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Comparing the Performance of Initial Coin Offerings to Crowdfunded Equity Ventures

Elijah Joseph Turan
Walden University

Walden University

College of Management and Human Potential

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Elijah Joseph Turan

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Abstract

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Elijah Joseph Turan

MBA, Norwich University, 2013

BS, Ohio University, 2010

Dissertation Submitted in Partial Fulfillment

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Abstract

Uncertainty in markets increases the likelihood of market failure due to volatility and suboptimal functioning. While initial coin offerings (ICOs) and crowdfunded equity (CFE) offerings may improve functioning in growing markets, there is a lack of knowledge and understanding pertaining to the relative efficiency and behavior of ICO markets compared to CFE markets, potentially perpetuating and thwarting the various communities they are intended to serve. The purpose of this correlational study was to compare a group of ICOs with a group of CFE offerings to identify predictive factors of funding outcomes related to both capital offering types. Efficient market hypothesis was the study's theoretical foundation, and analysis of variance was used to answer the research question, which examined whether capital offering type predicted the amount of funds raised while controlling for access to the offering companies' secondary control factors: historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors. Relying on a random sample of 115 campaigns (84 ICOs and 31 CFE) from websites ICOdrops.com, localstake.com, fundable.com, and mainvest.com, results showed differences in mean funds raised between CFEs and ICOs ($346,075 compared to $4,756,464, respectively). ANOVA results showed no single secondary control factors and only one two-factor interaction (company leadership and company investors) influenced mean funds raised. This study may contribute to positive social change by informing best practices among market participants including entrepreneurs, regulators, scholars, and investors.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Turmoil, apprehension, and overreaction may be the new normal in financial markets (Black et al., 2017). The problem is that investor uncertainty results in suboptimal resource allocation in capital markets, which inhibits economic growth, innovation potential, and investor returns. Black et al. (2017) found that heightened uncertainty levels increase corporate takeover activity based on inside information, which is a violation of federal law and contributes to market failure. Connolly et al. (2005) found that investors have a stronger tendency to eschew stocks in favor of safer investments like Treasury bonds when faced with market uncertainty. Romeo (2015) found a similar correlation between stocks and property assets.

Scholars have criticized initial coin offerings (ICOs) as inherently inefficient bubbles and have warned investors away from them (Quiggin, 2013), yet others have argued that ICO markets can exhibit efficiency and do perform critical functions where traditional capital markets tend to fail (Littlewood, 2018), thus providing democracy and opportunity to innovative and often marginalized entrepreneurs. Crowdfunded equity markets share many central features of ICOs, including a reliance on crowd funding techniques and support from nonaccredited investors. Critics have raised similar concerns regarding crowdfunded equity markets (Ibrahim, 2015), but crowdfunded equity markets have shown a level of efficiency (Gruner & Siemroth, 2019) and opportunity (Gale, 2018). A study assessing ICO market efficiency compared to crowdfunded equity market efficiency was needed to reduce uncertainty in ICO markets by informing investors of the dynamics in markets, thus reducing turmoil within them and improving capital allocation.

In Chapter 1, I outline the background, problem statement, purpose, research questions, theoretical foundation, nature, definitions, assumptions, scope and delimitations, limitations, and significance of the study.

Background of the Study

The damaging effects of uncertainty in markets, particularly capital markets, is well documented in the literature. Black et al. (2017) documented the effect of uncertainty in markets to increase not only inefficiency but also even criminal activity. Connolly et al. (2005) discussed how uncertainty also results in capital allocation away from innovative assets in favor of safe, low yield alternatives. Romeo (2015) found similar results concerning stocks and real estate.

Researchers have also found similar outcomes regarding the effect of uncertainty on ICOs and other emerging capital market types. Neuman (2018) highlighted many uncertainty risks pertaining to ICO and cryptocurrency markets via a discussion of the many risks inherent to those offerings and assets. Lichfield (2018) provided a similar discussion during an interview with digital currency researcher Robleh Ali who discussed the general lack of transparency in ICO markets, including a dearth of reporting information regarding most ICOs when compared to the reporting standards of initial public offerings (IPOs). Quiggin (2013) argued that crypto markets are inherently inefficient, that the rise of crypto markets in recent years represents a financial bubble in truest form, and that this bubble provides proof in refuting the efficiency of markets overall. Zetzsche et al. (2019) offered a similar argument by asserting that the rise of ICOs represents a market bubble that cannot offer investors enough material information

to afford rational engagement in crypto markets or efficiency of those markets. The authors argued, however, that one reason for the rapid rise of ICOs has been the failure of traditional capital markets to provide support for innovative yet socioeconomically marginalized entrepreneurs and investors, which is also a consistent narrative among those who argue in favor of ICOs and other emergent capital market types.

The rise of crowdfunded equity offerings parallels ascension of ICOs in recent years. Gale (2018) argued in favor of crowdfunded equity as a means of providing democracy currently missing in traditional capital markets, while Ibrahim (2015) argued that crowdfunded equity endangers investors via undue risk due to lack of transparency, reporting, and certainty compared to traditional capital market types.

But other scholars have shown crowdfunded equity markets to exhibit efficiency, thus bolstering their arguments that they provide an alternative to traditional capital markets, along with opportunities to entrepreneurs and investors traditionally shut out from markets. Gruner and Siemroth (2019) found that crowdfunded equity can efficiently allocate capital. Ahlers (2015) discovered that crowdfunded equity markets often respond to signaling to attract investor support, most particularly by providing information about retained equity and risk. Mamonov and Malaga (2017) examined success factors affecting crowdfunded equity markets and found that key information affects the success of equity crowdfunding. These combined findings suggest a level of efficiency in crowdfunded equity markets, despite their many criticisms and concerns to the contrary.

Both ICOs and crowdfunded equity offerings emerged as alternative financing options for entrepreneurs within the last few decades due to recent advances in

technology, social understanding, and legal/regulatory evolution (Brown et al., 2018; Dudgeon & Malna, 2018). Additionally, ICOs and crowdfunded equity markets have been simultaneously lauded as harbingers of improved opportunity and democracy in capital markets (Gruner & Siemroth, 2019; Littlewood, 2018). However, both ICOs and crowdfunded equity markets have also been criticized as dangerous, corrupt, and unstable (Beloussov, 2016; Ibrahim, 2015; Zetzsche, 2019).

Lee (2017) offered a macro-level assessment of the ICO market and warned of parallels with the Dot.com bubble. Lichfield (2018) also addressed systemic concerns of the ICO market by noting the danger that noninstitutional investors pose to the ICO market compared to the assumed safety of IPO markets. Debler (2018) discussed the regulatory environment surrounding ICOs pertaining to the Securities and Exchange Commission. Adhami et al. (2018) conducted research on the success factors of ICOs from a capital acquisition standpoint. Brown et al. (2018) investigated characteristics of entrepreneurs who pursued crowdfunded equity in the UK. Signori and Vismara (2018) also researched success factors that allowed crowdfunded equity-reliant firms to acquire additional capital post initial offering. Wonglimpiyarat (2018) and Fisch (2019) studied similar factors among startups relying on ICOs for initial capital infusion. However, few researchers have attempted to compare success outcomes between ICOs and crowdfunded equity offerings.

My study contributes to the literature by comparing ICOs and crowdfunded equity market dynamics to investigate efficiency characteristics like those previously found in crowdfunded equity markets. The literature has lacked comparisons, thus representing a

material knowledge gap pertinent to the rise and subsequent debates concerning ICOs and crowdfunded equity. My study comparing each market type may reduce uncertainty and increased efficiency in both markets.

Problem Statement

The social problem in my study was that uncertainty in markets increases the likelihood of market failure due to volatility and suboptimal functioning. This social problem pertains also to capital markets, including emergent types like ICOs and crowdfunded equity offerings. Whereas both ICOs and crowdfunded equity exhibit similar structure, dynamics, promises, and criticism, prior studies have shown crowdfunded equity markets exhibit some degree of market efficiency (Gruner & Siemroth, 2019). However, the literature prior to my study has not compared ICOs to crowdfunded offerings through this perspective.

This gap has deprived marginalized entrepreneurs and nonaccredited investors of critical information that would otherwise guide their decisions to enter emergent capital markets. The consequence of this knowledge gap is that market participants have to either choose blindly between the ICOs or crowdfunded equity markets, thus exposing themselves to otherwise preventable risks, or they have to opt out of emergent capital markets altogether, thus depriving themselves of the many opportunities that capital markets may provide them. The combined result of this knowledge gap was loss of macroeconomic innovation, perpetuated socioeconomic inequality, reduced capital market functionality, and increased volatility and risk in the entrepreneurial and investor communities. For example, Sunil (2021) documented a crash of the crypto markets that

wiped out $600 billion in a single week. For many investors, particularly nonaccredited investors, these losses can be devastating.

The research problem was lack of knowledge and understanding pertaining the relative efficiency and behavior of ICO markets compared to crowdfunded equity markets, which perpetuates the uncertainty associated with crowdfunded asset types and thwarts the various communities they are intended to serve. My study compared the primary market outcomes of ICOs compared to those of crowdfunded equity offerings, along with the factors that may have influenced those outcomes and may have informed burgeoning and otherwise marginalized startups and investors in which market, if either, would best match their individual needs. My study may also inform investors and broader market stakeholders in the actual functioning of emergent capital markets, which may guide future legal and regulatory evolutions. Information stemming from my study may contribute to positive social change by reducing uncertainty, risk, and market volatility while also increasing opportunity and innovation, particularly among marginalized entrepreneurs and nonaccredited investors.

Purpose of the Study

The purpose of this quantitative study was to compare a group of ICOs versus a group of crowdfunded equity offerings with the intent of identifying predictive factors of those funding outcomes. Using analysis of variance (ANOVA), my study had one primary binary control factor that denoted whether the offerings relied on either ICOs or crowdfunded equity offerings as a form of capital acquisition. My study had one continuous, numerical dependent variable that denoted the dollars raised by the

participants in the two different market types. I also assessed the influence of eight secondary control factors, each related respectively to access to historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors. All of the secondary control factors were binary (*Yes* or *No*) denoting whether the startups provided access to this information during their offerings.

Research Question(s) and Hypotheses

Research Question: How does capital offering type predict the amount of funds raised while controlling for access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors?

For each of the nine control factors (one primary and eight secondary), the following were the hypotheses that were tested to address the RQ:

H_{j0}: There is no difference in mean funds raised due to control factor *j*.

$\mu_{j1} = \mu_{j2}$ where μ_{j1} is the mean funds raised with control factor *j* at Level 1, and where μ_{j2} is the mean funds raised with control factor *j* at Level 2; and $j = 1, 2 \ldots 9$.

H_{jA}: Mean funds with control factor *j* at Level 1 is not equal to mean funds raised with control factor *j* at Level 2.

$\mu_{j1} \neq \mu_{j2}$.

For each pair of control factors, *j* and *k*, the following are the hypotheses related to the two-factor interaction (2FI) equal to *j***k*.

H_{f0}: The interaction of factors *j* and *k* is equal to zero.

$$j*k = 0.$$

H_{fA}: The interaction of factors *j* and *k* is not equal to zero.

$$j*k \neq 0.$$

Theoretical Foundation

The theoretical foundation grounding this study was the efficient market hypothesis (EMH; Leković, 2018). According to EMH, well-functioning markets should incorporate all historical, public, and inside information into current asset prices; therefore, it is very difficult (if not impossible) to consistently find arbitrage opportunities via deliberate analysis (Fama, 1970). Were ICO and/or crowdfunded equity markets to function efficiently, the central tenets of EMH would also hold true, and their aggregate outcomes would roughly match those of traditional equity markets when controlling for risk premiums. Given this result, the investment community would utilize these markets in an efficient manner, based on the central tenets of EMH (Fama, 1970). However, if this were not the case, then arbitrage opportunities would exist in the ICO or crowdfunded equity markets, and investors should either boost investment or increase divestment, accordingly. Were performance differentials found, then EMH would suggest the existence of inefficiencies in the ICO and crowdfunded equity markets, thus supporting the need for market reform appropriate to the findings (Zetzsche et al., 2019).

A key difference between traditional IPOs and emergent capital markets (ICOs and crowdfunded equity) pertains to regulations requiring financial reporting disclosures prior to launching a public offering. A widely accepted body of regulatory law pertaining

to traditional capital markets requires businesses seeking capital injection via IPOs to provide significant financial reporting to the public prior to any offering, coupled with illustrating proof of feasibility via a documented track record of organizational success (Lichfield, 2018). Traditional capital offerings typically also require partnership with an institutional underwriter, usually an investment bank, to guide processes and proofs along in preparation for the eventual launch. These long-held market expectations generally allow the accredited investors who participate in traditional capital markets to find and incorporate public and historical data into their pre-offering valuation assessments (Lichfield, 2018).

Conversely, ICOs and crowdfunded equity offerings adhere to far less stringent financial disclosure regulations when compared to traditional IPOs (Zetzsche et al., 2019). Moreover, both ICOs and crowdfunded equity offerings typically occur prior to establishing any viable proof of work to support project feasibility, as most offerings occur at the very beginning of the organizational life cycle and often prior to rigorous testing of the product/service prototype with a mainstream consumer base (Lichfield, 2018). Information deficiencies make it difficult for investors to incorporate public and historical data into their pre-offering valuations when considering investment in crowdfunded equity offerings and especially ICOs. Some scholars have argued that these issues render ICOs inherently inefficient (Quiggin, 2013). Additionally, because ICOs and crowdfunded equity offerings do not rely solely on the support of accredited investors, their capital networks not only often lack the sophistication expected from an exclusively accredited support base, but the nonaccredited investors who often participate

in emergent capital offerings are often friends, family, or some other interested parties of the entrepreneur (Lichfield, 2018). Dynamics seemingly present a challenge to the efficient workings of marketplaces, along with a heightened propensity toward behavioral characteristics among participating investors. Still, scholars have also argued in favor of ICOs as potentially performing needed functions that traditional capital markets have historically failed to meet, like offering opportunities to high-innovation entrepreneurs when ICO markets behave efficiently (Zetzsche et al., 2019). To adequately examine EMH in the ICO and crowdfunded equity markets, it was necessary to incorporate innovative efficiency indicators into the analysis, supported by a nuanced theoretical foundation integrated with EMH.

One avenue toward testing efficiency in ICO markets was to actively compare them to crowdfunded equity markets. Both emergent capital market types rely on crowdfunding as a central function, along with nonaccredited investor bases, early in the startup lifecycle. Whereas crowdfunded equity markets have been criticized nontransparent and volatile (Ibrahim, 2015), scholars have also found crowdfunded equity to exhibit efficient characteristics (Gruner & Siemroth, 2019) like signaling material information to the investment community (Ahlers et al., 2015), which scholars have found to influence positive outcomes during the offering process (Mamonov & Malaga, 2017).

My study compared ICOs and crowdfunded equity offerings according to transparency and outcomes, and it thus provides insights into whether ICOs share the efficiency characteristics previously identified in crowdfunded equity markets. My

approach theorized that if both markets share efficiency characteristics, then access to material information should have predicted funding outcomes regardless of offering type chosen by the individual startups. I further theorized, if one or both markets lack efficiency, then access to material information should not predict funding outcomes. I elaborate further on this approach in Chapter 2.

