally incomplete markets in which investors are not aware of the number of securities available in each firm. He suggests that in this model, firms that are recognized by fewer investors (determined by fewer news articles) need to compensate their investors with higher returns. Based on this model, Burns and Moro claim that an increase in the number of news articles that features the ICO leads to an increase in investor recognition, and thus to a lower return compared to stocks with no media coverage.

281. *See* Howell et al., *supra* note 89, at 12 (discussing the practice of presales).

282. *Id.* (finding that forty-five percent of the sample had a presale); Benedetti & Kostovetsky, *supra* note 115, at 44 (finding that forty percent of the sample had a presale); Adhami et al., *supra* note 7, at 9 (finding that thirty-eight percent had a presale); Zetzsche et al., *supra* note 82, at 7 (finding that twenty-two percent of the sample had a presale, but suggesting that the actual number is higher, given the information asymmetry associated with ICOs); Fisch, *supra* note 16, at 12 (finding that sixty-five percent of the sample had a presale); Momtaz, Initial Coin Offerings, *supra* note 106, at 35 (finding that forty-four percent had a presale).

283. Howell et al., *supra* note 89, at 30.

284. Lyandres et al., *supra* note 9, at 21.

285. Lee et al., *supra* note 18, at 17, 19 (finding that 39.5 percent of successful ICOs included a presale, compared to 21.3 percent of failed ICOs; and that including a presale can boost the success likelihood by 15.2 percentage points ($p<1\%$)).

286. *See* Lyandres et al., *supra* note 9, at 21 ("the presale indicator is strongly associated with the pres- ence of institutional or sophisticated investors".

287. *See generally* Jiasun Li & William Mann, Initial Coin Offerings and Platform Building (Oct. 1, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3088726 [https://perma.cc/L6SX-BR35] (archived Feb. 16, 2020) (presenting a theoretical model that rationalizes these results. They show that given the multistage nature of ICOs, and that investors are

it another way, presales are interpreted by later investors as evidence that earlier investors held favorable information, and thus trigger an information cascade.[288] This interpretation is consistent both with the equity crowdfunding literature and with the IPO literature.[289] Interestingly, Benedetti and Kostovetsky found that presales have become more popular over time, "with an average incidence of 1% for ICOs completed before July 1, 2017, 29% for the second half of 2017 ICOs, and 57% for 2018 ICOs,"[290] suggesting that issuers are learning from past experience.

Other studies, on the other hand, have found that presales are neither associated with success[291] nor negatively related to ICO success.[292] A possible explanation, as Amsden and Schweizer suggested, is that presales may indicate that a firm is insecure about the ICO.[293] Another explanation is that, to attract sophisticated investors, firms need to offer high bonuses during presales and as discussed above, high bonuses may lead to pump-and-dump, as well as Ponzi schemes.[294] Empirical evidence suggests that investors are aware of these risks, so that offering bonuses—particularly high ones—predicts failure and lower first-day returns on the secondary market.[295] A possible explanation for the latter result, as Lee *et al.* suggested, is that rational secondary market investors aware of the

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heterogeneously informed, investors with a relatively high signal would join early and those with a relatively weak signal would "follow the crowd").

288. *See, e.g.*, Lee et al., *supra* note 18, at 5; Howell et al., *supra* note 89, at 30.

289. Lyandres et al., *supra* note 9, at 20. In the context of equity crowdfunding, *see generally* Lars Hornuf & Armin Schwienbacher, *Market Mechanisms and Funding Dynamics in Equity Crowdfunding*, 50 J. CORP. FIN. 556 (2018); In the IPO context, *see* Ivo Welch, *Sequential Sales, Learning, and Cascades*, 47 J. FINANCE 695 (1992) (develops a model according to which, later potential investors can learn from the purchasing decisions of earlier investors).

290. Benedetti & Kostovetsky, *supra* note 115, at 17.

291. *See id.* ("pre-ICOs do not seem to be correlated with success").

292. Amsden & Schweizer, *supra* note 188, at 33; Momtaz, Initial Coin Offerings, *supra* note 106.

293. Amsden & Schweizer, *supra* note 188, at 18.

294. *See* Li & Mann, *supra* note 287, at 26; Amsden & Schweizer, *supra* note 188, at 39 (discussing effects of bonuses); Bourveau et al., *supra* note 118, at 40.

295. Lee et al., *supra* note 18, at 3, 17 (find that high bonuses (>20%) are more prevalent in failed ICOs ($p<0.1$); that ICOs offering large bonuses are 10.9 percentage points less likely to succeed; that high bonuses negatively predict the total amount raised in an ICO, are negatively correlated with first-day sales volumes, and have a significantly lower first-day return than that for token sales without large bonuses). Bourveau et al., *supra* note 118, at 44 (finding that offering bonuses and bounties is negatively associated with the amount raised, and that this is positively associated with extremely negative returns in the long term (less than or equal to -75%)). On the other hand, Amsden & Schweizer, *supra* note 188, at 38, find that the offering of presale bonuses is not significantly correlated with either the probability of the token's tradability or the amount raised.

bonuses would demand a lower price, closer to the tokens' intrinsic value.[296]

C. *Token Sale Design Choices*

1. Blockchain and Token Types

Type of blockchain: ICOs can either develop their own blockchain or launch their tokens on an existing platform, such as Ethereum or Bitcoin. Most ICOs are currently launched on Ethereum and use the standardized smart contract ERC20,[297] a "token standard [that] describes the functions and events that an Ethereum token contract has to implement."[298] A possible reason for the popularity of this protocol is that it ensures the interoperability of different tokens. Tokens issued under this protocol can interact with smart contracts on the Ethereum platform, and with every wallet that supports Ethereum-based tokens.[299] Another reason may be that ERC20 simplifies the process of issuing a new token, enabling anyone to issue a new token using less than one hundred lines of code.[300]

Investors value the Ethereum standard: empirical studies examined the association between the type of blockchain and ICO success and found that investors value the Ethereum standard. Momtaz found that using ERC20 is positively related to the amount raised and with first-day return.[301] Fisch found that launching an ICO on Ethereum is positively associated with the amount raised.[302] Similarly, Amsden and Schweizer found that launching an ICO on Ethereum is positively correlated with the probability of having tradable tokens after ICO completion.[303] However, they also found it is negatively correlated with the amount raised.[304] A possible reason for the latter result is that large ICOs may prefer to create their own blockchain due to limitations in the functionality of Ethereum.[305] In line with this interpretation, Howell *et al.* found that creating a new

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296. Lee et al., *supra* note 18, at 26.

297. Adhami et al., *supra* note 7, at 6 (finding that fifty-six percent of the sample use Ethereum); Amsden & Schweizer, *supra* note 188, at 32 (finding that over eighty-five percent of the sample use Ethereum); EY 2017, *supra* note 114, at 19 (finding that seventy-seven percent of the sample use Ethereum); Fisch, *supra* note 16, at 12 (finding that seventy-eight percent of the sample use Ethereum); Howell et al., *supra* note 89, at 23 (finding that seventy-four percent of the sample use ERC20); Lee et al., *supra* note 18, at 13 (finding that seventy-eight percent of the sample use Ethereum); Rhue, *supra* note 9, at 19 (finding that nearly eighty-five percent of the sample use Ethereum).

298. *ERC20*, *supra* note 68.

299. Robinson, *supra* note 20, at 958 n.349.

300. *See* Rohr & Write, *supra* note 26, at 474 (describing the benefits of ECR20).

301. Momtaz, Initial Coin Offerings, *supra* note 106, at 34.

302. Fisch, *supra* note 16, at 14.

303. Amsden & Schweizer, *supra* note 188, at 33.

304. *Id.* at 37.

305. *Id.*

blockchain protocol is among the strongest predictors of liquidity, and that it is also positively associated with higher returns on the secondary market.[306] Their suggested explanation is that ventures that launch a token on a native blockchain ensure that the token value is correlated, at least in theory, with the platform value.[307] Another possible explanation is that creating a new protocol signals high technical expertise.

Type of token: A token may represent a variety of rights, ranging from financial to consumptive rights. Empirical studies show that the most common type is utility token.[308] Empirical studies also examine whether token type affects its success probability. Adhami *et al.* hypothesized that the rights attached to the token matter, because they contribute to the question of whether the token qualifies as a security.[309] They found empirical evidence that partly supports their hypothesis, showing that only the right to access a service (utility token) and profits rights are associated with success (significant at 99 percent and 95 percent, respectively).[310] Howell *et al.* found that tokens that convey utility-like rights are more likely to succeed.[311] Fisch, however, analyzed the relation between utility token—a dummy variable measured manually based on the ICO's white paper—and ICO success, and found no significant difference between security and utility tokens with regard to the amount raised.[312]

2. Economic Variables

Fraction of tokens for sale: As in IPOs, a venture that launches an ICO can decide how many tokens would be sold. Empirical studies found that the average fraction of tokens for sale in an ICO is between 54 percent and 61 percent,[313] and that it is negatively and reliably

306. Howell et al., *supra* note 89, at 31.

307. *See id.*

308. *See* Adhami et al., *supra* note 7, at 8 (finding that sixty-eight percent of tokens convey a right to access a service (utility token); 24.9 percent convey governance rights (such as voting in decision polls); and 26.1 percent convey profit rights); Fisch, *supra* note 16, at 12 (finding that eighty-three percent of the sample are utility tokens and seventeen percent are security tokens); Howell et al., *supra* note 89 (find that sixty-eight percent of tokens are utility tokens); Blaseg, *supra* note 229, at 29 (find that seventy-one percent of tokens are utility tokens).

309. Adhami et al., *supra* note 7, at 7.

310. *Id.*, at 7.

311. Howell et al., *supra* note 89, at 33.

312. Fisch, *supra* note 16, at 14.

313. Benedetti & Kostovetsky, *supra* note 115, at 25 (finding that the average percent of all tokens sold during the ICO is 60); Howell et al., *supra* note 89, at 25 (finding that the average percent is fifty-four); Lee et al., *supra* note 18, at 40 (fifty-seven percent among successful and sixty-one percent among failed ICO); Amsden & Schweizer, *supra* note 188, at 32 (sixty percent); Lyandres et al., *supra* note 9, at 15 (fifty-seven percent;

associated with the probability of ICO success and with the amount raised.[314] These results suggest that a higher fraction of tokens owned by issuers signals that they are more committed to the project (have more "skin in the game"). This is in line with Vismara's research (in the context of equity crowdfunding), which found that entrepreneurs who sell larger portions of their companies at listing are less likely to attract the interest of potential investors.[315] This result is also consistent with Richard Brealey's *et al.* argument (in the context of IPOs) that the willingness of persons with inside information to invest in the project signals quality.[316]

Soft cap: When launching a token sale, a venture must decide whether to include a soft cap requirement. A soft cap, as mentioned earlier, is the minimum amount of funds aimed at by the ICO.[317] If an ICO fails to reach the soft cap requirement, funds are usually returned to investors.[318] Therefore, a soft cap requirement reduces investor risk. Empirical studies found, however, that soft cap requirements are not very common.[319] They also examined the association between including a soft cap requirement and determinants of ICO success and found contradictory results.[320] Lee *et al.* found that the average (median) soft cap for successful ICOs is $6.8 ($2.7) million, similar to that set by unsuccessful ICOs, suggesting that having a soft cap does not affect ICO success.[321] Similarly, Rhue and Blaseg found that it has no significant effect on ICO success.[322] Bourveau *et al.* found that including a soft cap requirement is negatively and significantly associated with the amount raised and with successfully completing the fundraising;[323] and Abe De Jong *et al.* found that the soft cap target

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in ten percent of the ICOs all tokens are offered to ICO investors); Fisch, *supra* note 16, at 11 (fifty-six percent).

314. *See* Lee et al., *supra* note 18, at 40; Amsden & Schweizer, *supra* note 188, at 32; Lyandres et al., *supra* note 9, at 15. On the other hand, however, De Jong et al., *supra* note 243; Fisch, *supra* note 16, at 11; and Howell et al., *supra* note 89, at 25 found that the association is not significant.

315. Silvio Vismara, *Equity Retention and Social Network Theory in Equity Crowdfunding*, 46 SMALL BUS. ECON. 579, 588 (2016).

316. Richard Brealey, Hayne E. Leland & David H. Pyle, *Informational Asymmetries, Financial Structure, and Financial Intermediation*, 32 J. FINANCE 371, 371 (1977); *see also* Lowell W. Busenitz et al., *Signaling in Venture Capitalist—New Venture Team Funding Decisions: Does It Indicate Long-Term Venture Outcomes?*, 29 ENTREPRENEURSHIP THEORY & PRAC. 1, 2 (2005) (describing the willingness of persons with inside information in the context of venture capital).