Nature of the Study

In this quantitative study, I used ANOVA to compare the amounts of money raised by a group of startups that recently completed ICO offerings, versus a group of startups that recently completed crowdfunded equity offerings. The primary control factor denoted whether each startup in the study relied on an ICO or a crowdfunded equity offering, and this primary control factor was therefore binary. The dependent variable was a continuous numerical variable measuring the amount of money that each startup in my study raised, whether via ICOs or crowdfunded equity. I also examined the influence of eight secondary binary control factors, expressed as *Yes* or *No*, that signified whether each startup in the sample provided investors with the following:

- Historical financial data
- Pro forma financial projections
- Detailed product descriptions
- Video of product demonstrations
- Company website
- Company history
- Company leadership

- Company investors

I relied on publicly available secondary data from emergent capital market websites. Post-ICO data were found on the ICO crowdfunding website, icodrops.com (2022), which facilitates ICOs and stores historical market information. Post-crowdfunded equity offering data were initially to be found on the startengine.com (2022) website, which facilitates crowdfunded equity offerings and stores historical information on these offerings. But I ultimately relied on the sites localstake.com (2022), mainvest.com (2022), and fundable.com (2022), which provide similar data to startengine.com.

The intent of my study was to explore the efficiency of the ICO market compared to the crowdfunded equity market. The objective for my study design was to assess whether offering type (ICOs or crowdfunded equity) predicted funding outcomes (amount of money raised) of the startups in my study when controlling for access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors.

The study design and variables related directly to the research questions, hypotheses, and theoretical foundation. The intent of the research was to fill the gap in the research related to the social problem. As previously discussed, prior research has indicated that crowdfunded equity offerings exhibit efficiency characteristics. However, little was known about whether the ICO market functions as efficiently as the crowdfunded equity market. By comparing two groups of startups using ANOVA, I

sought to discover how the two markets compared regarding efficiency by comparing the amount of funding raised by each group; and if other factors influenced those outcomes.

Definitions

Amount of funds raised: The single dependent variable. It was a continuous, numerical variable and denoted the amount of money that a startup raised via their public offerings, either via ICOs or crowdfunded equity.

Capital offering type: The primary control factor. It was a binary control factor that appeared as one of two possible outcomes: *ICO offering organization* or *crowdfunded equity offering organization*. The former denoted startups that sought capital via ICO offerings, and the latter denoted startups that sought capital via crowdfunded equity.

Company history: A secondary binary control factor that denoted whether the capital seeking organization provided a company history prior to the offering launch. The range of possible values was either *Yes* or *No*.

Company investors: A secondary binary control factor that denoted whether the capital seeking organization provided a list of investors in the company prior to the offering launch. The range of possible values was either *Yes* or *No*.

Company leadership: A secondary binary control factor that denoted whether the capital seeking organization provided a company leadership detail prior to the offering launch. The range of possible values was either *Yes* or *No*.

Company website: A secondary binary control factor that denoted whether the capital seeking organization provided a company website prior to the offering launch. The range of possible values was either *Yes* or *No*.

Detailed product descriptions: A secondary binary control factor that denoted whether the capital seeking organization provided a detailed product description prior to the offering launch. The range of possible values was either *Yes* or *No*.

Historical financial data: A secondary binary control factor that denoted whether the capital seeking organization provided historical financial data prior to the offering launch. The range of possible values was either *Yes* or *No*.

Pro forma financial data: A secondary binary control factor that denoted whether the capital seeking organization provided pro forma financial data prior to the offering launch. The range of possible values was either *Yes* or *No*.

Video of product demonstrations: A secondary binary control factor that denoted whether the capital seeking organization provided a video of product demonstrations prior to the offering launch. The range of possible values was either *Yes* or *No*.

Assumptions

An underlying assumption in my study was that rational, self-interested investors would respond, as a general tendency, more favorably to fundraising startups that provide material information to the investment community prior to making a public offering, as compared to those startups that offered relatively less material information to the investment community prior to an offering. A follow up assumption was that this assumed tendency of investors represented an efficient behavior within primary capital

markets. I based this assumption on the central assertion of EMH, which holds that investors naturally price all available material information into asset prices in an efficient marketplace (Fama, 1970). According to EMH then, investors in an efficient marketplace naturally seek out information material to asset prices. I relied on this rationale in my assumption that investors should show a greater propensity to invest in startups that provide greater transparency relative to other startups, and that this propensity to invest toward greater transparency is a sign of an efficient market.

Scope and Delimitations

The social problem was that investor uncertainty results in suboptimal resource allocation in capital markets, which inhibits economic growth, innovation potential, and investor returns. The research problem was lack of knowledge and understanding among investors and financial professionals pertaining to the efficiency of ICOs versus crowdfunded equity offerings, which perpetuates the uncertainty associated with emergent markets and thwarts the various communities they are intended to serve.

The specific aspect of the social problem that I sought to focus on was the knowledge gap regarding the differences between outcomes in the ICO market and those in the crowdfunded equity market when accounting for market transparency. I chose this focus based on the complete or near complete dearth of research that has actively compared the outcomes and dynamics of the two markets of interest.

The population in the study consisted of firms that sought startup capital via ICO offerings and those that sought startup capital from crowdfunded equity offerings. The target population derived from publicly available data for these firms provided by four

popular websites that serve those populations. The target population did not include startups listed on other websites or those that were not accessible to the general public. The website ICOdrops.com (2022) maintains both ongoing and completed ICO offerings and their associated funding results, including a listing of 1,305 completed ICOs that have run on the site between July 2014 to January 2022. The website startengine.com (2022) maintains both ongoing and completed crowdfunded equity offerings and their associated results, including a listing of 583 companies that have completed crowdfunding campaigns on the website. However, startengine.com ceased offering this information during the course of my research, so I found similar data from the crowdfunded equity sites localstake.com (2022), mainvest.com (2022), and fundable.com (2022). My study relied on a sampling of the target population.

The primary theory that provided a framework to the study was EMH as seen in the primary capital markets. The study did not cover EMH from a secondary market perspective, nor did the study account for behavior finance theory, although future researchers may further close the knowledge gap by doing so. The focus of the study also did not account for other seminal theoretical families in financial thought, like modern portfolio theory, nor did it account for the effects of business cycles on the markets of interest.

Limitations

One limitation was that other influences may have also affected the investment community's propensity to engage in emergent capital markets, some based on efficiency and rationality, and others based on inefficient or behavioral factors. Examples of rational

or efficient factors not considered in my study that may influence emergent capital market outcomes include privy investment information available to key investors but not the public, the respective strength of individual entrepreneurs' funding networks, etc. An example of nonefficient or behavioral factors that may influence capital market outcomes may include personal investor relations/affinities to the entrepreneurs and secondary capital market behavior. These other factors were beyond the scope of my research.

The study was also limited in that it only pertained to primary emergent capital market outcomes, rather than also incorporating secondary capital market outcomes. Secondary market information lacks transparency, but future researchers may wish to seek this information if conditions allow.

An additional limitation to the study was that it relied solely on a quantitative design to assess market efficiency and outcomes via publicly available secondary data. Future researchers may also choose to incorporate direct feedback from market participants via surveys or qualitative approaches such as interviews or focus groups. Future inquiry may inform the behavioral side of emergent capital market dynamics, along with further informing rational behavior within the realms of market efficiency.

Significance of the Study

This study was significant according to its potential to advance financial theory into emergent ICO and crowdfunded equity markets, improve the practical functioning of those burgeoning capital market types, and create positive social change by reducing uncertainty in those markets along with mitigating the turmoil associated with uncertainty. I elaborate on each of the areas of significance in the following subsections.

Significance to Theory

While much has been written and studied pertaining to the efficiency and transparency of capital markets, the current body of literature is almost exclusively focused on traditional capital market structures, like primary and secondary equity, bond, options, and commodities markets that are highly regulated and have long histories of study and commentary (Leković, 2018). The vast majority of research surrounding EMH and its related body of theory has focused on established marketplaces, and even emergent bodies of financial thought that somewhat counter EMH, like those ideas prevalent in behavioral finance, are almost exclusively dedicated to those traditional capital and securities markets, as well.

The sudden explosion of ICOs and crowdfunded equity offerings has grown those emergent markets into a force in the field of finance faster than the ability of researchers in the discipline to keep pace with their development and acceptance. These emergent markets are some of the most dynamic, promising, and evolving sectors of capital finance, yet their opacity and theoretical mystery make them also some of the riskiest, most volatile, and least understood markets in the capital sector.

Even those few theorists who have researched the workings and efficiencies of ICOs and crowdfunded equity markets have not compared outcomes between the two in comprehensive and meaningful ways. My study may make a significant contribution to theory by providing cross-market research likely for the first time. The results and conclusions of my study may subsequently guide the work of future theorists who may

choose to build upon my work, thus encouraging and empowering the next generation of scholars to usher EMH and its broader theoretical family into this new age of finance.

Significance to Practice

ICOs and crowdfunded equity offerings have developed rapidly in recent years, even now making inroads into mainstream practice. Many entrepreneurs and investors have entered these emergent arenas in pursuit of the vast opportunities that others have enjoyed while participating in them, yet they ultimately do so at their peril given the dearth of comprehensive research pertinent to crowdfunded markets. Opacity further prevents entrepreneurs and investors from fully knowing if they are choosing the best option in emergent finance, particularly when considering the many similarities and differences between ICOs and crowdfunded equity offerings.

Many startups may benefit from seeking capital via either ICOs or crowdfunded equity offerings, but the gap in research that meaningfully compares the two forces entrepreneurs to intuitively choose one or the other, as opposed to relying on informed and educated knowledge when selecting a capital market type. A similar problem exists for investors who wish to participate in emergent capital markets but who also lack access to the requisite knowledge to know whether ICOs or crowdfunded equity offerings represent the best markets for them.

My study may help to close this gap of practicable knowledge by offering entrepreneurs and investors useful knowledge that may guide their entrance into either emergent capital market, based on their own individual aptitudes for risk and reward. This added professional insight may even reduce the tendency by market participants to

react to behavioral factors, like herd behavior, in favor of transparency and efficiency factors. These outcomes may also reduce risk and volatility in both the ICO and crowdfunded equity markets on a practical basis. The study may contribute to greater efficiency, less risk, and improved stakeholder outcomes in both emergent capital market types.

Significance to Social Change

Advocates for both ICOs (Littlewood, 2018) and crowdfunded equity markets (Gale, 2018) have argued that traditional capital markets behave unfairly by favoring accredited and institutional investors while simultaneously blocking out and marginalizing small and individual investors who lack access to institutional wealth, thus creating misbalanced feedback loops in traditional capital markets that trend toward increased inequality. Similar arguments exist regarding the unfair nature of traditional capital markets toward favoring established companies over fledgling startups, thus creating noncompetitive business landscapes. Proponents of ICOs and crowdfunded equity offerings argue that they operate more equitably than traditional capital markets and even represent the democratization of capital offerings, thus empowering entrepreneurs, bettering marginalized communities, and enriching nonaccredited investors while contributing to a more vibrant, dynamic, and innovative economy.

Critics of ICOs (e.g., Quiggin, 2013) and crowdfunded equity offerings (e.g., Ibrahim, 2015) have argued that crypto marketplaces suffer higher risks for volatility, corruption, fraud, crime, and systemic failure, while also exhibiting the overall behavior of a market bubble that must inevitably correct itself. These dueling and seemingly

mutually exclusive narratives inhibit market stakeholders from safely and knowledgably engaging with emergent capital markets while also causing these marketplaces to grow with asymmetry and instability, thus harming stakeholders and causing risk and lost opportunity to the broader economy.

My study may create positive social change by empowering stakeholders to engage in ICO and crowdfunded equity markets, along with better knowing which of those markets may be right for them. This may in turn result in improved efficiency, transparency, and stability of emergent capital markets while also bettering marginalized entrepreneurs, investors, and communities, alongside strengthening the broader economy.

Summary and Transition

In this chapter, I outlined the recent research related to my social problem, problem statement, purpose, research questions, theoretical foundation, nature of the study, definitions, assumptions, scope and delimitations, limitations, and significance of the study. I assessed the mean primary market outcomes of startups seeking ICO funding versus startups seeking crowdfunded equity funding, along with assessing the influence of other factors that may affect those outcomes.

Both emergent capital market types have exploded in recent years due to breakthroughs and reforms in technology and regulations, respectively. Their market growth has developed faster than scholars have been able to study them, resulting in significant knowledge gaps pertaining to those markets. The knowledge gap concerning differences in outcomes between the two markets and factors that may influence those outcomes has created much uncertainty among stakeholders in those markets. This

uncertainty inhibits optimal market performance and leads to reduced outcomes for investors, entrepreneurs, communities, and the broader economy.

The theoretical foundation of my study, study design, and research questions were designed to fill this knowledge gap via a quantitative assessment comparing those specific market types. The study may contribute to positive social change by optimizing the outcomes for participants of those markets, along with the communities and economies that rely on them. In the next chapter, I outline the search strategy I relied on to conduct the literature review, the theoretical and conceptual lens I interpreted it through, and my conclusions drawn from it.

Chapter 2: Literature Review

The social problem of my study was that investor uncertainty results in suboptimal resource allocation in capital markets, which inhibits economic growth, innovation potential, and investor returns. As such, the research problem was lack of knowledge and understanding among investors and financial professionals regarding ICOs and crowdfunded equity offerings, which is perpetuating the uncertainty associated with these asset types and thwarts the various communities they are intended to serve. The purpose of this quantitative study was to compare a group of ICOs versus a group of crowdfunded equity offerings with the intent of identifying predictive factors of those funding outcomes.

The current literature surrounding ICOs and crowdfunded equity is expansive and quickly evolving, but also lacking in critical areas. The majority of past researchers have examined the technology, laws, potentials, risks, and other fundamental and systemic factors that influence these emergent capital markets. A small but arguably growing number of scholars have researched factors that affect primary market outcomes for ICOs and crowdfunded equity offerings. However, few if any scholars have attempted to directly compare outcomes and influencing factors of the two emergent primary markets. In this chapter, I provide my literature search strategy, my theoretical foundation, my literature review, and my summary and conclusions.

Literature Search Strategy

The primary sources of information that I relied on while conducting my literature review are found through the Walden University Library portal, which subsequently

connects to numerous databases and search engines. The database I relied on most heavily was Business Source Complete followed by Academic Search Complete. My key search terms included: *Initial Coin Offerings, ICOs, Crowd Funded Equity, Block chain, Distributed Ledger Systems, Crypto Currency, Emergent Finance,* and *Crypto Tokens.* I also included secondary search terms for technologies that may currently or in the future interface with the block chain platforms that ICOs run on, including *Artificial Intelligence, AI, Internet of Things, IoT,* and *Quantum Computing.*

Most of the literature that I included in my search came from a window between 2015 to present, with the majority of sources originating in the years 2017 to 2022. The exceptions to this date range pertained to the seminal works that I relied on to formulate my theoretical foundation, particularly those pertaining to EMH and the functioning of traditional capital markets. I have included a wide range of sources and literature types including peer-reviewed works like scholarly papers. I also included many works from industry and professional publications due to the nature of the constantly evolving ICO and crowdfunded equity spaces. While many of those works have not been peer-reviewed, they contain commentary and reporting that have and continue to influence prevailing opinion among professionals, industry practitioners, and future researchers, so I included those works because of their influence on scholarly thought.

Theoretical Foundation

EMH is a prevailing body of theoretical thought and was first formalized by Harry Roberts in 1967 (Sewell, 2011). Existing within mainstream financial thought, EMH is widely adhered to among both financial scholars and also practitioners (Leković,

2018). The central tenets of the theoretical foundation rest on the assertion that financial markets (or any markets broadly) are fundamentally efficient in that they efficiently incorporate all pertinent information from historical, public, and (arguably) private sources, and that this information informs and guides the investment community in setting asset prices in open places of commerce (Fama, 1970). EMH holds that it is very difficult if not impossible to find arbitrage opportunities within efficient markets, as traders and analysists in any transparent and functioning market would very quickly find pricing aberrations and subsequently trade them away via opportunistic buying and selling reactions (Leković, 2018). While proponents of EMH agree that market failures, bubbles, and imbalances are both possible and common, they argue that this volatility stems more from lack of material information to properly guide markets, rather than market participants failing to incorporate this information in their collective decisions. The prevailing assumptions of EMH are that asset prices within any reasonably transparent and functioning market reflect the best estimates of those market participants at any given time, and those participants may rationally assume that the prices within those markets at any time have been efficiently priced at those levels (Fama, 1970).

The foundational concepts for EMH have existed in the realms of financial thought and practice for centuries and have evolved over time through the seminal and iterative contributions of many scholars before Roberts formalized the concept in 1967 (Sewell, 2011). EMH has fallen in and out of favor with mainstream thought throughout the decades, and the hypothesis was considered largely heterodox until the mid- to late-20th century (Sewell, 2011). One of the most influential contributions to EMH came from

Fama (1970) whose work entitled "Efficient Capital Markets: A Review of Theory and Empirical Work" influenced generations of subsequent EMH theorists, thus contributing to the adoption of EMH into mainstream financial thought. EMH prevailed as a widely accepted body of theory throughout the 1980s, 90s, and early 2000s and was often cited as justification for the deregulation of financial markets (Sewell, 2011). Many contrarian theorists criticized EMH following the 2008 financial crisis (see for example O'Sullivan [2018] and Yusuf [2015]). They pointed to the crisis as proof that EMH did not hold true, even blaming EMH as encouraging and justifying the many market misbehaviors that created the crisis (Sewell, 2011). Behavioral finance theorists have put forward psychological theories to explain how markets may behave irrationally and thus inefficiently. Decades of scholarly research have resulted in mixed conclusions across many industries, markets, and countries concerning the validity of EMH in its different forms (Sewell, 2011).

The rise of Bitcoin and other crypto assets into major markets has spurred some critics of digital currencies to further argue that EMH does not hold true. Quiggin (2013) argued that the rapid adoption and growth of Bitcoin markets, which the author asserted lacks true value and represent an impending market bubble, proves that the central tenets of EMH are false. They asserted that if EMH were true that the investment community would never have priced Bitcoin at the heights of value that the emergent currency has attained (Quiggin, 2013), both since the writing of their article and especially in years subsequent.

The question of EMH validity as applied to the burgeoning ICO and crowdfunded equity markets is of great importance regarding the assumed risks and opportunities found within those rapidly expanding markets. If Quiggin (2013) was correct in their assertions, then investors and entrepreneurs assume great peril when choosing to participate in those forums. Other scholars have also seconded this assessment. Lichfield (2018) discussed the information asymmetries inherent to ICOs compared to traditional equity markets, which would signify market inefficiencies and their associated risks. Neuman (2018) also discussed many similar risks inherent to cryptocurrencies. Zetzsche et al. (2019) discovered an overall dearth of material information after examining more than 1,000 ICO whitepapers. All these observations and findings would suggest a high degree of inefficiency in ICO markets; however, Zetzsche et al. (2019) also argued that ICOs arose in large part due to the failure of traditional capital markets to meet the needs of highly innovative startups and that ICOs may provide solutions to these shortcomings were they able to function efficiently.

An avenue toward discovering the true level of efficiency in ICO markets may come through actively comparing them to crowdfunded equity offerings. Like ICOs, crowdfunded equity relies on a non-accredited investor base and emergent crowdfunding technology. Also, like ICOs, crowdfunded equity has been criticized as being inefficient (Ibrahim, 2015).

Other scholars, however, have argued that crowdfunded equity markets do exhibit efficiency. For example, Gruner and Siemroth (2019) along with Ahlers et al. (2015) found that entrepreneurs communicate with investors via signaling. Mamonov and

Malaga (2017) found that investors responded to material information provided by startups during the crowdfunded equity process. These findings suggest a level of efficiency in crowdfunded equity markets not accounted for by other scholars.

My research directly compared outcomes between ICOs and crowdfunded equity offerings, along with the influence of market transparency on those outcomes and illustrated whether ICOs exhibit similar efficiencies that scholars have previously found in crowdfunded equity markets. These observations may reduce the uncertainty surrounding ICOs, along with reducing the market volatility surrounding them. Sunil (2021) discussed a recent drop in secondary crypto markets that wiped out $600 billion in a single week. Assessing the true level of efficiency in the ICO markets may smooth volatility, thus better informing and protecting vulnerable stakeholders from losses and contributing to positive social change.

Literature Review

Initial Coin Offerings (ICOs) are a crowdfunding method that firms, often startup ventures, rely on to raise capital by offering cryptocurrencies to investors who conversely seek shares of ownership in those ventures or access to their goods and services (Gale, 2018). ICOs have risen in popularity with the rise of blockchain based networks, which provide the technological foundation that allow for cryptocurrencies like Bitcoin to exist. ICOs have also grown in scope and scale alongside crowdfunded equity offerings. Similar to ICOs, crowdfunded equity offerings also seek funding from investors who provide capital via crowdfunding platforms. Crowdfunded equity offerings differ from ICOs insofar as they provide ownership of traditional stocks instead of cryptocurrencies.

ICOs and crowdfunded equity's exponential market growth stem from recent technological advances, coupled with contemporary loosening of regulations that allow for them to operate under certain conditions. Numerous uncertainties, bottlenecks, opportunities and speculations concerning technology, regulation, and investor sentiment pertinent to ICOs and crowdfunded equity offerings have motivated numerous authors, scholars, practitioners, and investigators to study, conjecture, and argue concerning the trajectory of crowdfunded markets. For this literature review, I present a comprehensive summary and critical comparison of the existential literature pertinent to ICOs, crowdfunded equity, blockchain networks, and associated technologies. I conclude my review and synthesis by identifying the gap within the literature. To ease in comprehension and analysis, I present my review according to broad topics within the literature, starting with regulation and policy.

Regulation and Policy

Due to legal uncertainties surrounding ICOs specifically and distributed ledger systems generally, a significant share of the existential literature focuses on current and likely regulations in the US. Price (2017) discussed issuer obligations when issuing ICOs. As the commissioner of the Australian Securities and Investments Commission (ASIC), Price sought to provide clear guidance to readers as to under what conditions an ICO would be subject to the Corporations Act, which is the primary regulatory body of securities in Australia. As in the United States and other nations, Australia considers ICO-issued tokens to be securities if ownership of them entails ownership or dividend rights. If an ICO necessitates operation of a financial market (in that the tokens can be

subsequently bought, sold, or issued on a standing exchange) then they are also subject to additional oversight via proper licensing requirements. However, ICOs may be required to merely abide by the general laws pertinent to sellers of goods and services, like basic consumer protection and rudimentary transparency. Price also made a point to differentiate ICOs from crowdfunded equity markets, the latter pertaining to the actual issuance of equity stocks, and the other to cryptocurrency. While this article was limited in that it did not provide original insights consistent with primary research, the work was useful in that it offered yet another contrast between international efforts to regulate ICOs. Future research could center on better understanding investor and entrepreneur response to policy differences, as in nations where capital has flowed, and where investors and customers have been most protected.

Lee (2018) postulated emergent ICO standards via new wealth management technology. The author completed a case study on an entrepreneurial venture known as Tend. Operating on a blockchain based distributed ledger system, the fledgling company (as of the time of writing) was seeking funding from investors via an ICO. The business model sought to mimic popular timeshare structures whereby millionaire investors would gain partial ownership and access to extremely expensive assets (i.e., vineyards, art, and autos) from billionaire divestors who are seeking to add liquidity to fallow assets. The intention was to provide investors not only access to assets but also capital appreciation (like capital gains and dividends) from them. The company was seeking to capitalize on emerging psychological needs whereby experience supersedes outright ownership, thus partially democratizing and liquidating asset allocation across the emerging economy.

The author wrote the work as a profile piece, so the author's assertions should be viewed as if written with bias, and the findings are not fully generalizable. The work is valuable in that it provides a personalized expression of an emerging trend in ICO-funded markets: the tendency of investors to prefer access to assets on demand, rather than full-time access rights afforded to outright ownership. The author's article provided an international perspective to digital token use and ICOs insofar as the company founder is applying experience from Swiss banking and pursuing funding from investors in emerging markets East Asia, Latin America, and the Emirates.

Conversely, other scholars have focused on the regulatory and policy environment surrounding ICO markets. Tashea (2018) described legal uncertainties surrounding ICOs. The author discussed how different standards exist in different legal jurisdictions regarding disparate fintech vehicles among various agencies. Many regulators fail to agree on whether ICO-issued tokens are commodities or securities, thus affecting their legal requirements. According to the author, many entrepreneurs and investors find this ambiguity concerning, therefore likely stifling growth in the industry and funneling funds into legal jurisdictions with relatively lax sentiments. The author did not conduct original research, instead relying on in-person interviews and summarized concepts based on previous studies. The article is valuable in providing an intriguing view into the disparate legal opinions on the issue.

Whereas Tashea (2018) focused on the legal landscape surrounding ICOs, Pooley and Lee (2018) covered the legal landscape for blockchain economies, along with the ways that technology may even change the legal industry itself. The authors wrote the

piece to better inform their readership who are attorneys and other legal professionals on the issues surrounding the burgeoning field that they should be aware of. The authors provided a description of what Bitcoin and other cryptocurrencies are and the legal environment pertaining to digital assets. The authors discussed blockchain distributed ledger systems with a particular emphasis on how public databases may provide innovation opportunities across multiple industries, many of which are not even related to cryptocurrency markets. Examples include real estate transactions, remittance markets, and the wholesale decentralization of the information economy, all of which do and will carry significant implications for the legal profession and the client base it serves. The authors have provided a valuable contribution to the literature, particularly regarding how law and technology interface. Future researchers could benefit from this starting point by focusing on how future cases will set precedents around cryptocurrencies and blockchain technology, coupled with how innovations in those technologies may affect legal issues at a later date.

Not all scholars shared the concerns expressed by Tashea (2018) regarding ICO regulatory uncertainty, instead arguing that regulators and blockchain developers should coordinate efforts. For example, Werbach (2018) argued the legal needs for blockchain success. Because of the inherently transparent and immutable nature of blockchain networks, the author conjectured that blockchain technology may represent the most important technological breakthrough since the internet insofar as it fulfills this most basic human need. Werbach argued that trust verification efforts via blockchain may be counterproductive if lacking a sound regulatory environment and legal landscape.

Werbach deviated from typical discussion on the topic by asserting that practitioners, regulators, lawmakers, and jurists should not concentrate on how to regulate blockchain so much as how blockchain regulates itself. The author suggested that stakeholders should look at process rather than procedure. Werbach stated that blockchain may act as a partner in legal enforcement rather than as a problem requiring regulating. The author argued that blockchain developers and regulators should work together to create mutually desirable solutions. This article was valuable insofar as it framed blockchain technology from a legal perspective, similar to the work of DiNizo (2018) and Fenwick et al. (2017).

Werbach's (2018) recommendations seemed sanguine compared to del Castillo's (2018) writings about SEC actions against Ethereum-based ICOs. del Castillo reported on the punitive actions of the Securities and Exchange Commission against two firms financed via initial coin offerings. These firms where Carrier EQ and Paragon, which had raised funds to provide mobile banking to emerging markets and sales legally sanctioned medical marijuana, respectively. These dual enforcements came just after the SEC leveraged punitive action against the restaurant rating firm Munchee. The firms raised startup funds via initial coin offering under the assumption that the cryptocurrencies that they were raising were commodities rather than securities, the latter requiring greater regulatory oversight than the former according to the Securities Exchange Act of 1934. These increasingly aggressive actions by the SEC toward interpretation and enforcement of cryptocurrency markets coincided with extreme market duress affecting digital asset exchanges, following the onset of a broad-based market correction of blockchain based assets.

A frequent topic of interest in blockchain and ICO research and commentary is concerned with the inherent risks of emergent technologies and practices. For example, Mckendry (2018) addressed the need for new legislation to prevent hate groups from leveraging crypto groups for gain. Mckendry reported on the efforts of Rep. Emanuel Clever and other lawmakers to restrict digital currency flows from supporting hate groups. According to the author, the House Financial Services Committee identified instances where groups associated with the Unite the Right rally in Charlottesville, VA. Lawmakers have voiced concern that the anonymity factor underlying blockchain based cryptocurrencies allow hate groups and other prohibited parties from transferring funds to one another, along with potentially raising funds via digital crowdfunding platforms. Rather than seeking legislation to curtail these activities from Congress, however, Clever sought out responses from heads of the Digital Chamber of Commerce and the Bitcoin Foundation seeking clarification on how the private sector seeks to provide remedy to these concerns in the absence of regulatory response. Mckendry provided a valuable contribution to the existential literature by highlighting the potential threats that exist via the emergence of fintech solutions like digital crowdfunding and cryptocurrencies.

Similarly, the literature reflects broad concerns regarding the financial and macroeconomic risks of crypto markets. Specifically, Nelson (2018) discussed monetary policy and financial stability concerns surrounding crypto currencies. Nelson conducted an analysis regarding the potential macro risks to financial and monetary systems owing to the rise of digital currencies. The author was interested in two primary threats to existing fiat currency markets. The degree of leverage in digital currency markets may

theoretically pose a systemic risk to traditional monetary markets if investors have borrowed heavily from the latter to finance their speculations in the former. The elevated volatility in digital currency markets could result in a bubble that rippled into traditional money markets pending high macro leveraging between the two. The author asserted that leverage remains low, given the reluctance of accredited investors to speculate in cryptocurrency markets. The systemic risk of digital token market shock to established money markets remains small. Nelson also investigated the likelihood of crypto currency markets eventually undermining or replacing established national monetary markets. The author also asserted that this outcome is unlikely. Digital currency markets pose low risk to macro monetary markets on both accounts, according to the author.

Similar to Nelson's (2018) concerns, Rahman (2018) postulated on monetary policy given fiat and crypto currency competition. Rahman analyzed how the rise of digital currency markets may affect optimal monetary policy under conditions of competition between fiat and digital currencies. The author relied on the Friedman rule, which advocates deflationary monetary policy as optimal, according to a Fernández-Villaverde and Sanches framework and devoid of friction. The author found that monetary equilibrium in a completely private digital currency landscape would be suboptimal, given the profit motive of markets to expand. The author also found that, given the presence of governmental intervention to curb profit maximization of miners to constantly grow the digital money supply, crowdfunded markets could achieve optimal monetary policy under key conditions. Rahman asserted that direct competition between digital and traditional monetary systems is suboptimal according to the Friedman rule,

and only fiat monetary regimes are capable of socially desirable policy according to the Friedman rule. This article is an interesting companion piece to the work of Nelson (2018) mentioned previously. The practical importance of Rahman's findings is limited insofar as the author relied on the Friedman rule as a representation of optimal monetary policy, despite the reluctance of central banks to apply it in real life.

In contrast to the regulatory and policy research and commentary discussed previously, Truby (2018) focused instead on ways that policy and regulation might improve blockchain functioning itself. Specifically, Truby addressed legal and policy options that may result in reduced blockchain and crypto energy needs. Truby evaluated the intensive use of energy and other finite, carbon-based resources to support digital currency transactions and all other blockchain based activities. While energy usage, mostly expended by miners who are needed to prevent the double-spending problem of crypto assets, does allow for increased trust, security, and transactional outcomes in these markets, the author asserted that the environmental strain that these operations entail grossly overshadows these advantages, particularly during a critical time in ecological history when global climate change threatens continued human existence. Caldwell (2018) discussed anticompetitive outcomes in crypto mining networks. Caldwell provided an expose on emergent cyber attacks in which nefarious actors have been infiltrating both private and, increasingly, organizational IT systems to hijack their electronic infrastructure to conduct digital currency mining operations on their behalf. Because crypto mining is the method in which market participants may create and, therefore, possess new digital monies, there is a direct incentive for hackers to conduct

these operations. Because mining is highly expensive and capital intensive, however, malicious actors also have an incentive to trick others to conduct these activities on their behalf. Targets will not realize that their assets are running mining operations, therefore draining energy and productivity to enrich the hackers. These operations can occur on enterprise infrastructure or personal devices on a wide network. While hackers are not necessarily trying to damage their targets through malware or spyware, their infiltrations do enable increased vulnerabilities to the target for follow up attacks.