317. *See* Lee et al., *supra* note 18, at 1.

318. *See infra* Part II.D.3.

319. Amsden & Schweizer, *supra* note 188, at 54 (finding that thirty-two percent of the sample specify a soft cap requirement); Bourveau et al., *supra* note 118, at 18 (finding that thirty-nine percent of the sample specify a soft cap requirement).

320. Blaseg, *supra* note 229, at 31; Lee et al., *supra* note 18, at 16; Rhue, *supra* note 9.

321. Lee et al., *supra* note 18, at 16.

322. Blaseg, *supra* note 229, at 31; Rhue, *supra* note 9.

323. Bourveau et al., *supra* note 135, at 44.

amount is negatively associated with success.[324] On the other hand, Amsden and Schweizer, Howell *et al.*, and Fisch found that a soft cap requirement is positively associated with the amount raised.[325]

Hard cap: Similarly, a venture may decide whether to include a hard or maximum cap requirement. Empirical studies found that the average hard cap ranges from $43–$93 million, but the distribution is highly skewed with a median value of $20–$23 million.[326] Studies also suggest that ICOs tend to set high hard caps that they are unlikely to reach,[327] and that a higher hard cap is negatively associated with ICO success.[328] These results are in line with the theoretical and empirical IPO literature, according to which large offerings send a negative signal to the market.[329] Similarly, in the context of reward-based crowdfunding, Ethan Mollick found that the funding goal is negatively associated with success.[330] Conversely, in the case of equity crowdfunding, Anna Lukkarinen *et al.* found that the fundraising target is positively associated with the number of investors, but insignificantly associated with the amount raised.[331] They suggest that the difference between reward-based and equity crowdfunding is rational as reward-based crowdfunding investors are interested in obtaining a reward rather than a stake in the company.[332] It would be interesting to see whether such a difference exists between utility and security token sales.

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324. De Jong et al., *supra* note 243, at 17.

325. Amsden & Schweizer, *supra* note213, at 37; Howell et al., *supra* note 89; Fisch, *supra* note 16.

326. *See* Benedetti & Kostovetsky, *supra* note 115, at 16 (finding that the average hard cap is approximately $43 million (median=$23 million)); Lee et al., *supra* note 18, at 16 (finding that the average hard cap for successful ICOs is approximately $88 million (median=$22 million)); Lyandres et al., *supra* note 9, at 15 (finding the mean hard cap is $70 million, while in more than fifty percent of the ICOs, it is larger than $20 million, highlighting that the distribution is skewed).

327. *See* Lee et al., *supra* note 18, at 8 (finding that only 12.2% of ICOs hit their hard cap); Lyandres et al., *supra* note 9, at 16 (finding that ICOs are able to raise on average forty-four percent of their hard cap, and only twenty-six percent of ICOs reach the hard cap).

328. De Jong et al., *supra* note 243, at 17; Lyandres et al., *supra* note 9. *But see* Lee et al., *supra* note 18, at 16 (finding that successful ICOs have on average a much higher hard cap, but the median hard cap is very similar).

329. Lyandres et al., *supra* note 9, at 4 (citing Craig G. Dunbar & Stephen R. Foerster, *Second Time Lucky? Withdrawn IPOs That Return to the Market*, 87 J. FIN. ECON. 610 (2008); Kathleen Weiss Hanley, *The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomenon*, 34 J. FIN. ECON. 231).

330. Ethan Mollick, *The Dynamics of Crowdfunding: An Exploratory Study*, 29 J. BUS. VENTURING 1, 5 (2014).

331. Anna Lukkarinen et al., *Success Drivers of Online Equity Crowdfunding Campaigns*, 87 DECISION SUPPORT SYS. 26, 35 (2016).

332. *Id.*

Currency accepted: The token sale is usually made through the project website, wherein investors are required to transfer money (either crypto or fiat currencies) to a smart contract address, which then transfers a predetermined amount of tokens to the sender.[333] Empirical studies found that ICOs accept on average two types of currencies.[334] Lee *et al.* found that ICOs that accept multiple currencies are significantly more likely to succeed.[335] Considering the volatile nature of cryptocurrencies, this result highlights the importance of expanding payment options. Amsden and Schweizer offered another interpretation, according to which, accepting multiple cryptocurrencies requires significant technical expertise, and thus signals quality.[336] Unsurprisingly, most ICOs accept Ether, and accepting Ether has a stronger positive relation with liquidity and volatility compared to accepting bitcoin.[337]

ICOs sometimes accept fiat currencies, mainly USD. Some studies found that accepting fiat currencies is correlated with a higher market cap and amount raised, and negatively associated with long-term failure (i.e., being delisted from exchanges).[338] A possible interpretation for these results is that ICOs that accept fiat currencies reduce investors' entry barriers.[339] Conversely, Amsden and Schweizer found that accepting fiat currencies is negatively related to the probability of having tradable tokens.[340] They suggest a twofold

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333. *See infra* Part II.D.3.

334. Amsden & Schweizer, *supra* note 188, at 54 (finding that on average an ICO accepts 1.6 different cryptocurrencies during the funding); Howell et al., *supra* note 89, at 25.

335. Lee et al., *supra* note 18, at 3 (finding that (1) ICOs that accepted multiple currencies were more likely to succeed ($p<10\%$), compared to ICOs that accepted just one currency; (2) and that accepting multiple currencies is significantly ($p<1\%$) and positively associated with higher gross proceeds). *But see* Blaseg, *supra* note 229, at 31 (finding that the number of accepted currencies do not affect success); De Jong et al., *supra* note 243, at 30 (finding that the number of accepted currencies does not affect success).

336. Note that they refer to cryptocurrencies and not just currencies. *See* Amsden & Schweizer, *supra* note 188, at 21.

337. Howell et al., *supra* note 89, at 25 (finding that only sixty-six percent of ICOs accept Ether, and that accepting Ether has a stronger positive relation with liquidity compared to accepting bitcoin); Rhue, *supra* note 9, at 14 (finding that ninety-four percent of ICOs accept Ether, thirty-six percent accept bitcoin, and eleven percent accept USD. Interestingly, she also finds that accepting bitcoin and Ether is positively correlated with the amount raised, with the relation with the bitcoin being significant ($p<5\%$) and with Ether insignificant).

338. De Jong et al., *supra* note 243, at 17 (found that accepting fiat currencies positively affect ICO success, but the coefficient is significant only in certain specifications); Momtaz, Initial Coin Offerings, *supra* note 106 (found that accepting fiat currencies is positively associated with gross proceeds and negatively with the probability of being delisted); Rhue, *supra* note 9, at 20 (found that accepting USD is positively associated with market cap (log-transformed market capitalization estimated from the price on March 31, 2018)).

339. Momtaz, Initial Coin Offerings, *supra* note 106, at 20.

340. Amsden & Schweizer, *supra* note 188, at 34.

explanation for this result. First, accepting fiat currencies may signal issuers' lack of confidence to complete the ICO by crypto investors only.[341] Second, it may expose the ICO to regulatory interventions, and therefore increase the uncertainty around the project.[342] In line with this interpretation, Momtaz found that ICOs that accept fiat currencies go public on average 389 days later than ICOs that do not; he suggested that in the early days, cryptocurrencies were not considered an asset in most jurisdictions, and thus the regulatory effort associated with accepting cryptocurrencies was less time consuming.[343]

Token supply control: Unlike stock supply, token supply is coded.[344] Therefore, unless specific code restrictions are applied, issuers can control token supply, and dilute the value of a token through new issuance.[345] Christian Catalini and Joshua S. Gans theorized that, in order to maximize the amount raised in an ICO, the growth rate in token supply between subsequent periods should be zero (i.e., ICOs should have a predetermined token supply).[346] Consistent with this theoretical model, Howell *et al.* found that the ability to create future tokens is negatively correlated with the amount raised.[347] However, Cohney *et al.* found the over 20 percent of ICOs that made promises regarding token supply in their sample of the top fifty ICOs of 2017 by market capitalization failed to reflect these promises in the actual code.[348]

Token price and supply: A venture can freely determine token supply, as well as the nominal price of each token. These decisions are arbitrary as the venture can manipulate the nominal price by altering the token supply, and they should not affect the overall market value of the venture.[349] Nevertheless, empirical evidence suggests that these factors play an important role in influencing the behavior of ICO investors, with token supply being positively associated with ICO success and token nominal price being negatively associated with ICO

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341. *Id.* at 32–33.

342. *Id.*

343. Momtaz, Initial Coin Offerings, *supra* note 106, at 22.

344. Cohney, *supra* note 26, at 613 ("Cryptoassets are . . . created, limited, and used up according to code").

345. *Id.*

346. Catalini & Gans, *supra* note 104, at 13.

347. Howell et al., *supra* note 89, at 31–32.

348. Cohney et al., *supra* note 26, at 29.

349. For example, a venture can freely decide whether to issue ten tokens with a nominal price of ten or one-hundred tokens with a nominal price of one. *See* Malcolm Baker, Robin Greenwood & Jeffrey Wurgler, *Catering through Nominal Share Prices*, 64 J. FINANCE 2559, 2559 (2009) ("A firm's board of directors may choose to split to manage the nominal share price and number of shares outstanding but cannot change its overall market value through these means"); Justin Birru & Baolian Wang, *Nominal Price Illusion*, 119 J. FIN. ECON. 578, 578 (2016) ("The level of a firm's stock price is arbitrary as it can be manipulated by the firm via altering the number of shares outstanding").

success.[350] A possible explanation for these results is that ICO investors suffer from a nominal price illusion (i.e., that investors overestimate the growth potential of low- compared to high-priced tokens).[351] This is in line with the IPO literature, according to which investors place higher valuations on low-priced shares, and therefore managers respond by supplying shares at lower price levels.[352] Alternatively, these results may suggest that investors compare tokens to bitcoin, and hence buy a high quantity of tokens, hoping that they will reach a value similar to bitcoin.[353]

Lock-up mechanism: A venture must decide whether early contributors and founders would be required to commit to a lock-up period, during which they would be prevented from selling their tokens. The lock-up mechanism is designed to protect investors against the threat of desertion.[354] Consistent with the IPO literature,[355] empirical studies found that reporting on having a lock-up mechanism is positively correlated with ICO success, suggesting that lock-up is a signal of quality.[356] Therefore, ventures have an incentive to implement such a mechanism. That said, Cohney *et al.* found that, in practice, many ICOs make promises regarding lock-up mechanisms but fail to reflect them in the actual code.[357] They compared the promises made in the disclosure documents with the actual functionality of the digital tokens for the top fifty ICOs that raised the most capital in 2017, and found that of the thirty-seven ICOs that promised a lock-up mechanism, 78 percent did not code it.[358] These results highlight the information asymmetry associated with ICOs and suggest that issuers exploit it.

Country restrictions: The token sale operates as a "worldwide crowdfunding event,"[359] but due to regulatory concerns, ICOs may decide to exclude residents from certain countries. A recent empirical study found that ICOs tend to exclude residents mainly from China and the United States.[360] Empirical studies also analyze the relation between country restrictions and determinants of ICO success. Lee *et*

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350. Amsden & Schweizer, *supra* note 188, at 4; Benedetti & Kostovetsky, *supra* note 115, at 4; De Jong et al., *supra* note 243, at 30–31 (the coefficients are significant only in certain specifications); Fisch, *supra* note 16, at 12.

351. Benedetti & Kostovetsky, *supra* note 115, at 28.

352. Baker et al., *supra* note 349, at 2559; Birru & Wang, *supra* note 349, at 580.

353. Benedetti & Kostovetsky, *supra* note 115.

354. Cohney et al., *supra* note 26, at 614.

355. *See* Alon Brav & Paul A. Gompers, *The Role of Lockups in Initial Public Offerings*, 16 REV. FIN. STUD. 1 (2003).

356. Blaseg, *supra* note 229, at 31; Bourveau et al., *supra* note 118; Feng et al., *supra* note 221, at 25; Howell et al., *supra* note 89, at 28–30.

357. Cohney et al., *supra* note 26, at 614–15.

358. *Id.*

359. Rohr & Wright, *supra* note 27, at 478.

360. Rhue, *supra* note 9, at 14 (found that thirty-three percent of the sample exclude Chinese and twenty-seven percent exclude US citizens).

al. found that restricted sales in certain countries are less likely to succeed.[361] Similarly, Momtaz found that the number of country restrictions is positively associated with money on the table (an additional restriction associated with an increase by $0.76 million).[362] This finding suggests that firms that choose to reduce the set of potential investors need to offer higher incentives for the remaining. However, he also found that ICOs that restrict countries are less likely to fail (to be delisted).[363] A possible reason for this is that by preventing certain countries from participating the firm reduces the risk of regulatory action.[364]

Specifically, Bourveau *et al.* and Howell *et al.* analyze the influence of restricting US investors.[365] Bourveau *et al.* found that ICOs that restrict US investors from participating are more likely to be successfully completed and to raise more capital.[366] In line with Momtaz's interpretation, they suggest that this may reduce the risk of future U.S. Securities and Exchange Commission (SEC) regulation and intervention, thereby increasing participation.[367] On the other hand, Howell *et al.* found that restricting US investors is unrelated to success (higher liquidity and volatility).[368]

Preregistering: The decentralized nature of cryptocurrencies, along with their anonymity, increase the risk of money laundering and terrorism financing,[369] and hence know-your-customer (KYC) policies are necessary for ICOs.[370] However, KYC policies are usually not mandatory procedures. Empirical studies analyzed the association between adopting KYC policies and determinants of ICO success and found contradictory results. Lee *et al.* found evidence for a negative influence of adopting KYC policies, both on successfully completing the fundraising and on long-term returns.[371] They suggested that this finding is not unexpected, as such policies have the potential of reducing demand by investors who do not want to reveal their

361. Lee et al., *supra* note 18, at 393.
362. Momtaz, Initial Coin Offerings, *supra* note 106, at 21.
363. *Id.*
364. *Id. at 22.*
365. Bourveau et al., *supra* note 118, at 44; Howell et al., *supra* note 89.
366. Bourveau et al., *supra* note 118, at 44.
367. *Id.*
368. Howell et al., *supra* note 89, at 30.
369. Loi Luu, *With Blockchain, Knowing Your Customer Is More Important Than Ever*, FORBES (May 15, 2018), www.forbes.com/sites/luuloi/2018/05/17/with-blockchain-knowing-your-customer-is-more-important-than-ever/#d9c832c559cc [https://perma.cc/8NZU-W8RU] (archived Nov. 6, 2019).
370. *See* Lyandres et al., *supra* note 9, at 15 (finding that forty-nine percent of ICOs feature a KYC procedure and that thirty percent of ICOs feature a whitelist); Rhue, *supra* note 9, at 14 (finding that forty-five percent of ICOs feature a KYC procedure).
371. Lee et al., *supra* note 18, at 40.

identity.[372] Considering the cyber risks associated with the crypto market,[373] it seems reasonable that investors hesitate to enter sensitive personal data. On the other hand, Lyandres *et al.* and Burns and Moro found that pre-ICO registration—whitelist or KYC policy—is positively related to the amount raised.[374] These results may suggest that adopting a KYC policy signals legitimacy.[375] Interestingly, Momtaz documented a negative and significant relation between money left of the table and adopting of KYC policies.[376] He suggested that this result is consistent with information eliciting theories in IPOs, according to which entrepreneurs get to know their potential investors during the book-building period and can thus price their tokens more accurately.[377]

D. *Token Sale Duration*

The average duration of an ICO is from twenty-five to forty days.[378] Empirical studies found that the duration of an ICO is negatively related to success. Lee *et al.* found that successful ICOs took an average of thirty days to complete, compared to 37.8 days for failed fundraisers (the difference is significant at the 1 percent level).[379] Momtaz and Fisch found that the duration of an ICO is negatively associated with the amount raised.[380] Similarly, De Jong *et al.* found the ICO duration is negatively associated with token tradability and the amount raised;[381] and Blaseg found that the announced duration of the ICO is positively and significantly associated with success.[382]

These results are in line with the crowdfunding literature. In the context of reward-based crowdfunding, Mollick found that the duration of crowdfunding is negatively associated with success and suggests that a longer duration may signal lack of confidence in the project.[383]

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372. *Id.* at 27.
373. EY 2017, *supra* note 114, at 32.
374. Burns & Moro, *supra* note 243; Lyandres et al., *supra* note 9, at 22.
375. Burns & Moro, *supra* note 243, at 25.
376. Momtaz, Initial Coin Offerings, *supra* note 106, at 21.
377. *Id.*
378. Adhami et al., *supra* note 7, at 7 (finding that the average duration is twenty-seven days, but that it is heterogeneous with "some ICOs close in a few days, whereas other are open for some months"); Benedetti & Kostovetsky, *supra* note 115, at 44 (finding that the average ICO lasts thirty-seven days (with a median of thirty-one). They also find that this figure has recently been rising with an average of forty-one days for 2018 ICOs); Fisch, *supra* note 16, at 11 (finding that the average duration is twenty-five days); Howell et al., *supra* note 89, at 42 (finding that the average duration of an ICO is forty days).
379. Lee et al., *supra* note 18, at 18.
380. Fisch, *supra* note 16, at 14; Momtaz, Initial Coin Offerings, *supra* note 106, at 4, 20.
381. De Jong et al., *supra* note 243, at 30–31.
382. Blaseg, *supra* note 229, at 20.
383. Mollick, *supra* note 330, at 8.

Similarly, in the context of equity crowdfunding, Lukkarinen *et al.* found that crowdfunding duration is negatively associated with the number of investors (which is a proxy of campaign success) but not related to the amount raised.[384] They suggest that shorter durations may encourage prospective investors to act fast.[385]

E. *Post-ICO*

1. Listing

After the token sale ends, ICOs generally list their tokens in crypto exchanges, and the issued tokens are then traded on the secondary market. Listing is an important indicator of ICO success, as it provides the main source of liquidity.[386] In particular, listing is important for usage tokens, where a user must hold a token in order to access a platform.[387] Therefore, some empirical studies use a listing as a proxy of ICO success[388] and a delisting as a proxy of failure.[389] Empirical studies found that the time from ICO completion to listing is highly skewed, with some ICOs being listed during the token sales and others over a year after ICO completion. The average ranges from 18.5–93 days.[390]

Lyandres *et al.* found that a token is traded on average on five different exchanges, and that the number of exchanges is positively associated with success.[391] This suggests that exchanges are willing to trade tokens of successful ICOs and that successful ICOs are willing to pay listing fees. They also found that larger ICOs are more likely to be listed, which makes sense, as listing is costly.[392]

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384. Lukkarinen et al., *supra* note 331, at 35.
385. *Id.* at 35.
386. Momtaz, Initial Coin Offerings, *supra* note 106, at 10.
387. Amsden & Schweizer, *supra* note 188, at 14.
388. *Id.* at 13–14; Lyandres et al., *supra* note 9, at 19.
389. Lyandres et al., *supra* note 9, at 19; Momtaz, Initial Coin Offerings, *supra* note 106, at 21.
390. Benedetti & Kostovetsky, *supra* note 115, at 19 (finding that the average (median) time is 31 (16) days and that some ICOs were listed prior to the end of the ICO); Lee et al., *supra* note 18, at 25 (finding that the average time from ICO completion to listing is 18.5 days); Momtaz, Initial Coin Offerings, *supra* note 106, at 3 (average (median) time of 93 (42) days).
391. Lyandres et al., *supra* note 9, at 16, 23.
392. *Id.* at 22, 27.

2. Underpricing

Underpricing is a phenomenon whereby the price of an asset is on average lower than its issuance price.[393] This phenomenon has been observed by many researchers in the context of IPOs, and various explanations have been offered for it. Some studies suggested that information asymmetry between the issuer and potential investors can explain IPO underpricing, at least in part.[394] Other studies theorized that the information asymmetry between the issuer firm and the underwriter can explain this phenomenon.[395] Some scholars also suggested that firms intentionally underprice their stock.[396] For example, Rajesh K. Aggarwala *et al.* argued that managers strategically underprice their stocks in order to generate a higher price at the lock-up expiration,[397] and Ivo Welch argued that high-quality firms underprice their stocks to obtain a higher price at a seasoned offering.[398]

Empirical studies found significant evidence of underpricing in ICOs, and in a larger degree than compared to IPOs.[399] Various theoretical explanations were offered for this phenomenon in the context of ICOs. Momtaz, for example, argued that ICOs have an incentive to underprice their token to generate market liquidity, which is an important signal for investors.[400] This argument is consistent with Lyandres's *et al.* finding that liquidity is increasing in ICO underpricing[401] and with Howell *et al.* who suggested that in the absence of measures of commercial success, liquidity is a major signal of ICO quality from early investors' perspective.[402] Momtaz also argued that ICOs with a native token have an incentive to underprice their token to attract a large user base, as the value of the token is partially determined by network size.[403] Cong *et al.* developed a theoretical

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393. Thijn Felix, Underpricing in the Cryptocurrency World: Evidence from Initial Coin Offerings 7 (June 1, 2018) (unpublished manuscript) (on file with author), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3202320 [https://perma.cc/2V99-HGS7] (archived Nov. 11, 2019).

394. *See* Kevin Rock, *Why New Issues are Underpriced*, 15 J. FIN. ECON. 187, 187 (1986) (finding that information asymmetry can explain IPO underpricing). *See also* Felix, *supra* note 393, at 7–10 (provides a further review of IPO underpricing literature).

395. *See* David P. Baron, *A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues*, 37 J. FINANCE 955, 955 (1982).

396. *See* Rajesh K. Aggarwal et al., *Strategic IPO Underpricing, Information Momentum, and Lock Up Expiration Selling*, 66 J. FIN. ECON. 105, 106–08 (2002).

397. *Id.* at 134 .

398. Ivo Welch, *Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings*, 44 J. FINANCE 421, 421 (1989).

399. *See* Table 4 in the Appendix.

400. Momtaz, Initial Coin Offerings, *supra* note 106, at 14.

401. Lyandres et al., *supra* note 9, at 6.

402. Howell et al., *supra* note 89, at 30 (they also find that liquidity is positively associated with the amount raised and with successfully completing the fundraising).

403. Momtaz, Initial Coin Offerings, *supra* note 106, at 9.

model that supports this argument, according to which when a platform has native token investors (users) join the platform not only to enjoy its utility but also to benefit from the rising token price as a result of the growing network size.[404]

Momtaz, Benedetti and Kostovetsky, Lyandres *et al.* and Felix analyzed the determinants of ICO underpricing.[405] Unsurprisingly, Benedetti and Kostovetsky and Felix found that presales have a significant negative influence on underpricing.[406] This result is consistent with the argument of Howell *et al.* and Lee *et al.* that early investment rounds provide an indication of the demand for the token, thus helping determine an appropriate price for the launch of the ICO.[407] Felix and Lyandres *et al.* found that the issue size of an ICO is negatively and reliably associated with underpricing, suggesting that larger ICOs are associated with a lower degree of information asymmetry.[408] Conversely, Momtaz found that issue size is positively associated with money left on the table.[409] Momtaz also found that country restrictions are positively associated with money on the table, suggesting that higher incentives are required for the remaining potential investors.[410] Interestingly, in contrast with IPOs, Chanson *et al.* and Benedetti and Kostovetsky found no significant association between firm's age and underpricing.[411]

IV. INFORMATION ASYMMETRY

This Part focuses on information asymmetry. It shows that a high degree of information asymmetry exists in ICOs, and then outlines three sources of informational asymmetries—the absence of standard disclosure requirements, investors' lack of fundamental technical knowledge, and projects' early stages of development during the offering.[412] Subsequently, it discusses the role of signaling theory and rating websites in mitigating these asymmetries.

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404. Cong et al., *supra* note 121, at 28–29.

405. Benedetti & Kostovetsky, *supra* note 115, at 1; Felix, *supra* note 393; Lyandres et al., *supra* note 9; Momtaz, Initial Coin Offerings, *supra* note 106, at 5.

406. Benedetti & Kostovetsky, *supra* note 115, at 4; Felix, *supra* note 393, at 29.

407. Howell et al., *supra* note 89, at 12; Lee et al., *supra* note 18, at 3.

408. Felix, *supra* note 393, at 29; Lyandres et al., *supra* note 9, at 27.

409. Momtaz, Initial Coin Offerings, *supra* note 106, at 4.

410. *Id.* at 20.

411. *See* Benedetti & Kostovetsky, *supra* note 115, at 5 (finding the reason for the insignificant relation might be the use of a weak proxy: Twitter account age).

412. These sources were initially identified at Fisch, *supra* note 16, at 6. *See also* Moral Hazard, *supra* note 11, at 6–7 (discussing four distinct origins of information asymmetries in token sales).