Whereas many of the authors discussed previously focused on domestic blockchain concerns, lack of consensus between governments and the patchwork legal approach that globally exists has caused many scholars to focus on international regulations of ICOs and associated block chains. Debler (2018) examined the implications of foreign-based ICO-issuers that make offerings in the US, thus falling under Securities and Exchange Commission (SEC) jurisdiction. Debler started out by offering a background on basic concepts like cryptocurrencies, ICOs, how startups leverage ICOs and their inherent risks, and how regulators are increasing their scrutiny of cross-border ICOs. The author launched a nuanced legal argument affirming that the SEC does have authority to regulate the majority of ICOs, as they meet the primary requirements of securities according to salient, precedent-setting cases. Debler argued that the SEC also possesses sweeping authority to regulate international ICOs, which the author supported via reference and analysis of existential agency law and landmark court cases. Debler argued that the SEC also possesses sweeping authority to regulate international ICOs, which the author supported via reference and analysis of existential

agency law and landmark court cases. Overall, the author contributed a valuable addition to the literature pertaining to ICOs. This is especially true because, unlike many other authors on the topic who rely on opinion and conjecture, Debler synthesized a compelling argument via analysis of the legal system and case law. The topic of ICO regulation from a securities perspective is one of great interest to many researchers, lawmakers, investors, and entrepreneurs, and Debler offered a niche perspective by focusing on international ICOs.

Many scholars have researched and discussed the need and types of regulations best pertaining to blockchain, cryptocurrencies, and ICOs. Bellavitis et al. (2022) discussed entrepreneurship, ICOs, and regulation; whereas Yeung and Galindo (2019) assessed internal governance mechanisms for blockchain, as did Jayasuriya Daluwathumullagamage and Sims (2020) regarding blockchain governance and regulation. Zhang and Zhang (2021) explored policy uncertainty and its effects on ICO markets while Truby (2020) evaluated sandbox regulation proposals. O'Dair and Owen (2019) examined blockchain financing, opportunity, and policy; meanwhile, Matei and Baks (2019) analyzed bitcoin regulation and challenges. These challenges often stem from the rapid rise of ICO and crypto markets (Vega, 2021). The conversation of ICO and crypto trends and regulations remains a major topic among industry insiders with Hajric (2020) reporting on a crypto exchange's CEO remarks.

A major driver of the debate around crypto regulation is regarding whether crypto currencies constitute securities or not, as discussed by Lambert et al. (2022) and Maughan (2019), the latter evaluating whether security tokens could potentially convert

to non-security tokens. Amid this activity and discussion, the Securities and Exchange Commission (SEC) has played a central role. Kharif (2021) discussed cryptocurrencies and increased SEC oversight. Perhaps as an example, Robinson and Kharif (2019) reported the SEC's halt on Telegram token sales after the company's $1.7 Billion ICO. Conversely, SEC alleged that a cryptocurrency analyst was paid $5 million to push ICO (Dolmetsch, 2022). Simultaneously, Meyerowitz (2022) reported on the Justice Department's launch of a national cryptocurrency enforcement team. In one example of state response, Massachusetts formed a fintech panel following a crypto crackdown (Hernandez, 2019).

Another major issue pertaining to crypto regulation has been the content of ICO white papers, particularly legal content (Kasatkin, 2022). Thewissen et al. (2022) studied ICO white papers via a topic modeling approach, along with the role of linguistic errors and investment decisions pertaining to ICO white papers.

Outside of formal regulation, many scholars have attempted innovative approaches to regulating the sector, including through machine learning (Yin et al., 2019), and through the controversial use of future token agreements (Strassman, 2019). Conversely, Collomb et al. (2019) discussed a risk-run approach to blockchain regulation. Efforts by organizations and industries to self-regulate are a mainstay in the literature.

International Regulation

Similar to the landscape in the U.S., many other national governments are choosing their own regulatory paths (Pavlidis, 2020). Bacina (2019) discussed token

offering regulation in Austria while (Vandezande, 2020) evaluated the EU's framework, and Kondova and Simonella (2019) assessed blockchain financing in Switzerland.

In contrast to Debler's (2018) work, which focused on attempts by American regulators to enact policy on foreign based entities, others have focused on the attempts of foreign governments themselves to regulate their own ICO and crypto markets. For example, Nordrum (2017) provided an interesting article focusing on potential ICO and blockchain application in the public sector. Because of the improved functionality that distributed ledger systems offer regarding transparency, speed of transaction, and security, many public organizations like local, state, and national governments are exploring the idea of replacing their central, relational databases with DLT. Nordrum conducted a case study research project wherein two public sector DTL projects were highlighted. The first cast focused on Dubai, the most economically prosperous city in the Emirates, which is the current blockchain epicenter of the Middle East. According to the author, the city was planning to launch a shared platform next year that several governments projects will be able to utilize next year to host their individual projects in blockchain technology. The Emirates were pursuing a share asset approach. The state of Illinois was encouraging various departments to utilize blockchain networks to manage their various projects, but it was allowing each department partaking in the initiative to select its own blockchain network for their separate projects. While Dubai was seeking synergy gains with a common network, Illinois was attempting to find optimal functionality via customization. This was a very interesting article in that it highlighted how public sector entities are embracing blockchain technology, which thus far has been

positioned as an alternative to governments. The author showcased two very different methods of adopting and applying blockchain technology, which is very pertinent toward any attempt to leverage these networks in a real-world setting.

Conversely, Reutter et al. (2017) provided an overview of the how initial coin offerings are regulated under Swiss law. Beginning with an explanation of what ICOs are and how they operate, they categorized cryptocurrency tokens according to five distinct yet potentially overlapping groups: usage tokens that allow the owner to utilize a platform, good or service, work tokens that allow a holder to procure their work to the issuer, profit tokens that allow the owner to claim rights to net gains from the issuer from dividends, voting tokens that provide the right to voter on management issues of the company, and native cryptocurrency tokens that allow the holder to own, hold, and then trade those assets. Depending on which class any given token falls under, they may be subject to certain regulations under Swiss law but not to others. The authors provided an overview on what conditions would require the ICO issuer to provide merely a white paper versus a full prospectus, the former generally pertaining to goods and services provision, the latter to issuance of securities. The authors discussed differing allocation schemes by issues to investors. They expressed their aversion to first-come-first-served arrangements in favors of others like the pro rata cut back basis. The article was a useful companion piece to that provided by Lai (2018) and Price (2017), which covered ICO issuance regulations in East Asia and Australia, respectively. Generally, the Swiss system is more permissive of these arrangements, as has been its cultural long-term trend in

many financial matters. Future research could center on how investors, entrepreneurs, and consumers respond to national and local regulatory differences.

Asian markets are also a primary source of discussion including a primer on ICO regulation across the continent. Lai (2018) offered an overview of the regulatory environment of initial coin offerings in the leading economies of Asia. The author began by providing a concise explanation as to when ICOs would be regulated according to existing securities laws that govern initial public offerings of stocks. Generally speaking, cryptocurrency offerings that provide ownership, voting, dividend, and other rights often associated with stocks are subject to national and local security regulations. Tokens that merely provide usage rights of the network under construction are not subject to scrutiny. The regulatory landscape in many countries is confused in the sense that many ICOs offer mixed benefits to investors, and it is often difficult to decipher where a commodity offering ends and a securities offering begins. Lai offered a brief explanation of how ambiguity is being regulated in five major East Asian economies: China, South Korea, Hong Kong, Singapore, and Japan. Overall, China has adopted the most stringent stance with a ban on all ICOs; meanwhile, South Korea has issued a partial ban. Hong Kong, Singapore, and Japan have offered a much more welcoming environment to ICOs insofar as they provide only limited regulations in select cases. This article was useful as a survey work, but it did not provide an original contribution regarding empirical findings. The work was useful in that it did compare and contrast differing approaches among neighboring economies on the issue. Further research could focus on the outcomes of differing strategies utilizing empirical and original research. This work is similar to many

I have read on the topic in its emphasis on regulatory stances regarding initial coin offerings among national governments, especially in East Asia.

Similar to Lai (2018), Kim (2018) presented an overview of the South Korean landscape regarding blockchain technology, cryptocurrencies, and initial coin offerings. According to the author, South Korea is an international epicenter in the emergent field, only eclipsed in size by the United States and Japan. The country hosts the home of the Ether exchange, one of the largest cryptocurrencies in the world currently. While the field in South Korea is highly populated with small-cap investors and entrepreneurs, many large-scale corporations in the country are also involving themselves in the arena with significant investments in the field. These companies include well known names like Samsung. South Korea is establishing itself as a leader in the emerging field. South Korean authorities are seeking to tighten regulations in the field, even banning the use of ICOs as means of raising startup capital. Following similar actions by China, this step clearly demarcates South Korea from cryptocurrency friendly Asian centers like Hong Kong and Singapore. The author sought to explain why South Korean regulators made this decision, given its likely outcome of alienating international capital and reducing financial competitiveness. The author noted that, while the desire to reduce corruption and scams contributed to the decision, South Korean regulators are also very wary of North Korean cyber attacks, which have been frequent in recent years. Further research could benefit from focusing on the financial ramifications of this decision over the next few years.

In some cases, Asian governments themselves have articulated their regulatory stances. For instance, Lan (2017) presented a quasi official statement from on behalf of the Chinese government regarding its recent decision to tighten regulations on cryptocurrencies, including a wholesale ban on initial coin offerings. While the author noted the exponential growth rates that cryptocurrency markets had enjoyed, they framed this rapid development as unsustainable and rife with corruption. They noted several cases of fraud. They positioned cryptocurrencies and associated exchanges as a dangerous alternative to the established currency and securities markets in China, which they argued offered a much safer, better regulated, and more efficient space for investors. They refuted the legality of cryptocurrencies in China altogether, as many investors and entrepreneurs alleged that the ICO violated. They argued that Chinese law only accounted for the renminbi as the official national currency, and all others represented unsanctioned and illegal units of exchange, including cryptocurrencies. The article is limited in that the author is acting as a representative of the Chinese government on the issue, and they therefore harbor a bias on the issue. The article does represent a valuable resource as a quasi-official statement from the government to the business community on the issue. Likewise, the work compliments the work of Kim (2018) who wrote about the South Korean government's decision to pursue similar regulations.

Seeking to focus on another crypto power center in both Europe and Asia, Zharova and Lloyd (2018) offered a focused discussion on the status of cryptocurrencies specifically in Russia. The authors began by launching into a philosophical evaluation of the nature of money from an economic standpoint, along with the notion of legal tenders,

starting from the 18th century onward. The authors then honed their discussion on the rise of cryptocurrencies and their ongoing place in the Russian monetary system. The tendency from the Kremlin has been one of caution and suspicion. The Putin led government has (while voicing concern for the emerging assets) slowly enacted measures to rein it in to the broader monetary system, particularly through the use of sandbox systems whereby entrepreneurs and regulators work together during the asset development process to identify and head off risks before they become manifest.

Littlewood (2018) elaborated on the regulatory policy that Singapore has adopted in response to blockchain and other distributed ledger technologies. According to the author, Singapore is emerging as an international epicenter for the emerging industry, largely because of the public/private partnership that has arisen there whereby the government is actively collaborating with for-profit ventures in the development of innovative tech solutions. As a companion piece to the article, *Global Finance* also offered a sidebar that discussed how bitcoin is gaining acceptance among Islamic Finance scholars, one of whom offered a qualified yet positive opinion of the cryptocurrency. Littlewood's contribution provided an interesting contrast to that of Tashea (2018) who outlined other governments that are moving to ban blockchain technology (notably China and South Korea internationally and New York state domestically) versus those who are embracing it (i.e., Switzerland, Cayman Islands, Hong Kong, Israel, Singapore, and the Emirates). The work was limited in that its conclusions were based on surface-level interviews and generalized assumptions. Future research could benefit from an in-depth exploration of blockchain regulation, coupled with an exhaustive attempt to better

understand the outcomes (either intended or otherwise) of regulatory attempts. Littlewood's contribution was valuable in deepening the overall mosaic of national policy regarding the rapid, expansive, and transformative nature of distributed ledger technologies like blockchain. The article also outlined new diversification schemes around the topic like 108 Token that represents an aggregate basket index of 108 blockchain based investment vehicles specifically made for buy-and-hold investors who are interested in but not deeply informed on crowdfunded markets.

Many national governments have enacted strict regulations on blockchain technologies, cryptocurrencies, and especially ICOs. The Chinese government has adopted a strict regulatory environment concerning cryptocurrencies, along banning ICOs despite their large and growing market presence. South Korea has implemented similar regulations albeit with much laxer measures. Nations and autonomous municipalities with a history of permissive financial regulations like Singapore, Switzerland, and many Caribbean Island nations have positioned themselves as safe havens for crypto storage, trading, and innovation. Many Western governments have sought to balance market dynamics and regulatory stability via the sandbox model, whereby crypto markets may exist and innovate provided certain conditions. The overall emphasis within the literature concerning international regulations of ICO and crypto markets tends to focus on the current or future implications on affected markets and the likely impact of those implications on investment communities.

Industry and Market Concerns

A large section of the literature is dedicated to industry and market risks regarding the new technology and associated practices. Lee (2017) offered a critical analysis of initial coin offerings specifically and cryptocurrencies generally. The author began with an explanation of what ICOs are, followed by an overview on the exponential growth rates of crypto markets. Lee was skeptical of the trend and predicted that a bubble similar to the Dot Com Bubble is forming in the cryptocurrency arena, fueled largely by investor desire to capitalize on the early phase of a next generation in fintech. Lee did not conduct original research on the topic, relying instead on available public data and interviews to construct a commentary. The work was limited in its depth and findings, coupled with its openly opinionated stance, which was negative overall. The work is also useful and insightful, particularly in its observation that ICOs differ from IPOs not only in the nature of their offerings (i.e., cryptocurrencies versus equity stocks) but also in their likely stage in the entrepreneurial lifecycle. IPOs by regulation must occur later in the lifecycle after the company has established a revenue stream and possibly even profitability. The often cash-free nature of ICOs favors startups that do not have adequate funds to compensate investors with dividends, have not established revenue streams, and are initially seeking to build out operational infrastructure prior to the beginning of business activity with the public. It is not appropriate to apply equal expectations from ICOs with IPOs. The author offered a valuable contribution and provided a pessimistic perspective on the subject.

Not all authors shared Lee's (2017) cautionary narrative. Specifically, Shin (2017) wrote about the exponential growth rates of initial coin offerings, coupled with

examples from specific companies that have utilized the procedure to raise startup capital. The author discussed how many entrepreneurs are harnessing Etherium, which provides additional services through smart contracts for holders of its currency ether, thus allowing many startups to write functional code based on the foundational platform. The author speculated that this new phase in blockchain technology is opening up possibilities that exist well beyond the speculation and trading that dominates investments in bitcoin and earlier cryptocurrencies. Ether and similar technologies provide the ability for startups to not only fund projects but also manage their operations. While acknowledging the opportunities for quality ideas to evolve into established companies, the author also noted several ways that investors may suffer fraud and speculative losses, which are akin in structure to the Dot Com bubble of the 1990s. This article was valuable in framing the opportunities and threats of the ICO arena, while also placing it in context of the regulatory environment, which is ill-suited to manage it. It should be read in conjunction with those previously discussed previously.