Information asymmetry is a condition associated with financial markets, wherein potential investors lack information required to assess the true quality of the financial product.[413] Potentially, this may create a market for lemons, where high-quality companies will be deterred from entering the market.[414] A growing body of literature has discussed information asymmetry in the context of IPO,[415] VC,[416] and crowdfunding.[417] In the context of IPOs, for example, "potential investors possess substantially inferior knowledge relative to the owner of the security."[418] While initiators have access to information regarding the company's strategy and technology, potential investors have access to relatively limited information.[419]

The analysis presented in this Article suggests that a high degree of information asymmetry exists in the context of ICOs; white papers tend to be poor and misleading, but nevertheless, the ICO fundraising success rate is considerably high. Below, the Article outlines three potential sources of this information asymmetry.[420]

First, ICOs are not subject to standard disclosure requirements.[421] While a company that launches an IPO faces disclosure and registration requirements imposed by the securities regulator, ICOs' disclosure requirements are unclear and depend on their function as well as on the governing jurisdiction.[422] As a result, there is uncertainty about what should be disclosed, and ventures typically publish white papers that tend to be poor and misleading.[423]

Second, investors often lack fundamental technical knowledge required to assess the quality of the project.[424] Most ICOs are blockchain-based ventures, and in order to understand their business models, technological expertise is required.[425] Investors' lack of technical knowledge is thus a major source of information asymmetry. In line with this, the analysis in Part III shows that while investors tend to be highly sensitive to the technical aspects of the project, and

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413. Jensen & Meckling, *supra* note 11; Moral Hazard, *supra* note 11, at 6–7.

414. Akerlof, *supra* note 12, at 489–90.

415. Cohen & Dean, *supra* note 13.

416. *See* Gilson, *supra* note 14 (discussing information asymmetry in the context of venture capitalists).

417. Ahlers et al., *supra* note 15, at 6, 19.

418. Cohen & Dean, *supra* note 13, at 683–84.

419. *Id.*

420. The discussion here relies on Fisch, *supra* note 16, at 6; Moral Hazard, *supra* note 11, at 6–7.

421. Fisch, *supra* note 16, at 6.

422. Lee et al., *supra* note 18, at 7; OECD, *supra* note 108, at 26. For an overview of the top twenty-five ICO jurisdictions in market capitalizations and their comparative regulatory responses, *see generally* Kaal, *supra* note 158.

423. Adhami et al., *supra* note 7, at 10; Cohney et al., *supra* note 26, at 5 (finding mismatches between the underlying code and the promises disclosed in the white paper); Zetzsche et al., *supra* note 82, at 34.

424. Fisch, *supra* note 16, at 6.

425. *Id.*

specifically to source code disclosure,[426] they are insensitive to mismatches between promises made in white papers and the actual code, and that the number of uncoded promises does not affect the amount raised.[427] This implies that investors either do not review the source code or are unable to assess its quality.

Third, most ICOs are launched at a very early stage. A 2017 study found that most ICOs are in the idea stage, and their platforms/services are expected to be launched in a year or more after the ICO;[428] and a follow-up study found that "[a]bout a year after raising money, only a small portion of ICO-funded start-ups have progressed towards working product offerings."[429] Given that most ICOs are launched at a very early stage, and lack track of records, unsophisticated investors are unable to make an informed investment decision. This is in contrast with IPOs, where a potential issuer will have to "demonstrate a proper (and stable) amount of revenues, which can only be achieved after a company has reached a certain level of maturity."[430] This is partially due to exchanges and investment banks' (which act as underwriters) listing requirements, which have a tendency to select IPOs that have the potential to perform well after.[431]

A. *Reducing Information Asymmetry through Signaling—Are Investors Able to Distinguish Between High- and Low-Quality Firms?*

Against that background, recent researchers have analyzed the role of signaling theory in reducing the information asymmetry associated with ICOs.[432] The signaling theory originally developed in the context of labor markets and it examines how high-quality job candidates can distinguish themselves from low-quality candidates.[433]

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426. *See infra* Part III.B.

427. Cohney et al., *supra* note 26, at 29.

428. EY 2017, *supra* note 114, at 16.

429. *EY Study: Initial Coin Offerings (ICOs) The Class of 2017—one year later*, ERNST & YOUNG 6 (2018), https://www.ey.com/Publication/vwLUAssets/ey-study-ico-research/$FILE/ey-study-ico-research.pdf [https://perma.cc/PT8T-X64F] (archived Nov. 11, 2019).

430. Collomb et al., *supra* note 78, at 296–97.

431. *Id.*

432. *See* Fisch, *supra* note 16 (study examining the role of signaling ventures' technological capabilities in ICOs).

433. *See* Michael Spence, *Job Market Signaling*, 87 Q.J. ECON. 355, 355–61 (1973) (outlining the signaling theory as it applies to labor markets). In the context of IPOs, see Trevis Certo et al., *Signaling Firm Value Through Board Structure: An Investigation of Initial Public Offerings*, 26 ENTREPRENEURSHIP: THEORY & PRAC. 33, 36 (2001) (explaining the application of signaling theory to the incentives a firm's board of directors has at the IPO stage). In the context of crowdfunding, *see* Ahlers et al., *supra* note 15, at 956–57, 958–64 (describing how signaling theory works in crowdfunding ventures). In

In the context of financial markets, signaling theory examines how high-quality ventures can distinguish themselves from low-quality firms by sending signals about venture's true quality.[434]

Given the high variation in ICOs' quality, high-quality ICOs are incentivized to send signals about the venture's true quality, so that potential investors will be able to distinguish between them and low-quality ICOs.[435] The rest of this subpart examines how firms can signal quality in the context of ICOs.

First, ICOs may signal quality through voluntary disclosure. Past studies in the context of equity funding found that firms are incentivized to provide information voluntarily to reduce information asymmetry.[436] The rationale here is that low-quality ventures might be deterred from providing information about the ICO, whereas high-quality ICOs might be willing to provide additional information. Therefore, providing more extensive information in the white paper may signal quality.[437]

Empirical studies analyzed whether ICOs can signal quality by providing more extensive information; however, results were inconsistent. While the majority of ICOs publish a white paper, most studies found that simply disclosing a white paper does not affect ICO success.[438] However, empirical evidence suggests that proxies of white paper's quality (e.g., number of words, pages, and unique words) predict success, suggesting that investors value the quality of the

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the context of ICOs, *see* Fisch, *supra* note 16, at 5–8 (discussing how signaling theory can apply to the ICO market).

434. In order for the signals to be effective, they must be observable by potential investors and costly to imitate. *See* Brian L. Connelly et al., *Signaling Theory: A Review and Assessment*, 37 J. MGMT. 39, 47–50 (2011) (listing several sources stating that the observability and costliness of signals are important for them to be successful).

435. *See id.* at 40 (explaining the incentives signaling theory creates in general); Fisch, *supra* note 16, at 11, 18 (briefly describing some of the disparities in ICOs and showing findings that demonstrate what signals ICOs may use to effectively indicate quality to investors).

436. *See* Feng et al., *supra* note 221; *see also* Richard Frankelet al., *Discretionary Disclosure and External Financing*, 70 ACCT. REV. 135. 136–37, 140–49 (1995) (divulging findings that show that firms make earnings forecasts as a tool to communicate with investors); Leone et al., *supra* note 252, at 118–48 (examining the correlation between disclosure of proceeds usage and initial IPO returns, and finding that disclosure tends to help avoid underpricing).

437. However, to ensure that low-quality ICOs will be deterred from providing misleading information, they must face penalties in the event of fraudulent disclosure. *See* Patricia J. Hughes, *Signalling by direct disclosure under asymmetric information*, 8 J. ACCT. & ECON. 119, 121–37 (1986) (making findings that demonstrate how having a penalty set for inaccurate disclosures should incentivize truthful disclosures); *see also* De Jong et al., *supra* note 243, at 8 (stating, based on Hughes' findings, that low-quality ICOs are less likely to share information with investors when they may incur a penalty for that information being fraudulent).

438. *See infra* Part III.B.1 (examining several studies about the effects of white paper disclosure).

information disclosed in white papers.[439] In line with this, De Jong *et al.* found that ICOs with a higher transparency rating (i.e., that disclose more extensive information) according to ICOBench are more likely to succeed,[440] and Bourveau *et al.* found that ICOs with informative white papers according to ICOBench are more likely to succeed.[441]

However, when Bourveau *et al.* manually analyzed the association between disclosure practices (ICO team information, token allocation information, founder tokens vesting period, use of proceeds, white paper opacity, and white paper length) and ICO success they found no significant association, which may suggest that ICOBench disclosure indicators are not entirely accurate.[442] This is also in line with the contradictory effect of disclosing information about the use of proceeds and token allocations. The lack of clear positive effect with regard to these indicators may suggest that investors do not fully assess the information disclosed in white papers. Therefore, the effect of providing more extensive information in white papers is not entirely clear.

Second, due to the complex technological nature of ICOs, some have argued that ICOs can signal quality through technological capabilities.[443] In line with this argument, empirical evidence suggests that disclosing a technical white paper and the amount of technical language in the white paper predict successful fundraising.[444] However, Feng *et al.* found that the amount of technical discussion in white papers predicts success only for high-quality ICOs.[445] A possible

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439. *See id.* (explaining data that demonstrates how the quality of information white papers disclose relate to the success of an ICO).

440. *See* De Jong et al., *supra* note 243, at 18 (concluding that higher ratings for ICOs correlate with stronger performance).

441. *See* Bourveau et al., *supra* note 118, at 32–33, 47–48, 54 (finding that (1) completed ICOs tend to have significantly higher ratings than failed ICOs; (2) rating is positively associated with the likelihood of completing an ICO; (3) higher ratings are strongly negatively associated with two measures of crash risk, extreme negative returns and negative return skewness; and (4) higher ratings are negatively associated with post-ICO illiquidity and return volatility).

442. *See id.* at 2, 18–20, 44 (finding no substantial correlation between ICO disclosure practices and the ultimate success of an ICO).

443. *See, e.g.*, Feng et al., *supra* note 221, at 22–29 (reporting findings about the effect of the quality of blockchain technology an ICO uses on investors and the success of the ICO); Fisch, *supra* note 16, at 12–14, 18 (discussing findings regarding how various indicators of technological capabilities serve as effective signals to investors).

444. *See* Fisch, *supra* note 16, at 12–14, 18 (explaining the effectiveness of technical white papers as signals); Lyandres et al., *supra* note 9, at 19–20, 50 (showing and summarizing data demonstrating that white papers with more technical language are more effective for ICO success).

445. *See* Feng et al., *supra* note 221, at 5–6 (finding that white paper technical discussion increases the amount raised for ICOs with high blockchain ratings, but that the same does not hold true for those with low blockchain ratings).

interpretation for this is that projects are more likely to provide technical discussions in the white paper when they are in more advanced stages.[446]

Another important signal on that matter is ventures' source codes. Almost all the empirical studies analyzed in this Article found that disclosing a source code on GitHub prior to the ICO predicts success.[447] Source code disclosure allows potential investors to preassess the technical validity of the project, and thus it is an important signal.[448] Likewise, most empirical papers found that proxies of source code quality predict success, suggesting the quality of the source code is associated with the value of the ICO.[449] However, it seems that investors are only sensitive to "surface" technical signals and are unable to assess the true quality of the code.[450] While disclosing the source code and proxies of code quality, like being active on GitHub, predicts success, mismatches between the source code and promises made in the white paper do not affect fundraising success.[451] This may suggest the investors review the source codes but are unable to evaluate their true quality, or, alternatively, it is possible that investors are relying on intermediaries, which only assess "surface" indicators regarding the quality of the code.

With respect to the use of blockchain technology, empirical evidence suggests that investors are able to distinguish between ICOs that leverage blockchain technology and ICOs that don't really need to use blockchain,[452] and see the Ethereum standard as a valuable signal.

Third, due to the lack of legal protection to ICO investors, coupled with the large amount of fraudulent ICOs, ventures may signal quality by implementing practices intended to protect investors. Obviously, empirical papers found that ICOs that state that they will implement

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446. *See id.*; Lyandres et al., *supra* note 9, at 12–13 (choosing to measure technical language in white papers on the thought that technical white papers come about from more developed ICO projects).

447. *See infra* Part II.B.2 (analyzing the results of studies on how source code disclosure affects ICO success); *infra* Table 2 in the Appendix (organizing the findings of several studies into categories based on how it determined certain variables affect ICO success).

448. *See* Adhami et al., *supra* note 7, at 7 (acknowledging the potential disclosing source code has for allowing potential investors to scrutinize an ICO).

449. *See infra* Part III.B.2 (listing various studies showing that certain indicative factors relating to source code quality correlate with ICO success).

450. *See, e.g.*, Cohney et al., *supra* note 26, at 639–47 (finding that ICOs that made code promises in its white paper but did not actually include them in the code had similar fundraising outcomes to those that did); *supra* Part III.B.2 (noting that some investors seem to rely mostly on the promises about the source code in white papers as opposed to reading the actual code).

451. *See* Cohney et al., supra note 26, at 439–47 (listing the authors' findings that whether or not promises appeared in code did not affect ICO fundraising success); *supra* Part III.B.2 (describing the findings of Cohney et al., *supra* note 26).

452. Feng et al., *supra* note 221, at 25–26 (reporting findings about the differences in amounts raised that tend to show that investors can tell when an ICO uses blockchain and when others do not).

lockup mechanisms and restrict the ability to create future tokens are more likely to succeed.[453] However, such statements were found to be false in certain cases.[454] Surprisingly, the effect of including a soft cap is unclear.[455] This result is surprising, because most ICOs implement an "all or nothing" mechanism, and hence the presence of a soft cap reduces investors' risks.[456] Additionally, consistent with IPOs and crowdfunding, a higher fraction of tokens owned by issuers is associated with success, suggesting that it signals "skin in the game."[457] Empirical studies also analyze the effect of adopting a KYC mechanism and came with conflicting results. This result is not entirely surprising; while KYC potentially may signal legitimacy, investors might be hesitant in providing private information, due to a large amount of cybersecurity incidents occurring in the blockchain industry.[458]

In line with the contradictory results outlined here, empirical evidence suggests that investors are not entirely sensitive to disclosure about risk and regulation.[459] Most ICOs do not specify the applicable law and jurisdiction, and the presence of such information has only a minor effect on ICO success.[460] While these results are surprising, it is possible that ventures were unable to specify the applicable law and jurisdiction due to regulatory uncertainty. Additionally, Feng *et al.* found that most ICOs do not disclose information related to the project's risks and that such disclosure does not affect ICO success.[461] Combined, these results suggest that investors are not entirely sensitive to risk and regulation related information.

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453. *See infra* Part III.C.2 nn.387–88 (citing several sources reflecting how lockup mechanisms positively affect the success of an ICO).

454. *See, e.g.*, Cohney et al., *supra* note 26, at 638–43 (reporting data showing that ICO projects that promise lockup in their white papers will frequently not actually encode it into the ICO).

455. *See infra* Part III.C.2 (describing several studies that reached contradictory conclusions about the effect of including a soft cap in an ICO).

456. *See id.* (stating how most ICOs return funds to investors if they fail to reach their soft caps).

457. *See id.* (looking at several studies and determining that investors react positively to token issuers owning a significant portion of the tokens in a project).

458. *See id.* (noting the various findings of several conflicting studies and the reasons results could come out either way).

459. *See supra* Part III.B.1. (pointing out that even though most ICOs don't disclose much, if any, applicable law or potential regulatory issues, most have been successful anyway).

460. *See id.* (noting the infrequency of these types of disclosures and what the continued success rate of ICOs may mean about how investors perceive that information).

461. *See* Feng et al., *supra* note 221, at 39, 41 (giving datasets showing that a majority of ICOs do not disclose risk information and that such nondisclosure is not an impediment to the ICO succeeding).

B. *The Role of Rating Websites in Reducing Information Asymmetry*

Considering the information asymmetry associated with ICOs, analysts play a vital intermediary role. The absence of traditional underwriters—who play a critical intermediary role in the IPO market[462]—coupled with the complexity of this new technology, increase the demand for information. Analysts, who are typically equipped with in-depth knowledge about the industry, may screen ICOs' disclosures and provide evaluations that are more accessible to unsophisticated investors, for whom conducting due diligence on each ICO might be too costly. It also has been suggested that ICO analysts are "likely to be unbiased due to reputational concerns."[463]

Empirical studies have analyzed the association between analysts' rating and ICO success and found that analysts' rating from unofficial websites strongly and reliably predicts ICO success.[464] Lee *et al.* found that the rating provided by ICOBench is positively associated with the amount of funds raised, successfully completing the ICO, quicker sale, and long-term returns on the secondary market.[465] Bourveau *et al.* found similar results when analyzing the rating scores from ICOBench and ICORating,[466] and Rhue found that ICO Drops' reputation and hype scores are positively and significantly associated with higher ROI, and that ICO reputation scores from Etherscan predict a higher market cap.[467] Similarly, Momtaz found that the quality of the management team, as measured by ICOBench, is positively and significantly associated with market performance and higher gross proceeds.[468] Additionally, Boreiko and Vidusso found that ICOBench and ICOHolder ratings predict success, but ICOBazaar and ICOMarks do not, suggesting inconsistency across different rating sites.[469]

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462. Lee et al., *supra* note 18, at 16.

463. *Id.* at 27.

464. Independent analysts' ratings seem to predict IPOs success, and thus it is not surprising that it predicts ICO success. *See, e.g.*, Brad M. Barber et al., *Comparing the Stock Recommendation Performance of Investment Banks and Independent Research Firms*, 85 J. FIN. ECON. 490 (2007) (comparing the profitability of security recommendations issued by investment banks and independent research firms andfinding that the buy recommendations of independent research firms outperform those of investment banks).

465. *See* Lee et al., *supra* note 18, at 3–5 (finding that higher ratings for an ICO have a positive correlation with the listed factors).

466. *See* Bourveau et al., *supra* note 118, at 30–33 (finding that higher ratings correlate positively with the rate of ICO success as well as positive long-term outcomes).

467. *See* Rhue, *supra* note 9, at 16, 22 (stating the results of the studies on the ICO Drops scores, which correlated with greater return on investment, and Etherscan scores, which correlated to higher market capitalization).

468. *See* Momtaz, Initial Coin Offerings, *supra* note 106, at 18–21, 24–25 (finding that management quality is a strong predictor of ICO success).

469. *See* Boreiko & Vidusso, *supra* note 204, at 19. These findings are consistent with Rhue, *supra* note 9, at 21–24 (noting the inconsistencies in the information reputation score systems provide to investors as well as their unreliability as predictors

Additionally, they show that the frequency of being included in a rating platform predict success.[470] David Florysiak and Alexander Schandlbauer found that ICOBench rating is positively and significantly predicts ICO success.[471]

While rating sites potentially may reduce information asymmetry, recent research suggests that they generally provide low-quality data and that it is not uncommon for fraudulent ICOs to appear in such websites, due to their business model, according to which issuers are paying to the rating sites in exchange for the rating (which also suggests that they are not independent).[472] This is consistent with recent blog posts that have showed that ICO aggregators simply sell the rating scores (i.e., the number of stars that the "expert" analysts would give to the ICO) without conducting serious due diligence.[473] If these accusations are true, this may indicate that the reputational concerns in the market are not strong enough, as some scholars have suggested.

Additionally, empirical studies suggest that their indicators are not entirely reliable. For example, Bourveau *et al.* found a strong relationship between an informative white paper, a dummy variable measured by ICOBench, and ICO success,[474] but when they manually analyzed the association between disclosure practices (ICO team information, token allocation information, founder tokens vesting

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of ICO success) and Lyandres et al., *supra* note 9, at 19–23 (finding that several variables had differing effects on ICO success).

470. *See* Boreiko & Vidusso, *supra* note 204, at 8–9 (finding that the frequency of an ICO's inclusion on a rating platform has a positive correlation with fundraising success).

471. *See* Florysiak & Schandlbauer, *supra* note 142, at 29 (finding that there is a positive correlation between an ICO's average rating and its statistical likelihood of success).

472. *See* Boreiko & Vidusso, *supra* note 204, at 5 (stating that it is not uncommon for ratings lists to include, among other things, data of poor quality and fraudulent ICOs, leading to the opinion that they are of dubious value to investors seeking reliable information).

473. *See, e.g.*, Markus Hartmann, *This Is How Easy It Is to Buy ICO Ratings — An Investigation*, MEDIUM (June 14, 2018), medium.com/alethena/this-is-how-easy-it-is-to-buy-ico-ratings-an-investigation-13d07e987394 [https://perma.cc/9P7R-78XM] (archived Nov. 6, 2019) (reporting the results of an experiment that revealed ICOs could pay more money in order to receive higher ratings and visibility) ; Filip Poutintsev, *Beware of ICO Bench!*, HACKERNOON (May 29, 2018), https://hackernoon.com/beware-of-ico-bench-97addacfedc7 [https://perma.cc/YA6M-VUTT] (archived Nov. 5, 2019) (alleging that ICOBench's rating bot simply assigns ratings based on the promotional package an ICO buys, and that human ratings experts are easily bribed into giving higher ratings); *see also* Cohney et al., *supra* note 26, at 649 (acknowledging widespread reports of ICO ratings websites' practice of accepting payment for better ratings).

474. *See* Bourveau et al., *supra* note 118, at 19 (finding that white paper length (which indicates the amount of information in the white paper) has a strong positive relationship with variables indicative of ICO success).

period, use of proceeds, white paper opacity, and white paper length) and ICO success, they found no significant association.[475] This is consistent with Florysiak and Schandlbauer's findings that expert analysts rely on "easy-to-extract publicly available information such as team size or the number of social media channels," and hence their rating is uninformative.[476]

Most importantly, empirical studies suggest that rating sites very often do not provide any information regarding the technical aspects of the project, or more specifically, regarding the source code of the project.[477] Cohney *et al.*, for example, found that only one of the top five rating sites by Alexa ranking posts code information.[478] Similarly, Markus Hartmann *et al.* have analyzed twenty-eight websites that offered ICO evaluations and found that "technical information regarding the underlying blockchain infrastructure that a startup project builds upon is not covered by any of the identified evaluation websites."[479] As the source code, the *de facto* business model of the project, plays a vital role in the ICO mechanism, we would expect a different result.

Last, on top of the drawbacks outlined above, most rating sites are not transparent with regard to their evaluation process. Hartmann *et al.* found that only six of the twenty-eight websites that offered ICO evaluations provided information about their evaluation process.[480] These findings are particularly important due to the accusations that ICO rating sites sell their rating scores without conducting due diligence.

C. *Moral Hazard*

Along with the severe information asymmetry, recent studies have observed moral hazard in ICOs. Moral hazard is a condition associated with information asymmetry where "transacting parties share risk, and one party bears the cost of risk taken by another party."[481] This condition has been previously observed in the context of

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475. *See id.* at 19–20, 44 (demonstrating that the listed variables lack any strong association with predicting ICO success).

476. Florysiak & Schandlbauer, *supra* note 142, at 6 n.3.

477. *See* Cohney et al., *supra* note 26, at 642–43 (assessing the rate at which ratings websites post information about an ICO's source code, as well as looking at its prevalence in writings regarding retail valuation); Felix Hartmann et al., *Evaluation of Initial Cryptoasset Offerings: The State of the Practice*, 1 2018 INT'L WORKSHOP ON BLOCKCHAIN ORIENTED SOFTWARE ENGINEERING 33, 36 (2018) (analyzing the prevalence of technical information within ICOs' disclosures).

478. Cohney et al., *supra* note 26, at 642–43.

479. Hartmann et al.,, *supra* note 477, at 36.

480. *Id.* at 37.

481. *See* Moral Hazard, *supra* note 11, at 11 (defining moral hazard).

IPOs.[482] In IPOs, moral hazard occurs when founders attract private or public capital and face a conflict of interests: on the one hand, they are interested in acquiring growth capital in the long-term, but on the other hand they are interested in an exit strategy in the short term.[483] Hurt argues that "the sheer amount of personal wealth that could be manipulated from an IPO is very tempting and may take priority over raising the most capital for the long-term goals of the company."[484]

In the context of ICO, moral hazard exists in a way that ventures are incentivized to implement an opportunistic behavior and exploit the outlined informational asymmetries to signal quality during the ICO, thus raising more funds, but having lower returns on the long-term. Cohney *et al.*, for example, found that issuers exploit investors' lack of technological expertise, showing that of the thirty-seven ICOs that promised a lock-up mechanism, 78 percent didn't code it; and of the thirty-two ICOs that promised supply restrictions, only 76 percent coded it.[485] However, they also found that the information asymmetry decreases over time and investors are learning about the true quality of the source code.[486] This suggests that opportunistic behavior has a positive effect on ICO success—as previously discussed, disclosure about lock-up mechanisms and token supply restrictions are associated with ICO success—but negative long-term consequences. Similarly, empirical evidence shows that issuers tend to exaggerate information disclosed in white papers, and that exaggerating information in white papers is associated with raising more funds in less time. However, exaggerating information was also found to be associated with lower market returns and with a higher initial price volatility that decreases over time.[487]

Given the informational asymmetries associated with the market and the potential benefit of exploiting these informational asymmetries, issuers are facing a dilemma: on the one hand, an opportunistic behavior has negative long-term consequences, but, on

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482. *See* Christine Hurt, *Moral Hazard and the Initial Public Offering*, 26 CARDOZO L. REV. 711, 720-61 (2005) (assessing the risks of moral hazard found in the IPO context).

483. *See id.* at 721–22 (describing the potential moral hazard issues that can arise between founders and IPO issuers).

484. *Id* at 722.

485. *See* Cohney et al., *supra* note 26 at 636–38 (analyzing the results of audits of tokens promising either lock-up mechanisms or supply restrictions).