Shin's (2017) comparison of the financial bubble of the 1990s to cryptos today is a common theme in the literature. Steele (2018) compared the rise of bitcoin investing and its inherently volatile nature to the beanie baby bubble of the 1990s. They noted similarities in marketing between both assets, including overblown TV personalities, unrealistic expectations, profile pieces on highly successful and youthful investors, and tragic stories of those who lost nearly everything in those respective arenas. Steele took care to differentiate between blockchain technology and cryptocurrencies generally from their critique, instead focusing on the unscrupulous marketing tactics employed by TV

personalities and advertisers who prey on the ignorance, desperation, and aspirations of uninformed investors, most of whom are in precarious financial straights from the beginning. Their argument was similar in a broad sense to that of Lichfield (2018). Steele's conceptual worldview was valuable in formulating a research framework, particularly among qualitative researchers.

Similar to the beanie babies comparison, Mentzer and Gough (2018) analyzed the effect that the advent and application of the ether-based digital game Cryptokitties has had on the Ethereum blockchain network. Debuting in late November of 2017, the online game crypto kitties enjoyed exponential adoption rates which propelled the ether cryptocurrency within digital asset marketplaces, second only to Bitcoin. The authors started to ascertain whether rapid adoption rates of the game resulted in slower processing times within the Ethereum network. Two primary considerations that the authors examined were in weather the games adoption rate allowed the Ethereum network to onboard new participants and whether the game could be used as in as an educational platform to educate students about crypto currencies. The authors provided a valuable addition to the literature, insofar as they utilized network analysis as a basis for their primary research.

Choosing to focus on an individual company and its relation to market risks, McDowell (2018) reported on speculative financial troubles concerning blockchain based firm R3. McDowell conveys a rebuttal by R3 CEO David Rutter who attested those recent assertions by their former employees regarding the organization's financial position were false. The former employees alleged that R3 could face insolvency as early

as 2019, despite receiving recent and substantial support from its external partners. According to Rutter, these statements were not true, and he seconded that the firm had just received $120 million from some 45 partners while also enjoying $20 million of annual revenue. McDowell further explained the nature of R3, which is a consortium created in 2014 by nine large banks with a stated mission of integrating blockchain technology into capital markets. The consortium has been controversial, as many of its founding firms have opted out of the alliance while other market players have signed on.

In relation to many of the polarized opinions discussed previously, Lichfield (2018) provided a nuanced discussion about the rise of initial coin offerings, focusing largely on their negative aspects coupled with improved alternatives for the future. The author did not assert that ICOs are inherently harmful or dangerous. Lichfield did argue that ICOs could be beneficial if they are marketed to accredited investors (i.e., those whose aggregate wealth allow for safety via high-risk ventures) while incorporating contracts between investors and entrepreneurs. The author argued that many ICOs do not employ safety precautions, instead often relying on capital from small-cap investors who cannot suffer high risk ventures but who engage in this activity based on unrealistic expectations and already desperate financial positions. The author proposed that ICOs could under ideal circumstances be reformed and renamed into IPOs with a similar structure that IPOs had in the 19th and early 20th centuries whereby small regional businesses could seek capital influx from prospective shareholders who harbored realistic interests in those businesses. They harkened back to the early days of the NYSE before entrance into the exchange was limited only to well-established, large cap firms. They

also called for the removal of token or coin as definitions, instead arguing that ICOs should provide ownership in the venture by investors, rather than merely access to the prospective network. The article was valuable as effectively a Q&A opinion piece by a resident expert in the field, but it was limited insofar as the concepts presented were basically the educated opinions of a subject matter expert. While not scientific in the strict sense, future researchers could incorporate the article into their future investigative pursuits.

The consensus among scholars is that ICOs specifically and blockchain based crypto markets pose heightened volatility risks. Many argued that the explosive growth of crypto markets derives not from true economic value but, rather, primarily through speculation and market mania. A common theme in the literature has been comparisons to the Dot.com bubble of the early 2000s in relation to crypto markets today. Most scholars aligning to this school of thought have asserted the need for greater regulatory scrutiny within crypto markets, while simultaneously warning investors to avoid crypto marketplaces. A major concern among industries and markets is the use, ease, and acceptance of blockchain transactions, which Grover et al. (2019) addressed.

In contrast to McDowell's (2018) focus on an individual company, Yacik (2017) took an industry approach and highlighted recent warnings by the Office of the Comptroller of the Currency toward perils associated with onboarding of fintech by banks. Because of the exponential growth of financial technology, many banks are either onboarding solutions internally or partnering with external fintech providers to remain competitive. The Comptroller issued its concerns that doing so could increase banking

sector volatility. The author also highlighted recent fintech trends in the banking industry including use of biometric data from fingerprints and eyeballs for customer recognition, corporate credit cards to cover employee reimbursable expenses, and digital currencies like those raised via ICOs. The author discussed how regulators are requiring disclosure of banking culture to assure corporate risk reduction. Although somewhat disjointed in format, the article provided a useful overview of fintech and regulation trends in the banking industry.

Crime and Corruption Concerns

Other authors have focused on crime and corruption risks associated with ICOs and blockchains. Weaver (2018) presented in this article a very scathing critique of cryptocurrencies based on four primary criteria. The author addressed the market from a technological standpoint, followed secondly by economic risks. Third, the author cautioned against the risks inherent to the cryptocurrency ecosystem. Finally, Weaver discussed societal risks. The article was limited in that it lacked balance, only focusing on negative factors. Many of the points that author made were intuitive and worth future investigation. Weaver did not conduct any original research in this piece, instead relying on educated conjecture, as has been a very common pattern in the literature regarding this subject. The piece is valuable, but it should be paired with other sources to provide a more balanced perspective on the overall market.

Similar to Weaver (2018), Higbee (2018) provided an analysis of three primary cybercrime threats that are both on the rise and rely on cryptocurrencies to function. Higbee addressed mining application attacks, just as Caldwell (2018) did. The author

mentioned the common utilization of the Coinhive application to carry out these attacks. Because both writers are colleagues as the same publication, this similar dialogue is aligned with the mission and focus of their journal. Higbee also discussed ransomware attacks. Hackers will beguile targets to infect their IT systems or personal devices with infectious viruses that will halt or inhibit their operational capabilities. The hackers will engage the targets into negotiations to free their electronic assets in exchange for cryptocurrencies, which may be transferred and traded anonymously. Due to the volatile nature of digital tokens, the hackers often must directly negotiate to ensure they are reaping sufficient rewards to justify the effort of their attacks. The author addressed phishing attacks. These resembled the former discussion in which hackers force targets to unwittingly engage in mining operations on their behalf, typically mining for Monero tokens (which can be mined on basic computer systems) utilizing Coinhive. The hackers rely on phishing schemes to capture target login information so they can hijack their IT assets.

Rotundu (2022) discussed the benefits, risks, and threats of blockchain, while Benedetti et al. (2021) evaluated blockchain and corporate fraud. Teichmann and Falker (2021) assessed cryptocurrencies and financial crime, and Dumchikov (2022) explored digital currency and economic crime. Tarabay (2021) reported that Google sued two Russians for an alleged crime scheme, while Meyerowitz (2021) reported that three North Koreans were charged in an alleged scheme to commit cyberattacks and financial crimes across the globe. In this context, Ramanan and Gebraeel (2022) evaluated blockchain based decentralized replay attack detection for large scale power systems, and Grech et

al. (2020) provided critical analysis of smart contracts. Despite efforts by law enforcement, Kim (2022) asserted that crypto crimes have hit record highs, and Redmond et al. (2022) discussed the rise of crypto private investigations.

Sigler (2018) likewise provided an expose on cyber attacks that rely on cryptocurrency. The content in their article was very similar to that of both Higbee (2018) and Caldwell (2018), particularly given the fact that Sigler also focused on attacks that force targets to mine on behalf of hackers. Sigler did provide original content by explaining in detail how hackers achieve their objectives through infection of either malware or, as is increasingly popular, Java Script into web site code. Web sites mine as long as their browsers are open. Hackers can maximize their profits by employing watering hole attacks against influential web sites that stream content for long periods of time to large networks of users, thus infecting the entire information web. Sigler then concluded by explaining how these attacks are harmful to targets and ways that individual and organizations may mitigate the dangers. Sigler's, Weaver's (2018), and Higbee's (2018) alarmist views regarding crypto markets are not the only perspectives in the literature, which also includes sanguine views.

Benefits and Opportunities

The literature also includes work focused on the benefits and opportunities of ICOs and crypto networks, along with potentials for blockchain technology in general. For example, Gale (2018) provided a profile piece regarding a new entrant into the initial coin offering sector. Named Equi after the Ethereum-based digital assets that the firm will issue, Equi combines characteristics of equity crowdfunding markets and venture

capital firms. The firm's advisory council will select between 10 to 15 startups to receive capital injection. Successful applicants, according to the firm's founders, should exhibit high growth potential and hail from the technology sectors. The firm differs from other private equity firms in that it will accept capital injection not only from accredited investors but, also, from small cap investors. It combines a venture capital governance structure with a crowdfunding capital base. Gale provided a useful contribution to the literature here by highlighting a novel approach in the initial coin offering realm, which hybridizes traditional and emergent forms of capital markets.

Casey and Vigna (2018) provided a compelling argument toward the likely future benefits of blockchain technology, particularly regarding its ability to revolutionize the financial sector. While acknowledging that a bubble is almost surely forming similar to the Dot Com Bubble, the authors countered that the unsustainable exuberance that cause so much disruption in the late 1990s allowed for the creation of an information infrastructure that has fueled economic growth and development throughout the 2000s. While that infrastructure was largely based on physical technology like coils and servers, the authors argued that the blockchain bubble is creating a societal infrastructure based on open-source knowledge creation. The authors presented a summary of dual-entry ledger history, which began in the 14th century and contributed to the Renaissance and later the Industrial Revolution. Casey and Vigna affirmed that the ongoing development of distributed ledger systems may replace the dual-entry ledger system and allow for the emergence of a new wave of innovation across several industries, particularly in the financial arena. Their central point was that ledger systems, although banal and often

overlooked, are key drivers of human innovation and progress. While the authors did make interesting assertions and observations, they did not support their arguments with original research, which has been a common pattern in many blockchain-related resources. Likewise, the piece was somewhat limited insofar as the comments were very general. Future research could benefit by conducting original research focused on a specific industry, time, place, etc. Casey and Vigna have provided a valuable contribution to the literature.

Lewis et al. (2017) also provided a useful overview regarding blockchain application in the financial sector. The authors began with an explanation of distributed ledger systems, which they supplemented with explanatory graphics. They compared and contrasted how distributed ledgers offer improvements compared to traditional relational databases. They also provided an explanation regarding the similarities and differences of permissionless distributed ledgers versus networks that do require permission to utilize, and they discussed under what conditions one version may be preferable to another. They then offered a discussion on the potential applications and benefits of blockchain technology in the financial area, followed by their drawbacks or challenges. Applications and benefits included how blockchain technology allows for the digitalization of assets, digital record keeping, smart contracts, reduction in post trade settlement time, and faster payments. Regarding challenges, the authors divided them up into two groups: technological/business and regulatory. The first group included difficulties in achieving consensus, standardization, interoperability, scalability, efficiency, immutability, legal uncertainty, security, liquidity, privacy and intellectual property. Regarding regulations,

the authors asserted challenges related to uncertainty and currency control. In many cases, the listed challenges were also benefits that posed additional considerations. The paper relied less on original research and more on the educated opinions of the authors. Much of the existential literature is limited in that regard. Future research could benefit by seeking to discover or reject scientific validity of the previously mentioned ideas.

Whereas Casey and Vigna (2018) historical viewpoint, Orcutt (2017) wrote specifically about a new initiative in Finland that utilizes blockchain technology to manage the ongoing refugee crisis. Because most refugees lack identifiable documents like IDs or passports, it is very difficult if not impossible for them to open traditional checking or savings accounts, let alone qualify for credit lines. Orcutt discussed a financial vehicle that is very similar to a MasterCard in look and functionality, but it relies on a distributed ledger network to run operations. The users do not need to furbish identifiable information to gain access to the asset, as the card links to the user via a unique identifier number. According to the author, this would allow refugees to start over in Finland, as they would be able to establish a financial background in their new home. This article was very interesting from a developmental finance perspective in that is showcased how blockchain technology may be harnessed to address global demographic challenges while also extending opportunities to disadvantaged persons. The article was limited in that it was describing new technology that had not yet been tested; thus, future research should focus on the real-world applicability and results of the program.

Similar to the emphasis that Orcutt (2017) placed on potential refugee benefits from blockchains, Guillermo (2017) conducted research into the behaviors and

characteristics of unbanked persons with the intent to identify pertinent factors that blockchain developers may utilize when creating technology solution to serve that population. The author relied on fuzzy-set qualitative comparative analysis to find five sensitivities of the unbanked population, it now estimated at 2 billion persons worldwide. The author postulated that blockchain does pose a positive potential in providing financial services to marginalized people due to the major roles of nonmonetary factors and informal financial practices on the lives of the financially excluded. Guillermo argued that the decentralized and anonymous nature of blockchain distributed ledger systems may better serve these populations, as centralized bureaucracies and identifiable prerequisites in formal banking institutions likely bar excluded persons from participating in them. The author provided a valuable contribution to the literature, particularly regarding this issue, which is a much anticipated and discussed potential benefit of distributed ledger systems and the global poor.

The potential for blockchain and crypto technologies to benefit people vulnerable to climate change and natural disasters is also a theme in the literature. del Castillo (2018) described the emergence of an ether based insurance market forming during the prelude of Hurricane Florence. The author began by explaining the current structure of traditional insurance markets, which rely on overlapping and often redundant layers of intermediaries whose collective functions are to verify and re-verify the authenticity of claimant information prior to a potential payout. Because these processes are slow and costly, an emergent industry has formed that relies on Ethereum supported smart contracts and the universally verifiable nature of blockchain transactions. Claims are

subject immediate recording and timely verification based on trusted third-party information provision, like satellite maps and publicly available weather conditions in affected areas. Hence, the author explained a concrete example of how blockchain and cryptocurrencies may revamp traditional industries for the better.

In contrast to Casey and Vigna (2018) historical viewpoint, Harnett (2018) provided an argument for why firms in the financial services sector should embrace next-gen learning platforms in anticipation of industry disruptions by emergent fintech. The author began with a historical example of how ATMs disrupted retail banking, even as the number of tellers increased via the demand for new skills that ATMs could not provide. The author pivoted to the contemporary landscape and alluded to the myriad emergent fintech innovations widely assumed to disrupt the industry, including AI, blockchain, and others. Harnett argued that financial services employees can stay competitive in the industry via next-gen learning platforms that provide multimedia tools, video, and adaptive learning paths, which are often available via multiple channels via mobile technology. Harnett asserted that organizations could recruit, develop, and retain talent, thus staying competitive despite ongoing industry disruption by adopting these platforms, along with implementing innovative onboarding techniques like preboarding to train recruits prior to their arrival.

The predominant theme among scholars focuses on the anticipated capacity of ICOs and crypto markets to provide capital and liquidity to marginalized communities. Many have argued that ICOs may provide a better avenue for minority-owned startups and financially oppressed entrepreneurs toward acquiring needed capital injections to

form and launch innovative ventures. Scholars have put forward similar arguments regarding crowdfunded equity markets, including those that rely on fiat currencies as well as cryptocurrencies. Others focused on the ability of blockchain networks to host decentralized cryptocurrency markets, which may be more accessible for unbanked persons than traditional financial institutions.