486. *See id.* at 655–56 (noting that the involvement of "smart money" actors in the ICO market can help alleviate information asymmetry issues by paying attention to the technical side of source code disclosures and making sure issuers follow through on promises when they fail to code them).

487. *See* Moral Hazard, *supra* note 11, at 29–30, 34 (reporting the effects of white paper exaggeration on the above-mentioned outcomes).

the other hand, it has a positive effect on ICO success.[488] The amount raised in an ICO is particularly important because of network effect and because early liquidity is an important signal for investors in the absence of measures of commercial success.[489] Therefore, it is possible that resisting opportunistic behavior from issuers' perspective might be inefficient (i.e., that low-quality ICOs with misleading and exaggerated information disclosed in white papers may outperform high-quality ICOs that resist opportunistic behavior).[490]

V. POLICY IMPLICATIONS AND CONCLUDING REMARKS

The previous Parts outlined three sources of informational asymmetries and showed that signaling theory and rating websites are not entirely effective in mitigating these asymmetries. These findings suggest that ICO investors are not entirely rational, and that we cannot fully rely on the competitive forces of an economy in this case. Therefore, the Article argues that regulators should address the sources of informational asymmetries discussed in this Article—which are a source of investors irrationality—by adopting mandatory disclosure provisions. Against that background, this Part discusses the question of how regulators can mitigate the information asymmetry associated with the market by imposing specific disclosure requirements. More specifically, it focuses on tokens that are *de facto* securities and examines how regulators can adjust the prospectus requirements to the unique characteristics of ICOs.

The traditional IPO disclosure requirements are not well suited for ICOs for a threefold reason.[491] First, the costs associated with an IPO prospectus are high relative to the total capital raised in ICO and may thus constitute a barrier to market development.[492] The analysis in Part III suggests that the funds raised range from $13 million to $16 million, which is typically higher than the amount of funds raised in a traditional crowdfunding, but lower than the amount raised in an IPO. Therefore, ICOs generally do not fall within the current exemptions in securities regulation, and have to spend a relatively large amount of

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488. *Id.* at 36.

489. *See* Howell et al., *supra* note 89, at 25 ("From the perspective of an early stage investor, liquidity is a central benefit of ICOs relative to conventional financing instruments."); Momtaz, Initial Coin Offerings, *supra* note 106, at 14 (recognizing the importance of early liquidity as an incentive for early investors, which subsequently bolsters network effects).

490. Moral Hazard, *supra* note 11, at 36.

491. The discussion here relies on Lars Klöhn et al., *Initial Coin Offerings (ICOs) Economics and Regulation* 35–38 (Nov. 26, 2018) (unpublished manuscript) (on file with Soc. Sci. Research Network) (assessing and rejecting the arguments against applying IPO prospectus requirements to ICOs).

492. *See id.* at 35–36 (discussing why prospectus costs would not be prohibitive for most ICOs).

funds in an early stage to comply with the prospectus requirements.[493] It should be noted, however, that the majority of ICOs conduct presales and can use the capital raised during these rounds to cover these costs, at least partially.

Second, ICO investors will not benefit from the prospectus as much as IPO investors do. To begin with, most ICOs are launched at the idea stage, and hence can provide only a little amount of useful information.[494] Additionally, ICO investors are not entirely rational. As shown in Parts III–IV, disclosure requirements intended to protect investors that predict success in IPOs—such as information about the use of proceeds and about the risk and regulation associated with the project—do not predict success in ICOs (results are mixed). Finally, some of the information required under the prospectus rules is irrelevant in the assessment of ICOs, due to their unique technological nature.

Third, the prospectus requirement "is based on the idea that professional investors read the prospectus, value the security on that basis and influence the offering price through the book building process."[495] This rationale, however, does not apply to ICOs, in which the tokens are generally offered at a fixed price.[496]

Combined, the arguments outlined above suggest an incompatibility between ICO and IPO prospectus requirements; the costs associated with an IPO prospectus are high relative to the total capital raised in ICO (and potentially may pose a barrier to market development), and the effectiveness of the prospectus requirement in mitigating information asymmetries is low, compared to the case of IPOs. These arguments, however, are not necessarily justifying an exemption from the prospectus requirement. As shown in Parts III–IV, the competitive forces of an economy are not well-suited to address the market inefficiencies in the case of ICOs. Instead, the Article suggests that the prospectus requirements will be adjusted to better fit the unique characteristics of ICOs and proposes four specific disclosure requirements that should be imposed.[497]

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493. Against that background, Rohr & Wright argue that a registration exemption should be designed for tokens that are in fact securities. *See* Rohr & Wright, *supra* note 27, at 522–23.

494. Klöhn et al., *supra* note 491, at 36.

495. *Id.* at 37.

496. *See id.* (presenting this line of thought as an argument against the prospectus requirement).

497. For additional requirements, *see id.* at 38 ("What rights does the token convey? . . . On which exchanges will the token be tradable? How exactly does the (decentralized) business model work? What factors determine the network effects? Why have no similar networks been created so far? Are there any competitors in the market? What is the regulatory environment like? What experience do the mostly very young founders have? Which blockchain technology is the basis for the network? Which

First, most ICOs are launched by a blockchain-based venture and, accordingly, there should be a focus on the technological aspects of the project. On that manner, Hacker and Thomale have suggested that companies that launch ICOs should be required "to publish the code underlying the blockchain-based vehicle and the token sale at least one month in advance of the token sale."[498] The underlying code of a venture is the *de facto* business model of the project, and hence it is essential information required to make an informed decision. However, a requirement to publish the source code prior to the token sale could be problematic for a twofold reason. First, this requirement will not be effective unless the code will be audited by a reliable intermediary. The analysis presented in this Article suggests that while disclosing the source code significantly predicts success, the number of mismatches between promises made in white papers and the actual code does not affect ICO success. These results imply that investors value the disclosure of the source code but are unable to assess its true quality. Therefore, the focus here should not be on the requirement to disclose the source code—which the majority of ICOs disclose voluntarily anyway—but on an intermediary that will audit the source code. Second, by disclosing the source code, ICOs enable other ventures to imitate their technology, and therefore may lose their competitive advantage. In line with this, Bourveau *et al.* found a positive and significant association between source code disclosure and crash risks in the long term.[499] This point should be considered as well when discussing source code disclosure.

Second, the Article proposes to include a requirement to disclose information about the existence of presale rounds and their terms. The first justification for this requirement is to prevent ventures from maintaining pump-and-dump scams. Rational investors who are exposed to information regarding the presales, would price this information and demand a lower price, or alternatively, the implementation of lock-up mechanisms. The second justification for this requirement is semantic, and it stipulates that the term "initial coin offerings" can be misleading if the token sale event is not the first offering.

Third, the Article proposes to include a disclosure requirement in relation to the ability to create new tokens after the launch of the ICO. Catalini and Gans theorize that in order to maximize the amount raised in a token sale, an ICO should have a predetermined token supply,[500] and empirical evidence suggests that the ability to create

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technological risks exist? Have the relevant smart contracts been audited and, if so, by whom?").

498. Hacker & Thomale, *supra* note 57, at 42.

499. *See* Bourveau et al., *supra* note 118, at 44 (reporting data that show the above-mentioned relationship).

500. *See* Catalini & Gans, *supra* note 104, at 2–31 (explaining why ICOs should limit the supply of tokens available at the outset of the project).

future tokens is negatively associated with the amount raised in an ICO. These results suggest the investors are able to price this type of information, and hence such a requirement will be effective.

Fourth, the Article suggests that ventures should explain in their prospectus why blockchain technology is required for their project. Empirical studies support this suggestion showing that most ICOs do not need blockchain, but yet use it to attract investors driven by hype, and that investors are able to distinguish between ICOs that leverage blockchain technology and ICOs that do not really need to use blockchain.[501] In order for this requirement to be effective, the Article further suggests that a structured methodology to determine whether blockchain is the appropriate technical solution will be developed.[502]

Another area for considerations is the role of rating websites as an information intermediary. While rating scores from rating websites strongly predict successful fundraising, they are generally providing low-quality data. Most of the rating websites do not provide any information regarding the technical aspects of the project, and some of them have been accused of selling their rating scores without conducting due diligence. These findings may indicate that the reputational concerns in the market are not strong enough, or alternatively, that investors are unable to assess the quality of these evaluations due to lack of fundamental knowledge about this innovative industry.

Although a more in-depth analysis of ICO rating websites is required in order to propose conclusive policy suggestions, these findings suggest that, in the current state of the market, rating websites are a source of market inefficiency; the quality of their ratings is typically low, they do not provide any information regarding the technical aspects of the project, and yet their rating scores are strongly associated with ICO success indicators. Therefore, the Article argues that regulators should pay close attention to these rating websites and focus on the (lack of) transparency with regard to their evaluation process.[503]

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501. *See, e.g.*, Feng et al., *supra* note 221, at 25–26 (discussing data that points to the use of blockchain being important to investors regardless of whether the ICO actually needs to use it or not).

502. On that matter, see Karl Wüst & Arthur Gervais, *Do you need a Blockchain?*, 2018 CRYPTO VALLEY CONFERENCE ON BLOCKCHAIN TECHNOLOGY 45, 45–53 (2018) (espousing a structured methodology for determining whether a particular project requires the use of a blockchain); Morgen E. Peck, *Blockchain world – Do you need a blockchain? This chart will tell you if the technology can solve your problem*, 54 IEEE SPECTRUM 38, 38–39, 60 (2017) (providing a less technical explanation of a structured methodology to determine the utility of a blockchain for a project).

503. For a similar suggestion, *see* Hartmann et al., *supra* note 477, at 37 (acknowledging the transparency of an ICO evaluation process as a critical factor in determining whether that process is reliable).

To conclude, this Article reviewed empirical studies on the characteristics of ICO and determinants of ICO success, compared their findings with studies in the context of IPOs and crowdfunding, and offered theoretical explanations. By comparing determinants of ICO success with determinants of IPOs' success, the Article contributed to the literature on the classification of tokens as securities, as it showed the circumstances in which ICO investors and initiators behave like IPO investors and initiators.

The Article also provided another perspective for the discussion on ICO regulation, by analyzing informational asymmetries associated with ICOs. It found strong evidence for information asymmetry: ICO investors are given so little information and thus their investment decision cannot be based on completely rational grounds. In addition, the Article outlined three sources for these asymmetries—the absence of standard disclosure requirements, investors' lack of fundamental technical knowledge, and projects' early stages of development during the offering—and discussed the role of signaling theory and rating websites in mitigating these asymmetries.

It showed that the effectiveness of signaling in mitigating these asymmetries is limited; ventures that voluntarily disclosed more extensive information in their white papers were not necessarily more successful. Additionally, the Article showed that while independent analysts play a vital intermediary role, and their rating scores are associated with success indicators, their ratings are generally low quality, inaccurate, and do not include any information regarding the technical aspects of the project. Hence, the Article claimed that the effectiveness of ICO rating websites in mitigating the information asymmetry associated with the market is limited as well.

In many cases, the competitive forces of an economy can be relied on to drive abnormal returns in financial markets back down to marginal cost. The analysis presented in this Article suggests that ICOs are not one of those cases. Instead, regulators should address the sources of informational asymmetries discussed in this Article—which are a source of investors' irrationality—by mandatory disclosure provisions. To this end, the Article developed four specific disclosure requirements tailored to the unique characteristics of ICOs.

VI. APPENDIX

A. *Table 1—Empirical Papers*

Table 1 presents selected empirical papers. For each paper, it reports the objective of the empirical analysis, the variables used to measure success, sample period, sample size, secondary market sample size, success rate, and sources. The papers presented are as follows: A&S = Amsden & Schweizer; A,G&M = Adhami, Giudici &

Martinazzi; B = Bourveau *et al.*; Blaseg; B&K = Benedetti & Kostovetsky; B&M = Burns & Moro; C,H,S&W = Cohney, Hoffman, Sklarof & Wishnick; C,G,R&W = Chanson, Gjoen, Risius & Wortmann; D,M&S = Drobetz, Momtaz & Schröder; D,R&V = De Jong, Roosenboom & van der Kolk; EY = Ernst & Young; F = Feng *et al.*; Fisch; Felix; H,M&V = Huang, Meoli & Vismara; H,N&Y = Howell, Niessner & Yermack; L,L&S = Lee, Li & Shin; L,P&R = Lyandres, Palazzo & Rabetti; M = Momtaz; R = Rhue; Z = Zetzsche *et al.* The variables used to measure success are divided into two categories. First, variables related to token tradability: 1. *Listed*: a dummy variable that equals 1 if the related token is traded on an exchange, and 0 otherwise. 2. *Listed on CMC* (A&S; B&K): a dummy variable that equals 1 if the related token is listed as traded on CoinMarketCap.com, and 0 otherwise. 3. *Liquidity* (H,N&Y): based on a standard illiquidity measure that has been developed by Amihud.[504] Second, variables related to the amount raised in the ICO: 1. *Amount Raised*: natural logarithm of amount raised in the ICO in USD. 2. *Raised Soft Cap*: a dummy variable that equals 1 if the ICO reached its fundraising goal, and 0 otherwise. 3. *Raised Capital* (B&K): a dummy variable that equals 1 for all ICOs that raised capital, and 0 otherwise. 4. *Raised Dummy* (L,P&R): a dummy variable that equals 1 if the ICO raised more than 5% of hard cap or more than $10,000 if hard cap is missing, and 0 otherwise.