Pandey (2020) asserted why blockchain is needed, while Bollaert et al. (2021) discussed fintech's potential to expand access to finance. Barreto et al. (2019) postulated the opportunities for cryptocurrencies and blockchain in tourism as a strategy to reduce poverty. Boulianne and Fortin (2020) balanced the risks and benefits of ICOs.

Emerging Trends

Because of their rapidly evolving nature, ICOs and associated blockchains and cryptocurrencies are a frequent topic of emergent trends across industry and the economy. Obukhova (2020) discussed ICO financing for high tech projects, while Chow and Zorthian (2021) assessed NFTs and the rise of crypto art. Kshetri (2019) evaluated the evolution of formal ICO institutions, and Yu et al. (2022) assessed blockchain based control on design of secure and real-time techniques. Li et al. (2019) explored a blockchain based decentralized framework for crowdsourcing, and Yeh et al. (2020) discussed a privacy preserving DDoS data exchange service over SOC consortium blockchain.

Alvarez and Tashea (2018) showcased the 2018 ABA Techshow and its emphasis on technology implications in the legal profession. The authors wrote about the recent contents of the ABA Techshow of 2018, which is an annual expo hosted by the American

Board Association. According to the authors, the agenda of the event showcased emerging technology trends and how they will likely affect practitioners in the legal industry, which was a departure from traditional areas of interest in prior events. Alvarez and Tashea noted that the primary focus in 2018 was on blockchain technology, the Internet of things (IoT), artificial intelligence, and virtual reality. While each area of technology is expected to bring change to the legal sector, the authors' observations were important in that they also noted the potential confluence of technologies to work together as a transformative force. This is a primary theme among other authors discussed in this paper, particularly those who note that the decentralized nature and complimentary characteristics of these technologies will likely allow for considerable synergy moving forward. The article was somewhat limited in its depth, as the authors covered the event from a reporting standpoint, often relying on direct quotes and paraphrasing of participants, rather than on direct research findings. This is a common theme among blockchain-related resources, as the emerging nature of the technology is often evolving faster than researchers can anticipate and respond to, thus forcing surface-level coverage of salient industry issues, often relying on conjecture and intuition rather than empirical findings. Future researchers can provide a significant contribution in the field by devising a study design that is both timely and focused on original findings via research.

Pănescu and Manta (2018) examined smart contracts pertinent to research data rights management regarding Ethereum blockchain networks. Pănescu and Manta constructed an interesting analysis regarding the potential for smart contracts, a key component of blockchain technology, regarding their application and enforcement of

reuse rights of research data. Data derived from primary inquiry is of value, both monetary and otherwise, and many authors and institutions limit access to data via the use of subscriptions and other means. Pãnescu and Manta analyzed the potential for smart contracts to verify and enforce agreements via the Ethereum blockchain network. Blockchain networks and smart contracts provide added efficiency in these agreements based on their ability to create a permanent and transparent record of transactions, which is more granular than alternative methods. The authors then honed their inquiry by focusing on the Solidity smart contract language, which runs on the Ethereum network. Pãnescu and Manta offered a valuable contribution to the literature by assessing a specific and salient set of concerns, which have heretofore not been analyzed.

Sun (2018) focused on crypto currency innovation in China. Sun discussed the unexpected ramifications of the recent ban on initial coin offerings by the Chinese government. The article is a valuable follow up piece to that of Lan (2018). Rather than resulting in a wholesales halt of cryptocurrency trading in the country, Sun described how entrepreneurs have leveraged various creative responses to circumvent the ban, thus arguably strengthening the market and mitigating the problems in ICO markets those Chinese officials had cited as justifications for the ban. Many entrepreneurs have utilized open-source technology and multilateral frameworks to work around the national regulatory framework, thus increasing transparency, system robustness, and asset fluidity. Sun highlighted how the ban actually hurt many Chinese investors who were forced to sell their cryptocurrency assets at greatly reduced prices following the ban, or even lost their portfolios entirely after it. The author provided a valuable follow up and balancing

perspective to the prior on the topic. Future researchers and policy makers in the West could benefit by incorporating these insights prior to recommending or implementing any similar policies, respectively.

Similar to Alvarez and Tashea (2018) industry specific focus, Crosman (2018) explored technology disruption implication in the banking sector. Crosman, a leading technology writer in the fintech arena, offered an expose on the potential benefits to the financial sector of three emergent solutions: quantum computing, blockchain, and artificial intelligence. Regarding quantum computing, the author provided a brief explanation of the technology dynamics and potentials, followed by a discussion on potential applications. From a fintech standpoint, these mostly focused on how banks and wealth management firms may optimize portfolio returns and risk/reward assessments like Monte Carlo analysis. Regarding blockchain, Crosman highlighted the heightened security potential provided by an immutable, verifiable, and instantaneous network. The author touted the benefits of AI from a wealth management perspective, as it can potentially allow portfolio managers to customize communications to their clients despite the seemingly overwhelming nature of big data. The author's primary point was that emergent fintech could assist the banking and wealth management community, rather than threaten its existence as others have postulated.

Crosman (2018) also wrote about the emergent partnership between banks and fintech companies providing quantum computing solutions. JPMorgan Chase and Barclay's have signed on to the IBM Q network, which allows them to test quantum applications in their own industries. The primary quantum solutions that banks are

interested in focus on portfolio optimization and scenario simulation like Monte Carlo analysis, given the massive amount of data and computation power that institutional investors and bankers require in these regards. Quantum computing could be partnered with AI, blockchain, and other emergent technology solutions. The interest of banks in quantum computing is similar to the role they played in blockchain development insofar as they are legitimizing functions, funding research, guiding inquiry, and encouraging infrastructure rollout. This article is similar to others in that the author highlighted how emergent technologies (mainly blockchain, IoT, artificial intelligence, quantum computing, and augmented reality) may interface with each other, especially as they are accepted by mainstream firms.

Essen (2017) looked beyond banking and focused to focus on the broader economy and conducted a Delpli study on potential blockchain applications in business and management. Essen asserted the disruptive nature of blockchain innovations to a host of industries, along with affirming that a knowledge gap exists regarding blockchain techniques, and this frustrates both academic inquiry and managerial application. According to the author, this hingers managers from both recognizing looming disruptions and performance improvement opportunities. The author employed a two-round Delphi study methodology to assess the expert opinions of business management scholars and expert practitioners in the ways they expected blockchain technology to change the future of business. They found high scores from both rounds regarding the effects that blockchain technology will have on the transfer of bonds, deeds, and stocks, particularly those currently relying on physical currency. The participants analyzed

myriad industries and forecasted material implications for many. The author provided a valuable contribution to the literature on the disruptive nature of blockchain and other emergent technologies, particularly via the addition of much-needed primary research on the topic. The authors acknowledged that the study was limited in its emphasis on managerial disciplines. The response rates of the participants were low, thus limiting the sample size. They speculated that lack of understanding of blockchain technology may have reduced response rates and even insights from those who did respond. They recommended that future studies should include participants from both the business management sphere and also the computer sciences realm, the latter assumedly possessing a greater understanding of the topic than the former, on average.

Conversely, Dibrova (2016) focused even more broadly than Essen (2017) and assessed the impacts of virtual currency in monetary development. Dibrova conducted a survey and discussion on the rise of cryptocurrencies from the vantage point of the larger monetary system. The author initiated with an historical analysis on money as an economic concept, which has grown and evolved since its modern emergence and theoretical underpinnings beginning in the 18th century. The author addressed the radical nature of crypto currencies, which differ from traditional monies in many ways, including lack of a central authority and a completely new technological infrastructure relying on distributed ledger systems. The author conducted a survey of general regulations across numerous countries, mostly focusing on China, Western Europe, and Eastern Europe. Hence, the author found that Russia was most strict among the survey countries, whereas China had targeted restrictions in place, and most other European countries had no

regulations or prohibitions. The author also tabulated prevailing Bitcoin prices between January 2013 and October 2015 to find significant volatility and overall exponential growth. The author found that cryptocurrencies pose both opportunities and dangers, and they possess long term survivability and potential. The author cautioned that governments should move to regulate them first.

Technological and Scholarly Analysis

Many authors have focused on in-depth technical analysis of ICOs and blockchain technology. For example, Kugler (2018) discussed the problematic energy needs of cryptocurrencies. Kugler provided a concise explanation for the energy expenditure problems that cryptocurrencies suffer, coupled with a few alternatives to reduce consumption rates. According to the author, the proof of work mining activities that allow cryptocurrency generation are inherently unsustainable from an environmental standpoint, their aggregate operations expending more energy in 1 year than the nation of Serbia. This is because the number of bitcoins is fixed to expand by one unit every 10 seconds, but the number of miners increases as the price of the currency appreciates due to profit-seeking behavior. The numeric puzzles needed to prove work become harder, therefore mitigating the industry influx but then also requiring more computing power to sustain operations. This pattern is compounded because other cryptocurrencies also utilize proof of work requirements to support monetary supply expansion and transaction verification. The problem represents a reinforcing feedback loop that may worsen exponentially over time. Some cryptocurrency providers have chosen more sustainable technologies. For example, Ethereum miners utilize GPU units unlike the ASIC units

used to mine bitcoin. Ripple and others have chosen not to require proof of work altogether, instead choosing more centralized designs like proof of stake. The author acknowledged that no true solution exists to solving the energy exhaustion issue without fundamentally altering the key characteristics of cryptocurrencies and, therefore, undermining their support. This article is useful insofar as it provided a good explanation to the energy problem, which is often referenced in related sources. The work is limited in its scope, the authors having wrote the piece to be brief and understandable to a lay audience. Future researchers could focus on either the technical aspects of the mining-related energy consumption process or finding possible solutions toward reducing energy consumption.

Like the emphasis that Kugler (2018) placed on blockchain energy needs, Liang and Zeng (2018) provided an empirical study regarding cryptocurrency transaction networks. Drawing on network theory, the authors studied the changing characteristics of three large blockchains over time: Bitcoin, Ethereum, and Namecoin. Despite patterns of other networks, the three prior mentioned did not increase in density over time, and they all exhibited constant changes with low node and edge repetition. They found that the power-law distribution as not effective in predicting network evolution behavior. The authors designed their study to utilize network construction analysis on a monthly basis. The authors found that the three networks exhibited high evolutionary tendencies and competitive power, and they asserted the need for future research in the field. This article is valuable insofar as its content provides an often-mentioned issue in blockchain technology sources, namely that they rely most heavily on conjecture and educated

opinion rather than primary research. The authors have provided a true research study utilizing a design, method, methodology, and framework appropriate for emergent technology. Future researchers could harness this starting point and continue investigating the topic, perhaps expanding on this initial inquiry.

Focusing on a very technical and scholarly viewpoint, Phillips and Gorse (2018) reassessed wavelet coherence analysis as a cryptocurrency price driver. The authors sought to identify any potential relationship between cryptocurrency price volatility and social media content. Seeking to understand the very volatile nature of cryptocurrency pricing markets, which often exhibit market bubbles, the author attempted to identify whether social media attention to markets via social media postings were correlated to market swings. The author conducted original research utilizing wavelet coherence measures to assess any potential medium-term positive correlations between the two factors. Philips ascertained that a relationship does exist, but it is moderated by market regime conditions, which necessitate the propensity for speculative bubbles in the cryptocurrency markets. The author also found short term correlations based on salient issues of the times, like largescale and publicized cyber security breaches. This article is valuable in that the author conducted new and informative primary research in a field that is currently lacking these findings.

Dos Santos (2017) also focused on scholarly theory and crypto markets. They examined whether bitcoin and blockchain technology could be considered a chaotic and complex system. The author framed this discussion via an ontological perspective evaluated blockchain technology and related markets from a comprehensive perspective,

considering its primary stakeholders and processes. The author evaluated the Information Theory of Complex Systems under the backdrop of blockchain technology. Dos Santos' work was valuable from at least two perspectives. The literature currently suffers a dearth of literature when considering blockchain technology from a purely theoretical or ontological perspective, as most authors choose to focus on purely practical applications or legal/regulatory considerations. The author contributed to the science and research of the field. The author also focused on the very salient concern that, if blockchain represents a complex and chaotic system, the networks may suffer from a 2010 Flash Crash style of crisis. The author conducted original research utilizing the Crutchfield's Statistical Complexity measure, therefore assessing that blockchain networks are sufficiently algorithmically complicated, but not complex and therefore not susceptible to the prior mentioned phenomenon.

Xing et al. (2018) explored internet number resource authority and BGP security solutions. Xing et al. discussed the inherent security flaws associated with Border Gateway Protocol (BGP). BGP is vulnerable to prefix and sub prefix hijacks and similar hacks, particularly when attacks originate from a central authority. The authors recommended utilization of an Ethereum-based smart contract system that would be inherently resistant to attacks based on the immutable and transparent nature of its design. The authors proposed the design and utilization of the so-called BGPcoin. They tested this early-stage digital asset via auditing procedures via extensive experimentation. This article is useful insofar as the authors focused their inquiry on BGP, which had not been the topic of much interest in the blockchain debate. The authors relied on experimentation

and synthesis, therefore, rendering a more-scientific perspective on the topic than had previously existed.

Woodside et al. (2017) studied technology adoption statuses and strategies for blockchain technologies. The authors conducted a primary research study on blockchain technology across a myriad of industries. Starting with a comprehensive literature analysis and background section, the authors expounded the specific nature, history, and mathematical theory behind distributed ledger technology. They assessed how this technology may disrupt numerous industries and in what potential ways. The authors conducted original research utilizing a mixed methods study that harnessed a triangulation method that included secondary data environmental, text, and financial analysis. The authors concluded that blockchain technology is currently positioned on the innovation stage of the innovation curve, but it is poised to move toward the diffusion and innovation phases. The technology is akin to the internet in the 1990s. The authors presented a deep, comprehensive, and rigorous study worthy of further review in while I conduct my own studies on the topic.

Dwyer (2015) examined the economics of private digital currencies. Dwyer provided an evaluation regarding the development of digital currencies like Bitcoin. The author began by explaining how recent breakthroughs utilizing distributed ledger technology and currency miners combine to prevent the double spending problem, which has long prevented tokens from retaining a positive value without the presence of a central banking system. The author then conducted an analysis of 24/7 computerized trading markets dealing in cryptocurrencies devoid of brokers or other similar trading

agents. Dwyer researched volatility rates in computerized digital token markets to find that they are on average higher than other relatively volatile commodity markets like gold or foreign currencies. That said, the author also found that the lowest monthly bitcoin volatility rates were lower than the highest gold and foreign currency market volatility rates. Dwyer's observations are valuable in the literature generally; specifically, findings were especially valuable for my own research.

Finally, Lo and Medda (2020) conducted an empirical study of Tokenomics, while Kher et al. (2021) assessed review and research on blockchain, bitcoins, and ICOs. Xu et al. (2019) provided a systemic review of blockchain.

Industry Impacts

Several scholars investigated the anticipated industry impacts of cryptocurrencies and blockchains. Zalatimo (2018) focused on the innovation and disruption of blockchain on publishing. Zalatimo began by providing historical examples of entrepreneurs who disrupted established industries because they embedded inefficiencies in widely adopted processes, and they created inventions that not only solved these problems but unseated the entire industrial order. These inventors included the creators of the printing press, the steam engine, the photograph, the computer, and the internet. The author then reported on a recent exposition that assembled a group of 50 executives and stakeholders from the publishing industry to hear from three entrepreneurs seeking to disrupt the industry. These startups included: Po.et, which focuses on content attribution, permission, and discovery; Amino Pay, a venture seeking to improve digital advertising supply chains; and Unlock, a new firm attempting to disrupt current paywalls and subscription

verification processes. The author did provide a valuable contribution to the literature, but the article did not include many details about the event itself (i.e., time, place, participants) nor did it contain much information about the actual discussion highlights.