Paper	Objective	Success Measures	Sample Period	Sample Size	Secondary Market Sample	Success Rate	Sources
A&S (2018)	Determinants of ICO success.	Token Tradability (Listed) and Amoun	2015–2018	1009	363	42% (36%[505])	ICObench.com and Cryptoslate.com. Cross-checked

504. *See* Yakov Amihud, *Illiquidity and stock returns: cross-section and time-series effects*, 5 J. FIN. MKT. 31, 34, 37 (2002) (describing Professor Amihud's illiquidity measure); Yakov Amihud et al., *Liquidity and Asset Prices*, 1 FOUND. & TRENDS FIN. 269, 313 (2006) (discussing Professor Amihud's illiquidity measure among other techniques).

505. Forty-two percent of tokens in the sample are traded on an exchange, but only thirty-six percent are listed as traded on CoinMarketCap.com. Amsden & Schweizer, *supra* note 188, at 32; *see also All Cryptocurrencies*, COINMARKETCAP, https://coinmarketcap.com/all/views/all/ (last visited Nov. 7, 2019) [https://perma.cc/2G8B-BHBL] (archived Nov. 6, 2019) (listing all cryptocurrencies traded on exchanges) [hereinafter COINMARKETCAP].

		t Raised					information with CoinSchedule.com, CoinMarketCap.com, TokenData.io, and CoinMarketPlus.com.
A,G&M(2018)	Determinants of ICO success.	Raised Soft Cap	2014–2017	253	253	81%	TokenData.io, CoinMarketCap.com, CoinSchedule.com, CoinDesk.com, ICOAlert.com, ICOBazaar.com, TokenMarket.net, and SmithAndCrown.com.
B (2018)	Determinants of ICO success, crash risks, and market returns.	Raised Soft Cap and Amount Raised	2014–2018	776[506]	659	85%	CoinMarketCap.com, CoinDesk.com, TokenData.io, CoinSchedule.com,

506. Out of which 659 have successfully completed an ICO (i.e., the soft cap was reached). Bourveau et al., *supra* note 118.

							SmithAndCrown.com, ICORating.com, and ICObench.com.
Blaseg (2018)	Determinants of ICO success, with a focus on disclosure.	Raised Capital, Amount Raised,[507] and Token Tradability (Listed on CMC)	2014–2017	1,104		61% (29%)[508]	BitcoinTalk.org, CryptoCompare.com, CoinMarketCap.com, Etherscan.io, and BlockExplorer.com.
B&K (2018)	Determinants of ICO success, market returns, and underpricing.	Raised Capital and Token Tradability (Listed on CMC)	2013–2018	2390	609	48% (26%[509])	ICOdata.io, ICObench.com, ICORating.com, ICODrops.com, and ICO-Check.com.
B&M (2018)	Determinants of ICO success, first-	Amount Raised	2017	146[510]	146	-	TokenData.io and CoinMarketCap.com.

507. The amount raised in million US dollars. Blaseg, *supra* note 229, at 28.

508. Sixty-one percent of ICOs raised capital during the ICO and twenty-nine percent of ICOs have listed their tokens. *Id.* at 12–13.

509. Twenty-six percent of ICOs have listed their tokens. Benedetti & Kostovetsky, *supra* note 115, at 15.

510. 146 ICOs that ended between June 2017 and November 2017 and which were trading for a minimum of four months from the first day of trading. Burns & Moro, *supra* note 243, at 10.

	day returns, and ROI.						
C,G,R &W (2018)	determinants of ICO organizational legitimacy and underpricing.	-	2017–2018	95	95	-	ICODrops.com and CoinMarketCap.com.
C,H,S &W (2018)	Compare the promises made in the white paper with the underlying code.	-	2017	50	50	-	CoinSchedule.com. They manually collected additional information from other sources, primarily www.icomarks.com.
D,M& S (2018)	Determinants of listing, first-day returns, and buy-and-hold performance.	-	2013–2018	1,403	1,403	-	CoinMarketCap.com.

D,R&V (2018)	Determinants of ICO success.	Amount raised, Token Tradability (listed on CMC), and ex-post project success. [511]	2015–2017	630	-	46%[512] (50%) [513]	ICObench.com, CoinDesk.com, ICOTracker.net, CryptoCompare.com, SmithAndCrown.com, Elementus.io, ICOdata.io, ICOMarketData.com, TokenData.io, CoinSchedule.com, ICOStats.com, and ICO-list.com.
EY (2017)	Report.	-	2015–2017	372		-	TokenData.io, CoinMarketCap.com,Token Market.net, ICOWatchList.co

511. Whether project's website is online (in July 2018) and whether the project was active on Twitter and GitHub between May and July 2018. De Jong et al., *supra* note 243, at 12–13.

512. Twenty-nine percent of the ICOs in the sample have soft cap. Of those, forty-six percent manage to raise more capital than the minimum target amount. *Id.* at 12.

513. Fifty percent of tokens in the sample are listed as traded on CoinMarketCap.com. *Id.*; *see also* COINMARKETCAP, *supra* note 505 (listing tokens traded on exchanges).

							m, TokenReport.com, and CoinSchedule.com.
EY (2018)	Report.	-	2015–2017	141		-	CoinGeko.com, ICObench.com, ICODrops.com, TokenData.io, ICOWatchList.COM, TokenMarket.com, TokenMarket.net, CoinSchedule.Com, CoinMarketCap.com, CoinDesk.com, CoinBase.com, and TokenReport.com.
F (2019)	Determinants of ICO success.	Amount Raised and	2016–2018	355	136	35%[514]	ICOBench.com, TokenData.io,

514. Thirty-five percent of ICOs have listed their tokens. Feng et al., *supra* note 221, at 23.

		Token Tradability					TokenMarket.net, ICOMarks.com, CryptoCompare.com, CoinMarketCap.com, and ICODrops.com.
Felix (2018)	Determinants of ICO underpricing.	-	2013–2018	255		-	ICObench.com and CoinMarketCap.com. He Manually added information from ICODrops.com and CryptoCompare.com.
Fisch (2019)	Determinants of ICO success.	Amount Raised	2016–2018	423		-	CoinSchedule.com. He retrieved additional information from ICODrops.com, ICObench.com, CoinMarketCap.com, and TokenM

							arket.net .
H,M&V (2019)	Determinants of ICO localization.	-	2017–2018	915		-	ICObench.com. They cross-checked information with CoinMarketCap.com, CoinTrends.top, CoinSchedule.com, CryptoSlate.com, ICODrops.com, CoinMarketCap.com, TokenData.io, and TokenMarket.net .
H,N&Y (2018)	Determinants of ICO success and failure.	Token tradability (Liquidity)	2013–2018	453[515]	453	47% (31%) [516]	TokenData.io and CoinMarketCap.com.

515. 453 tokens that have at least three months of trading data on CoinMarketCap as of April 11, 2018. Howell et al., *supra* note 89, at 21–22; *see also* COINMARKETCAP, *supra* note 505 (aggregating tokens traded on exchanges).

516. Only sixty-one percent (276) of ICOs have disclosed a fundraising goal. Of those, fifty-three percent failed to reach their fundraising goal. Therefore, only thirty-one percent of the total samples reached their fundraising goal. *See* Howell et al., *supra* note 89, at 25 (discussing the percentage of ICOs that disclose fundraising goals and the proportion that failed to reach theirs).

L,L&S (2018)	Determinants of ICO success, market returns, and underpricing.	Raised Soft Cap[517] and Amount Raised	2016–2018	1,549	433	45.4%	ICObench.com. They manually collected additional information from ICORating.com and TokenData.io.
L,P&R (2018)	Determinants of ICO success and market returns.	Amount Raised and Token Tradability (Liquidity)	2013–2018	3,068	603	46% (38%) [518]	Etherscan.io, CoinDesk.com, CoinGecko.com, CryptoCompare.com, ICObench.com, ICODrops.com, ICORating.com, ICOmarks.io, CoinMarketCap.com, ICOdata.io, and

517. Or if the ICO raised more than $0.5 million in the absence of a soft cap. Lee et al., *supra* note 18, at 1–2.

518. Forty-five percent the ICOs raised more than five percent of the hard cap or, if the hard cap is missing, more than $10,000 (only twenty-six percent of ICOs reach the hard cap). Thirty-nine percent of ICOs have listed their tokens. Lyandres et al., *supra* note 9, at 16.

							Foundico .com.
M (2018)	Determinants of ICO success, first-day returns, underpricing, and failure.	Amount Raised [519]	2015–2018	2,131	302	*[520]	ICObench.com and CoinMarketCap.com.
R (2018)	Determinants of ICO success, ROI, and market cap.	Amount Raised	-	357[521]	748[522]	-	ICODrops.com, ICORating.com, Etherscan.io, and CoinMarketCap.com.
Z (2018)	Analyze ICO characteristics, with a focus on	-	-	1XXX [523]	-	*[524]	Thirty different websites, including ICODrops.com, ICORati

519. Measured as the total funding amount raised through the ICO (not logged). Momtaz, Initial Coin Offerings, *supra* note 106, at 37.

520. Twenty-one percent of ICOs have failed—i.e., have been delisted at least at some exchange. *Id.* at 18.

521. She uses a sample of 435 ICOs, out of which 357 ICOs were completed. *See* Rhue, *supra* note 8, at 32 (including a table that demonstrates, among other things, the number of completed ICOs out of the data set).

522. A sample of coins and tokens that has been listed on CoinMarketCap. The sample is restricted to (1) currencies that were launched after January 1, 2017 to exclude established cryptocurrencies; and (2) currencies that have at least three months of data as of March 31, 2018. *Id.* at 16; *see also* COINMARKETCAP, *supra* note 505 (listing all cryptocurrencies listed on exchanges).

523. Over 1000. According to the authors, the database is being continuously updated. *See* Zetzsche et al., *supra* note 82, at 5 (drawing from a "rapidly growing" database of ICOs).

524. 18.7 percent of the ICOs in the sample have failed to reach their fundraising goal, while 8.25 percent managed to reach the goal. For 68.15 percent of the sample, they lack reliable information on the subscription status. *Id.* at 15 n.31.

	disclosure.						ng.com, CoinMarketCap.com, TokenData.io, CoinSchedule.com, and CryptoSlate.com

B. *Table 2—Determinants of ICO Success*

Table 2 summarizes empirical findings for selected variables. It presents the association between ICO success and the following variables. 1. *WP Disclosure*: a dummy variable that equals 1 if the ICO disclosed a white paper, and 0 otherwise. 2. *WP Quality*: proxies of white paper quality vary in the literature and include white paper length (A&S; B; Fisch), whether the ICO has an informative white paper (B), and number of unique words in the white paper (L,P&R; Blaseg; F). 3. *SC Disclosure*: a dummy variable that equals 1 if an ICO published its source code in an online repository such as Github, and 0 otherwise. 4. *Team Size*: the natural logarithm of the number of team members (B); the number of team members (M; A&S; D,R&V); the number of team members squared (B&M); or a variable equals 1 if founding team size is disclosed, and 0 otherwise (F). 5. *Use of Proceeds*: a dummy variable that equals 1 if information about the use of proceeds is disclosed, and 0 otherwise. 6. *Presale*: a dummy variable that equals 1 if the ICO had a presale, and 0 otherwise (A&S; B&K; H,N&Y; Fisch; M; L,L&S); or a dummy variable that equals 1 if the ICO has information about the amount raised in a presale (L,P&R). 7. *Preregistering/KYC*: a dummy variable that equals 1 if the ICO's investors are required to provide information to confirm their identity (KYC) or to register in order to participate (whitelist). 8. *Bonus*: a dummy variable that equals 1 if the ICO offers a bonus before the ICO, and 0 otherwise; or a dummy variable that equals 1 if an ICO offers a bonus over 20%, and 0 otherwise (L,L&S). Note that some authors provide different variables to bonuses offered during the ICO and bonuses given during the pre-ICO (e.g., A&S). 9. *Ethereum Blockchain*: a dummy variable that equals 1 if the ICO is on the Ethereum platform, and 0 otherwise. 10. *Utility token*: definitions for utility tokens vary in the literature. Consequently, the table reports the variable used in each paper. A,G&M use a variable that equals 1 if the token can be used to access or pay for services, and 0 otherwise; Fisch

uses a variable that equals 1 if an ICO highlights the utility of its token, and 0 otherwise. H,N&Y use a variable that equals 1 if the related token represents the right to access a service that the issuer will provide through a new network, and 0 otherwise. 11. *Lock-up Mechanism*: a dummy variable that equals 1 if information about lock-up mechanism is disclosed in the white paper, and 0 otherwise. 12. *Token Total Supply*: the natural logarithm of the total amount of tokens. 13. *Fraction of Tokens Sold*: percentage of tokens distributed in the ICO. 14. *ICO Duration*: the duration of the ICO in days; or the announced number of days for which an ICO accepts funding (Blaseg). 15. *Soft Cap/Fundraising Goal*: a dummy variable that equals 1 if the ICO has a soft cap/fundraising goal, and 0 otherwise. 16. *Accepting Ether*: a dummy variable that equals 1 if the ICO accepts Ether, and 0 otherwise 17. *Accepting Bitcoin*: a dummy variable that equals 1 if the ICO accepts Bitcoin, and 0 otherwise. 18. *Accepting USD/Fiat*: a dummy variable that equals 1 if the ICO accepts USD, and 0 otherwise (H,N&Y; R); or a dummy variable that equals 1 if the ICO accepts any fiat currency, and 0 otherwise (A&S; M;) 19. *Has Country restriction*: a dummy variable that equals 1 if the ICO is restricted in certain countries, and 0 otherwise (L,L&S). 20. *US Restriction*: a dummy variable that equals 1 if US citizens were from the ICO, and 0 otherwise.