In contrast to Zalatimo (2018) who focused on the publishing industry, Chavali et al. (2018) discussed blockchain effects on biotechnology, pharmacy, and life sciences. The authors explored the potential of integrating blockchain technology with life science/pharmaceutical applications. The authors discussed blockchain technology as a primary factor in the 4th industrial revolution, which is expected to fundamentally interface previously disparate realms like digital, physical, and biological processes. The authors discussed the opportunities and threats associated with multi sphere integration. They focused much attention on the possibilities of storing medical/pharmaceutical information on distributed ledger technology. The authors concluded that such an arrangement would create improvements in the affected industries. The article was valuable insofar as the authors explored yet another potential application of blockchain technology beyond merely hosting cryptocurrencies. The authors identified another sphere where initial coin offerings could be utilized and harnessed.

Conversely, Dupont (2017) explored the technology pertinent to notational services. Dupont explored the concept of blockchain technology as a notational technology. Stated otherwise, notation allows for the storage and verification of information that can be mutually referenced and agreed upon by multiple entities. Information is easily recorded, replicated, and verified by each block on the chain and stored on the node computational devices that support the network. The author argued

that blockchain technology represents an ideal candidate. The emphasis of this paper was to focus on the potential for blockchain networks to support abstract identities through the process of notation. This article was valuable within the existential literature because it highlighted how blockchain technology may enhance a given sector of information management.

Focusing more broadly than the industry analyses discussed previously, Fowler (2018) conjectured blockchain as a solution for benefit corporation certification. Fowler explored the potential of blockchain technology to assist in verification of company claims to the greater good. The author focused on public benefit corporations (PBC), which, while structured as for-profit entities, purport to promote positive social outcomes as part of their business operations and missions. PBCs have faced scrutiny from skeptical consumer and investor groups as being merely a label to attract business and capital while lacking any objective method to prove benevolent outcomes. Fowler proposed the utilization of blockchain networks as a verification methodology. Because blockchain bear the ability to store information in a transparent and immutable fashion, the author argued that PBCs could harness these networks as a justifiable verification system to their stakeholders regarding their ability to fulfill the altruistic objectives of their publicly espoused missions. Like the other articles discussed in this paper, the author created a valuable contribution by exploring how blockchain technology may be valuable outside of its currently used functions.

Pop et al. (2018) offered a specific conversation regarding impact on smart energy grids. The authors sought to ascertain it the value of blockchain networks utilizing smart

contracts to enforce regulations within smart energy grids. Within agreements, participants concur on energy usage production and consumption levels, which result in corresponding rewards and punishments. Those participants, whether firms or households, suffer financial fees if their pre-agreed consumption rates exceed those rations afforded to them; those participants who expend less energy enjoy financial benefits. Similar arrangements have often suffered due to lack of regulatory enforcement mechanisms, but the authors speculated that smart contracts running on blockchain technology could provide a needed regulatory arbiter, which could render smart energy grid agreements applicable. The authors provided the valuable contribution to the literature, particularly regarding the potential application of blockchain technology toward environmental processes.

DiNizo (2018) explored blockchain patent eligibility in a post CLS bank world. DiNizo explored whether blockchain technology is patent eligible under the current U.S. legal system. The author began by placing the importance of blockchain technology from a financial perspective insofar as the topic dominated the most recent World Economic Forum discussions while the blockchain industry has attracted billions of dollars even in its embryonic state. The intense interest in this this situation, according to the author, justifies a desire to protect blockchain related ideas via intellectual property law. The author began by discussing the intellectual property landscape via the landmark Supreme Court case Alice v. CLS Bank. DiNizo then discussed patent eligibility requirements as they pertain to software and business processes. The author considered the specific nature of blockchain technology from this perspective. DiNizo concluded that blockchain

technology should be eligible for protection under patent law, and the author discussed how attorneys should structure their arguments. This work was valuable insofar as it provides a lucid argument on a salient legal topic in blockchain technology. Future researchers should focus on how courts rule on this topic in the near term in relation to the arguments previously discussed.

Fenwick et al. (2017) examined blockchain impact in legal education. The authors assessed how emergent technology is disrupting the legal profession, particularly from a consulting standpoint. According to the authors, the legal profession is one of the most disrupted industries owing to the emergence of artificial intelligence and machine learning, coupled with big data. Their focus was mostly on blockchain, which they asserted as being the most significant disruptor to the practice. They justified this argument by considering how the sharing economy will nullify many of the fundamental assumptions embedded within legal thought, and they attested those legal practitioners must change their worldview to accommodate shifts. They suggested a change to the legal education system. This article was useful insofar as it complimented many of the other studies based around blockchain and its influence on the legal profession like the work of DiNizo (2018).

del Castillo (2018) discussed implications of Ethereum in commodities futures markets. This work compiled a collective commentary by a group of subject matter experts on the topic. These included those by Securities and Exchange Commission director William Hinman and the president of the Chicago Board of Exchange Chris Concannon. Both discussed the somewhat murky and mercurial regulatory commercial

and regulatory environment surrounding futures speculation of ether specifically and cryptocurrency generally. Future investigators could follow up on this work by conducting primary research on the futures markets surrounding ether and other cryptocurrencies to verify if the positions and expectations presented in this and the previous article were accurate.

Many scholars pointed to the decentralized nature of blockchain networks as a means of industry stakeholders to participate more freely, thus expanding collaboration opportunities in many industries and markets. Others posited that the transparency and immutability characteristics purported in distributed network systems may allow for improved authentication processes across multiple industries, along with improved crowdsources capacities across the economy. Still others focused more on the security characteristics of blockchain networks, often exploring how security could be improved following the introduction of these technologies as solutions to current industry vulnerabilities.

Despite the pervasive concerns pertaining to cryptocurrencies and associated blockchains, their potential to transform law enforcement is also a topic in the literature. Skelton (2022) discussed a possible overhaul of police tech, and Li et al. (2021) explored blockchain based lawful evidence management scheme for digital forensics. Kumar et al. (2021) provided a blockchain based digital forensics framework for IoT applications. Wang et al. (2020) described a blockchain based anonymous reporting scheme with anonymous rewarding. del Castillo (2019) reported on a search engine and law firm for Bitcoin crime.

The transformative potential of blockchain is a topic of discussion broadly. Li et al. (2019) postulated blockchain based fair and anonymous ad dissemination in vehicular networks, and Sharma et al. (2020) discussed a design of blockchain based precision healthcare using soft systems methodology. Aujla et al. (2020) assessed blockchain service for software defined networking in smart city applications.

Broad Topics of Interest

Other authors focused on general information specific to the technologies. Cennamo (2020) balanced decentralized versus proprietary blockchains on digital currency performance. Engle (2018) provided a contrarian opinion on blockchain technology, cryptocurrency, and bitcoins regarding their applicability to the financial sector. They argued that their continued challenges preclude any likely adoption by mainstream consumers and investors. According to Engle, a central problem of cryptocurrencies is that they must be mined to verify the validity of every transaction. Engle went further to attest that this prerequisite makes crypto currency inherently susceptible to criminal intentions. They noted that currency creation occurs at a rapid pace with very little oversight, which makes them attractive to drug dealers, money launderers, tax evaders, and even terrorists. They also countered blockchain proponents by asserting that built-in control mechanisms like public verifiability via hash coding can be overwritten by malware, which can result in identity theft. They also argued that governments are likely to continue eschewing cryptocurrency in favor of money that they can directly issue, control, and tax. The paper was limited insofar as its content relies mostly on the educated opinions of the author, rather than extensive research, either

primary or secondary. Future researchers could test Engle's assumptions via scientific inquiry. Indeed, doing so may assist in finding solutions to the many problems that the author underscored, thus contributing to positive social change.

Similar to Engle (2018), Beloussov (2016) attempted to mediate between the ongoing debate surrounding blockchain technology and its application potential. Blockchain proponents assert that these networks may be harnessed in an innumerable number of ways across seemingly endless industries, thus providing a viable solution to a great array of the earth's problems. Blockchain detractors systemically deny these claims with counter arguments. Currently, the technology is still too new for a definitive resolution, as it has not been applied to most cases. The author attempted to arbitrate the conflict via a moderated and nuanced discussion. Beloussov affirmed that many blockchain proponents are overly optimistic in their claims, which they largely fail to verify via empirical proof. The author also asserted that the central characteristics of blockchain technology position it as the currently best solution to many of the world's most pressing issues. The author did not see blockchain technology as a panacea for the world's many woes but, however, a potential paradigm shift in mitigating many of them.

Wilson (2016) also focused on blockchain application potential and provided background information regarding blockchain. Wilson provided a critical analysis of blockchain's application potential beyond Bitcoin and other cryptocurrencies. The author's primary skepticism rested on three overarching premises. Blockchain proponents have posited the technology to solve all manner of problems across myriad industries and applications. They have often only supported their assertions with hypotheticals rather

than proof of case examples. The author attributed this tendency to the same irrational exuberance that has accompanied many tech booms. The author asserted that, while blockchain applications can occur separate from bitcoin (or some other cryptocurrency) those same functions often require a digital monetary unit to support operations. Third, if organizations are to successfully adopt blockchain technology as part of their enterprise infrastructure, they would necessarily integrate them with centralized features. Permissioned networks are a primary example of this trend. The author asserted that centralized changes fundamentally undermine the decentralized foundations of blockchain technologies, thus rendering them meaningless. The author did provide legitimate challenges to blockchain viability. Those objections are not necessarily insurmountable or universal, as other sources have addressed and mitigated these claims. It is also possible that the article, written in 2016, was timely when written, but the rapid pace of development in the arena has already mollified these concerns in whole or in part.

Dudgeon and Malna (2018) provided an in-depth question-and-answer format surrounding distributed ledger technology. Their discussion began with very general remarks on what distributed ledgers are, how they may be both akin to or different from blockchains, how blockchains operate (including their use of hashes), how blockchains support bitcoins and other digital assets or infrastructures, the potential future uses of blockchain technology to include initial coin offerings (ICOs), corresponding challenges, what ICOs are and why they are gaining in popularity, how ICOs are (or are currently not) regulated, and the likely future of both ICOs specifically and blockchain generally. Dudgeon and Malna did not conduct original research in this paper. They listed a series

of common questions on the topic and provided concise yet informed answers to them, given the previous contributions of cited sources. Unlike Chen, the authors focused on both positive and negative aspects of their chosen topics, although their overall assessment was still generally optimistic. While somewhat elementary in depth, their commentary was very useful insofar as it provided valuable definitions to common yet often misunderstood terms. Their work was limited in that it only provides a survey-style understanding of a very complex and dynamic realm. The authors have also created a valuable contribution to the existing literature, particularly for scholars who are novices on the subject and who need a firm starting point prior to moving further in their investigations. Future areas of study could expand on the main issues addressed in this article to gain a deeper understanding of them individually, especially through the use of original research.

Unlike Dudgeon and Malna (2018) focus on the present, Extance (2015) explored the future of cryptocurrencies. Extance provided an overview of bitcoin specifically, and blockchain generally. The author focused on cryptocurrencies, particularly both bitcoin and ether. The emphasis of the piece was on discussing both the positive innovations and the ongoing challenges inherent to the technology. Extance dedicated the core of the article to explaining the mining process, which is crucial in verification of transactions, creation of new cryptocurrencies, and the prevention of the double-spending problem. The author credited cryptocurrencies with the creation of a monetary platform that is both anonymous, immutable, adaptive, and decentralized. The author focused on security, consolidation of power by mining pools, mining energy uses, criminal activity, etc. The

author also provided examples of potential solutions to address these issues. Extance offered a valuable contribution to the literature. The content was informative, particularly regarding issues that are not often covered in other resources.

Vigna (2016) discussed a controversial Ethereum update. Vigna reported and commented on a major action on the Ethereum network that occurred in 2016. Shortly before Vigna wrote the piece, practitioners created the Decentralized Autonomous Organization (DAO), which served as an Ethereum-based venture fund for startups, which peaked at an aggregate value of $155 million dollars just prior. Although the fund was designed to convene funds for entrepreneurial ventures, a bug in the code allowed for a copy-cat hacker to steal $60 million from the fund. The fund managers orchestrated a hard fork, therefore reversing all transactions during the timeframe of the heist and returning the fund to its previously unaltered state. Fund stakeholders were given a choice whether to accept the changes or not, and the vast majority did, therefore resulting in a retroactive state adoption. While this emergency maneuver allowed the fund managers to prevent the theft and return the imperiled capital to its rightful owners, many critics alleged that this action inherently violated the core principles of blockchain technology by allowing for a centralized authority to alter a P2P system that was supposedly immutable. This article was interesting insofar as it discussed a material event in blockchain history while also highlighting a primary set of concerns among its users, most notably the need for security versus transparency and decentralization.

Nott (2018) reported on the recent launch of a startup incubator in Melbourne, which will be the first in its state. Designed to onboard five ventures per year, program

participants will partake in regular workshops intended to help them understand their respective industries, potential needs, and ways that the technology may be able to meet them. On completion of the program, the startups will be offered the chance to pitch before investors in hopes of acquiring seed capital. Through brief and structured akin to a news article, Nott provides a valuable contribution to the literature in a few ways. First, the authored showed how adoption of the technology is taking place internationally, and in what ways various cities are seeking to insource market participants. From the perspective of initial coin offerings, the emergence of workshops may also affect the standard processes whereby entrepreneurs gain access to digital capital.

Similar to Nott's (2018) interest in a single entity, Reosti (2016) explored a collaboration between a crypto crowd funder and a bank. Reosti offered an expose on a new partnership between traditional banking and emergent crowdfunded equity markets. The author wrote about an arrangement between Fresno First Bank and Breakaway Funding. In this burgeoning arrangement, startups will seek crowdfunded support via Breakaway, as is an emergent practice among startups that lack a financial performance history. The innovation involved is that Fresno First will factor crowdfunded support into loan applications from startups as proof of viability. The bank is offering more flexible loan requirements than traditional banks, which normally seek at least 3 years of revenue and profits to prove credit eligibility, according to representatives from Fresno. This arrangement does not represent loosening of its overall requirements, which they tout as being very stringent. The new model is intended to allow the bank access to potentially lucrative investments before they would otherwise be available via traditional credit

rating means. Similar to the work of Brown et al. (2018), this contribution from Reosti highlighted new arrangements between traditional and emergent finance.

Many authors providing general information have approached the topic from either a broad or specific perspective. Authors focusing on a broad vantage point tended to provide background information on blockchain networks, which appear intended for readers without a cursory understanding of these technologies or their associated primary and secondary crypto markets. The authors contribute to the literature by satisfying increasing demand from readers without extensive exposure to these markets and technologies who simultaneously have an interest or need to better understand them. Other scholars focusing on specific background interests tended to study and report on timely occurrences in blockchain based markets following recent breakthroughs, innovations, and discoveries. The scholars appeared interested in providing salient information to readers dependent on remaining informed of material occurrences within these markets, i.e., market participants.