Variable	(+)	(-)	—
Disclosure Practices			
WP Disclosure	H,N&Y (2018)	B (2018)	A,G&M (2018)
WP Quality	A&S (2018); B (2018)[525]; Fisch (2019); L,P&R (2018); F(2019)[526]		Blaseg (2018)[527]
CS Disclosure	A&S (2018); A,G&M (2018); B (2018); H,N&Y (2018); D,R&V (2018)		Fisch (2019)
Team Size	A&S (2018); B (2018); B&M (2018); L,P&R (2018); D,R&V (2018)		F(2019)
Use of Proceeds	H,N&Y (2018)	F(2019)	B (2018)
Presales Practices			
Presale	A,G&M (2018); H,N&Y (2018); Fisch (2019); L,P&R (2018); L,L&S (2018)[528]; D,R&V (2018)	A&S (2018); M (2018)	B&K (2018)
Preregistering/ KYC	B&M (2018); L,P&R (2018)	L,L&S (2018)	A&S (2018); Blaseg (2018
Bonus		L,L&S (2018)[529];	A,G&M (2018); A&S

525. *See* Bourveau et al., *supra* note 118, at 18–20, 44 (finding that white paper length and informative white paper (a dummy variable according to ICOBench) reliably predicts ICO success, but when manually analyzing the association between disclosure practices (ICO team information, token allocation information, founder tokens vesting period, use of proceeds, white paper opacity, and white paper length) and ICO success, finding no significant association).

526. The coefficient is significant in most specifications. Feng et al., *supra* note 221, at 27.

527. The number of words in a white paper is not associated with the amount raised, but significantly and positively associated with token tradability. *See* Blaseg, *supra* note 229, at 31–32 (displaying tables that show the number of words in a white paper have little effect on funding amounts raised, but significantly affect whether the token gets listed on an exchange).

528. *See* Lee et al., *supra* note 18, at 19, 43 (finding that the existence of presales increases the success likelihood, but that presales are negatively related to the amount raised).

529. *See id.* at 40 (using an indicator that equals 1 if an ICO offers a bonus over twenty percent (equivalent to a discount of 16.7 percent), and 0 otherwise).

		D,R&V (2018)* [530]	(2018)[531]; B (2018); Blaseg (2018)
Blockchain and Token Type			
Ethereum Blockchain	H,N&Y (2018); M (2018); Fisch (2019); D,R&V (2018)[532]	A&S (2018) [533]	B&M (2018)[534]
Utility Token	A,G&M (2018); H,N&Y (2018)		Fisch (2019)
Economic Variables			
Lock-up Mechanism	B (2018); H,N&Y (2018); Blaseg (2018); F (2019)		
Token Total Supply	A&S (2018); B&K (2018); Fisch (2019); D,R&V (2018)		
Fraction of Tokens Sold		A&S (2018); L,P&R (2018); L,L&S (2018)	H,N&Y (2018); Fisch (2019); D,R&V (2018)[535]; Blaseg (2018)
ICO Duration		Fisch (2019); M (2018); L,L&S (2018) [536]; D,R&V	H,N&Y (2018)

530. *See* De Jong et al., *supra* note 243, at 16–17 (finding that not having a bonus scheme is associated with ICO success).

531. *See* Amsden & Schweizer, *supra* note 188, at 21 (finding, to the contrary, that offering a bonus during the ICO is significantly and positively associated with ICO success).

532. *See* De Jong et al., *supra* note 243, at 30 (finding that the variable Ethereum Platform is positively and significantly associated with the amount raised, but insignificantly associated with token tradability).

533. *See* Amsden & Schweizer, *supra* note 188, at 33, 37 (finding that the variable Ethereum Platform is negatively associated with the amount raised in an ICO, but positively associated with token tradability).

534. *See* Burns & Moro, *supra* note 243, at 22, 29 (also finding that the variable Ethereum Platform is negatively associated with first-day returns).

535. *See* De Jong et al., *supra* note 243, at 3, 17–18 (finding that the percentage of tokens retained by the project is significantly and positively associated with *expost* success measures, but is insignificantly associated with fundraising success).

536. *See* Lee et al., *supra* note 18, at 18 (finding that failed ICOs are longer than successful ICO, with the difference being significant ($p<0.1$)).

		(2018); Blaseg (2018)	
Soft Cap/Fundraising Goal	A&S (2018); H,N&Y (2018); Fisch (2019)	B (2018)	L,L&S (2018)*[537]; R (2018); Blaseg (2018)
The Token Sale Event			
Accepting Ether	H,N&Y (2018); R (2018)		
Accepting Bitcoin	H,N&Y (2018); R (2018)		
Accepting USD/Fiat	M (2018); D,R&V (2018)[538]	A&S (2018)[539]	H,N&Y (2018); R (2018)
Has Country Restriction		L,L&S (2018)	A&S (2018)
US Restriction	B (2018)	M (2018)	H,N&Y (2018)

C. *Table 3—Success and Failure Rates*

Table 3 presents ICOs' success and failure rates. For each paper, it reports the indicator used to measure success, success rate, the indicator used to measure failure, failure rate, and sample period and size. Measures of success: 1. *Listed*: a dummy variable that equals 1 if the related token is traded on an exchange, and 0 otherwise. 2. *Listed on CMC* (A&S): a dummy variable that equals 1 if the related token is listed as traded on CoinMarketCap.com, and 0 otherwise. 3. *Raised Soft Cap*: a dummy variable that equals 1 if the ICO reached its fundraising goal, and 0 otherwise. 4. *Raised capital* (B&K): a dummy variable that equals 1 for all ICOs that raised capital, and 0 otherwise. 5. *Raised dummy* (L,P&R): a dummy variable that equals 1 if the ICO raised more than 5% of hard cap or more than $10,000 if hard cap is missing, and 0 otherwise. 6. *Raised to Hard Cap* (L,P&R): "The ratio of the amount raised in the ICO to the hardacap." Measures of failure: 1.

537. *See id.* at 16 (while not analyzing a dummy soft cap variable, stillfinding that the average soft cap for successful ICOs is nearly identical to that set by unsuccessful ICOs, with the difference being insignificant).

538. *See* De Jong et al., *supra* note 243, at 30 (finding that accepting fiat is positively and significantly associated with the amount raised, but insignificantly related to token tradability).

539. *See* Amsden & Schweizer, *supra* note 188, at 34 (finding that accepting fiat is positively associated with the amount raised, but negatively related to token tradability).

Extreme Negative Return (B): a dummy variable that equals 1 if cumulative raw returns are less than or equal to -75% at the end of either the three-month, six-month, or twelve-month period after the ICO first begins trading on CMC, and 0 otherwise. 2. *Delisted*: a dummy variable that equals 1 if the related token was delisted at one or more exchanges, and 0 otherwise. 3. *Project Death* (M): a dummy variable that equals 1 if the related token was delisted at every token exchange platform, and 0 otherwise. 4. *Lost All Their Value* (EY): a dummy variable that equals 1 if the return to ICO investors have declined by more than 90% (from January 1 to September 2, 2018), and 0 otherwise.

Paper	Success Measure	Success Rate	Failure Measure	Failure Rate	Sample Period (Size)	Comments
A&S (2018)	Listed	42%			2015–2018 (1,009)	2 ICO occurred in 2015, 16 in 2016, 648 in 2017, and 338 in 2018 (as of March 2018)
	Listed on CMC	36%				
A,G&M(2018)	Raised Soft Cap	81%			2014–2017 (253)	4 ICOs occurred between 2014–2015, 33 in 2016, and 216 in 2017
B (2018)	Raised Soft Cap	85%			2014–2018 (776)	The secondary market sample is restricted to tokens that have at least three months of trading data as of May, 2018
			Extreme Negative Return (-75%)	26%	2014–2018 (569)	
B&K (2018)	Raised Capital	48%			2013–2018 (2,390)	
	Listed on CMC	26%				
EY (2018)			Lost All Their Value (-90%)	30%	2015–2017 (141)	30% of ICOs have declined by more than 90% from January 1 to September 2, 2018.
H,N&Y (2018)	Raised Soft Cap*	47% (31%) **540**			2013–2018 (268)	The sample is restricted to tokens that have

540. Only sixty-one percent (276) of ICOs have disclosed a fundraising goal. Of those, fifty-three percent failed to reach their fundraising goal. Therefore, only thirty-one percent of the total sample reached their fundraising goal. Howell et al., *supra* note 89, at 25 (reporting the percentage of ICOs disclosing fundraising goals and the percentage of that group failing to reach those goals).

			Delisted	9%	2013–2018 (453)	at least three months of trading data on CMC as of April 11, 2018
L,L&S (2018)	Raised Soft Cap[541]	45.4%			2016–2018 (1,549)	
L,P&R (2018)	Raised Dummy	46%			2013–2018 (3,068)	All but 16 ICOs happened between 2017–2018
	Raised to Hard Cap	46% (33%)			2013–2018 (1,200)	
	Listed	38%			2013–2018 (1,516)	
M (2018)			Delisted	21%	2015–2018 (495)	
			Project Death	13%		
Z (2018)			Failed to Reach the Fundraising Goal[542]	18.7%	(1XXX)	According to the authors, the database is being continuously updated

D. *Table 4—Underpricing*

Table 4 displays empirical findings related to underpricing. For each paper, it reports the indicator used to measure underpricing, the mean value, the median value, and the number of observations. Measures of ICO underpricing vary in the literature and include the following indicators. 1. *ICO to Open*: The difference between the ICO price and the first day opening price. 2. *ICO to Close*: The difference between the ICO price and the first day closing price. 3. *Open to Close*: the difference between the closing and opening price of the first day. 4. *ICO to 5th Close*: The difference between the ICO price and the closing price five days after the token is listed.

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541. An "ICO is deemed successful if its soft cap was reached or the project raised more than $0.5 million in the absence of a soft cap." Lee et al., *supra* note 18, at 40.

542. For 68.15 percent of the sample, they lack reliable information on the subscription status. Zetzsche et al., *supra* note 82, at 15 n.31.

Paper	Underpricing Measure	Mean	Median	N
A,G&M (2018)	ICO to Close	919%	24.7%	140
B (2018)	Log Open to Close	14%	6%	659
	Log ICO to Close	39%	40%	300
B&K (2018)	ICO to Open (equal-weighted returns)	179%	-	416[543]
C,G,R&W (2018)	ICO to 5th Close	111%	42.5%	95
D,M&S (2018)	Open to Close	14.8%	0.1%	1,403
Felix (2018)	ICO to Close	102%	26%	255
L,L&S (2018)	ICO to Close	158.2%	24.4%	432
L,P&R (2018)	Log ICO to Open	215.7%	14.7%	580
	Log Open to Close	11.6%	3.3%	603
M (2018)	Open to Close	8.2%	2.6%	302

543. Only ICOs that were listed within sixty days. Benedetti & Kostovetsky, *supra* note 115, at 21, 23.

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