Essaghoolian (2019) provided a comprehensive review of the many facets of Bitcoin, block chain, and ICOs. They divided the document into three parts, which respectively covered the following three components: an overview of what block chain technology is, the history and current status of cryptocurrency from a legal perspective, and a proposed framework to regulate ICOs. Chapter one covered block chain technology and its relation to Bitcoin, smart contracts and their relation to Ethereum, and what ICOs are and how they function. Chapter two covered several topics, including: cryptocurrency crimes and regulations; regulatory positions of the IRS, SEC, and FinCEN; and the

regulatory positions of foreign nations including China, South Korea, Russia, and Switzerland. The author also included in chapter two a discussion of the Howey Test, to include investment of money, horizontal commonality, vertical commonality, expectation of profits, and the effects of efforts from third parties. The author closed the second chapter by discussing the Simple Agreement for Future Tokens (SAFT), along with SAFT's many limitations. They finally closed the document by putting forward a proposed regulatory framework intended to improve upon the many limits to current ICO regulations that discussed structure, digital utility token exemption (DUTE), pre-ICO disclosures, post-ICO disclosures, and enforcement and penalties.

Similar to Essaghoolian (2019), Casarella and Manfrè (2019) created a concise but comprehensive document surveying several key concepts pertinent to ICOs. They began by dissecting the tradition capital raising methods of either conducting a private placement (whereby accredited investors inject money into the enterprise in a non-public and largely non-regulated environment) or via a public offering like an IPO on an exchange like the NYSE or NASDAQ. Public offerings are highly regulated with the Securities and Exchange Commission (SEC) because of their potential to affect retail or non-accredited investors. The authors finished the first section of the document by discussing the recent legalization of Regulation A+ offerings, which allow ventures to raise effectively crowdfund capital of up to $20 million in a Tier 1 offering or $50 million in a Tier II offering during a 12-month public solicitation period. Organizations seeking capital via Regulation A+ offerings may choose to have their outstanding share prices listed on a public exchange, thus resulting in the term mini-IPO. The authors then

transitioned into a background discussion of block chain, cryptocurrencies, and tokens including an overview of how distributed ledger systems, digital currencies and tokens exist and are traded, current and potential business applications of block chain, and current regulations. The authors closed the document by examining ICOs as an extension of Regulation A+ offerings that seek crowdfunded capital specifically by raising cryptocurrencies or digital tokens from investors, typically non-accredited. They covered regulatory and reporting requirements, which is typically little more than publishing a white paper. The authors also discussed the shift away from public ICO offerings in favor of private offerings, as the former is constrained by regulations limiting capital seeking firms to aggregate funds raised of only $1,070,000 per 12 months. The authors dissected the ICO advantage of not diluting equity as an IPO would, along with access to difficult to gain funds for technology and market intelligence including customer tastes for proposed goods or services. They also highlighted an advantage of ICOs over private equity placements due to increased access to liquidity in secondary markets, which also allow investors insights into startup progress via the fluctuation of tradable token prices. The authors then closed with a discussion on ICO regulatory considerations, specifically focusing on the difficulty in distinguishing security tokens versus utility tokens, the former requiring additional regulatory oversight than the latter. The authors provided a valuable contribution in the literature by affording a novel and critical regulatory and market linkage pertaining to ICOs as a specialized sub-market of Regulation A+ offerings, under which crowdfunded equity IPOs also apply. In the absence of a formal

regulatory framework, efforts at self-regulation through innovation have grown within the IPO sector and the literature, alike.

Integration with other Emergent Technologies

Many scholars have explored blockchain integration with other emergent technology, particularly Internet of thing (IoT), like Krichen et al. (2022) who surveyed blockchain applications, Amin et al. (2022) who explored next generation IoT, and Khan et al. (2022) who surveyed blockchain consensus algorithms for resource constrained IoT systems.

A major portion of the literature includes analysis on the potential for blockchain and IoT to transform healthcare like Mohammed and Hussein (2022), Said (2022), Lakhan et al. (2022), Sadhu et al. (2022), Kumar and Tripathi (2021), Veeramakali et al. (2021), and Srivastava et al. (2022). Other scholars have focused on blockchain and IoT integration for improved security functions, including Ibrahim et al. (2022), Na and Park (2022), and Sabrina and Sohail (2022). Lv et al. (2022) explored blockchain spoofing detection via fuzzy AHP in IoT systems, as did Roy et al. (2022) regarding IoT security on a multi-robot system for cloud-based rescue operations. Others focused on blockchain and IoT authentication like Liu et al. (2021), Liu et al. (2021), Hameed et al. (2021), and Umoren et al. (2022).

The nexus of blockchain and IoT in market operations is also a source of interest. Yujie and Qiuxia (2022) discussed IoT and blockchain integration into e-commerce, and Baig et al. (2022) explored open-source peer-to-peer energy trading system for a remote community using the IoT, Blockchain, and Hypertext Transfer Protocol. Both Baig et al.

(2022) and Rizwan et al. (2022) investigated blockchain and IoT integration into supply chain management.

Other scholars chose to explore blockchain and IoT integration in various industries and sectors. Yang et al. (2022) and Igboanusi et al. (2022) both focused on the transformative potential of the technologies in industry, as did Vangipuram et al. (2022) in agriculture, Li et al. (2022) in finance, Freire et al. (2022) in maritime monitoring, Trček (2022) regarding cultural heritage preservation, Ahamed Ahanger et al. (2022) for unmanned aerial vehicles, Lavaur et al. (2022) for Zk-Rollups, Honar Pajooh at al. (2022) for scalable distributed Hyperledger fabric for an IoT testbed, Li and Lin (2022) in vocational education, Antwi at al. (2022) on network optimization, and Chen et al. (2021) regarding blockchain based group key agreement protocol for IoT.

Like IoT, integration of blockchain and AI, along with federated and machine learning, is a major interest. Javed et al. (2022) surveyed integration of blockchain technology and federated learning in vehicular IoT networks, as did Ogundokun et al. (2022), Chen et al. (2021), and Chang et al. (2021) pertaining to federated and/or machine learning.

Many others have shared broad-based interests regarding blockchain integration. Zhang and Zhu (2022) explored environmental accounting based on AI, blockchain, embedded sensors. Zahoor et al. (2022) surveyed blockchain applications for Covid-19. Liu et al. (2022) discussed rural live broadcasting via blockchain and AI. Ding et al. (2022) investigated blockchain and cyber threats to smart grids. Ma (2022) conducted feasibility analysis of intelligent piano teaching, and Sousa et al. (2022) explored AI and

blockchain in education. Manoharan et al. (2022) examined blockchain and AI industrial applications.

Blockchain integration with quantum computing is also a topic of interest. Edwards et al. (2020) reviewed quantum and hybrid quantum blockchain protocols. Wang et al. (2022) evaluated quantum blockchain integration based on asymmetric quantum encryption. Sun et al. (2019) explored quantum-secured permissioned blockchain. Gao et al. (2020 expounded a novel quantum blockchain scheme based on quantum entanglement. Mosteanu and Faccia (2021) discussed fintech, quantum computing, fractals, and blockchain. Dai (2019) evaluated quantum-computing with AI and blockchain, as did Benkoczi et al. (2022) regarding quantum Bitcoin mining and Sun et al. (2019) regarding voting protocol on quantum blockchain.

Crosman (2018) wrote about Barclays' testing of quantum computing. The author wrote about the emergent partnership between banks and fintech companies providing quantum computing solutions. JPMorgan Chase and Barclay's have signed on to the IBM Q network, which allows them to test quantum applications in their own industries. Currently, the primary quantum solutions that banks are interested in focus around portfolio optimization and scenario simulation like Monte Carlo analysis, given the massive amount of data and computation power that institutional investors and bankers require in these regards. Quantum computing could be partnered with AI, blockchain, and other emergent technology solutions. The interest of banks in quantum computing is similar to the role they played in blockchain development insofar as they are legitimizing these functions, funding research, guiding inquiry, and encouraging infrastructure rollout.

Panarello et al. (2018) conducted a systemic survey of blockchain and IoT integration. The authors conducted a survey on the current research trends in IoT and blockchain technology integration. The authors of this work focused on understanding research and application on the topic from prior investigators and practitioners with an emphasis on different application domains, device manipulation and data management, and development levels of presented solutions. The authors began by dividing the literature into categories based on those three criteria before beginning their survey on the topic.

Like Crosman, Chao et al. (2018) examined the same integration in smart homes using a hypergraph-based blockchain model. The authors presented an analysis of a potential interface between smart homes and blockchain technology. Smart homes allow for the exchange of information between homes and any number of other IoT devices, including other homes, mobile units, etc. While this arrangement may provide an added level of convenience for the smart home dwellers via added intel and services, the solution also raises privacy issues, as personal information could easily be taken from the home by external sources and used in malicious or opportunistic ways. The authors presented the concept of pairing smart homes with blockchain networks to increase transparency and security of personal information. They also addressed the limited storage and battery life of IoT technology, which is problematic when paired with the energy and data heavy needs of blockchain technology. The authors presented a solution utilizing hypergraphs and hyperedge for node storage.

Park et al. (2018) explored smart contracts as a review system for IoT marketplaces. The authors suggested integrating smart contracts running on blockchain

technology as a natural verification method. These applications and networks also rely on P2P systems, but their inherently immutable and transparent nature also act to mitigate the prior mentioned shortcomings of alternative networks. The authors argued that integration of blockchain technology into IoT-bases systems could allow for value added outcomes. This line of inquiry is increasingly popular among industry analysts, so the authors have contributed a useful contribution in this case.

Harper (2017) examined both a tri-combination of artificial intelligence (AI), blockchain, and IoT. Harper (2017) offered an overview on three emerging technology forces anticipated to fundamentally alter big data collection, analysis, and application in the next few years. The author showcased artificial intelligence, IoT and blockchain technology. According to Harper, the distributed nature of these technologies will result in an increasingly decentralized structure in big data moving forward. IoT technology will continue to grow as a data-generating force, as these devices will only expand in terms of sophistication and social adoption. Personal data collected by mobile devices and other personalized smart technology will result in mass aggregations of big data stored in numerous and disparate cloud structures. AI will be needed to analyze and apply data aggregates via advanced and self-learning operations and outputs like algorithms and neural networks. This will allow users to make sense of information derived from the big data caches. The non-secured nature of most IoT devices creates a situation where data collected at the network peripheries (the majority of data in these networks) will be both isolated from central depositories and prone to compromise and attack. Harper argued that blockchain technology will allow for secure storage and practical retrieval of data.

This is due to the decentralized yet inherently secure, immutable, instantaneous, and verifiable nature of blockchain networks, which are well-suited to complement and augment both AI and IoT technologies. Harper offered a compelling argument for the future influence and coupling of these technologies. Harper (2018) separately studied distributed automation. The focus in this particular article centered on distributed automation, and Harper utilized a deeper analysis than in the 2017 article to explore the following areas of interest: AI, IoT, and singular blockchain networks. The author committed some effort to explaining the role of enterprise knowledge graphs, enterprise data fabrics, and comprehensive platforms, along with the singular trajectory of the prior mentioned technologies in a shared confluence and direction.

Hernandez (2016) covered the expansion of Microsoft's Azure blockchain service ecosystem. Hernandez provided an article explaining how Microsoft if entering into the blockchain market via it cloud-based Azure, which will provide customers with a blockchain-as-a-service offering. The author further noted that several other tech solutions are joining in on the effort including C++ Ethereum Stack and Bitpay. This article provided an important insight into the direction of mainstream technology provision, given the size and reach of the Microsoft brand coupled with its potential to enter and expand the blockchain sector. The author noted that other tech giants are also moving in this direction including the Linux Foundation, Accenture, Cisco, IBM, Intel, and J.P. Morgan.

Like Harper (2017), Imran et al. (2019) discussed challenges of and solutions to blockchain and IoT integration. The authors conducted a systemic investigation into the

specific needs of IoT devices, with a particular emphasis on security and performance issues, within the larger perspective of potential partnerships between IoT devices and blockchain based distributed ledgers. The authors identified gaps between performance and security benefits of paired blockchain-IoT solutions when viewed in relation to IoT performance requirements. The authors discovered and discussed the practicality of paring distributed ledger systems with IoT devices in reality. Having identified operational gaps and application issues, the authors then formulated their proposed approach to solving those prior mentioned considerations, which they argued would resolve what they consider as currently significant challenges toward the real-time integration of blockchain based information platforms and IoT device ecosystems.

Conversely to the work of Imran et al., Minoli and Occhiogrosso (2018) asserted blockchain as a possible security apparatus for IoT. Minoli and Occhiogrosso analyzed the significant security challenges that IoT solutions face on deployment. Because technology ecosystems rely on widely distributed networks of disparate and unique devices, individual units face increased security threats given their large attack surface that they host and the numerous vulnerabilities that devices suffer, particularly when operating on the network fringes, when relying on limited or outdated firewalls, or when falling into the hands of bad actors. Because IoT networks are all integrated, however, corruption of individual IoT units or weakening of their connection to one another can compromise entire IoT ecosystems. According to the authors, this problem is most pressing for mission-critical predicaments regarding transportation, health care surveillance, etc.; meanwhile, the authors also affirmed the need for reliability and

security among downstream IoT networks, as well. The authors analyzed blockchain technology as a potential solution to IoT security challenges, owing largely to the transparent, decentralized, and immutable nature of distributed ledger databases, which IoT network designers utilize in a defense-in-depth or Castle defense strategy. The authors acknowledged that blockchains should only be viewed as a piece of an emergent IoT security mosaic approach. Reyna et al. (2018) further discussed blockchain integration with IoT. The authors affirmed their expectation that blockchain will revolutionize IoT utilization; however, they cautioned against integration before gaining a full understanding of downside risks and improvement opportunity. The authors argued that formulation of consistent regulation of technology will speed their development, along with creation and application of consensus. The authors also predicted a dualism of opposing forces when onboarding both blockchain security solutions versus new and large waves of IoT devices into tech ecosystems. The authors predicted that the partnership between blockchain and IoT networks will cause cryptocurrencies to grow in scale to rival that of current fiduciary monetary systems. Wang et al. (2019) conducted a survey on the same topic. The authors here presented an extensive analysis of the potential integration of blockchain based networks to improve IoT ecosystems. The authors noted the challenges inherent among IoT devices and associated networks that will challenge these efforts, including the overwhelming and ever-increasing number of IoT devices, differences in structure between IoT networks, and the limited bandwidth, battery-power, erroneous radio linkages, and computational efficacy of IoT devices. The authors affirmed their prediction that the anticipated integration of blockchain and IoT

will address the challenges. The authors conducted and presented a comprehensive analysis of blockchain technology to date, particularly concerning its partnership with IoT. The authors concluded by suggesting future research to improve capacity, security, and scalability of blockchain based distributed ledger systems. Du et al. (2018) investigated blockchain integration into Fin Tech. The authors acknowledged that, given the very new and changing nature of distributed ledger technology, most discourse on this topic has focused on broad application ideation rather than specific organizational integration. The authors focused on the latter perspective by utilizing an affordance-actualization (A-A) framework that firms could utilize when integrating blockchain based fintech solutions. From this A-A theoretical foundation, the authors then developed a process model by adding an experimental phase whereby organizational leaders may identify, develop, and trial solutions. The authors noted that their case-study research should only be generalized following future research. The authors noted that their case study focused on a large and established organization, rather than among startups, which tend to operate differently. The authors specified that their case-study participant operates in an emerging economy; thus, future researchers should attempt to follow up on their findings in industrial and post-industrial landscape. Scholars focused on the potential compatibility between blockchain and IoT technologies tend to identify the purported decentralization, transparency, security, and immutability of blockchain networks as viable options for storage and retrieval of mass data captured via IoT devises. Those investigating potential AI integration have conjectured the potential of AI to analyze big data stored on distributed ledger systems, including big data gathered via aggregate IoT

device information integration. Scholars interested in integration of quantum computing into blockchain networks tend to focus on potential compatibility solutions between the divergent technologies, often seeking to reconcile the decentralized posture of blockchains with the centralized architecture of emergent quantum computers. Scholars focusing on emergent technology integration broadly agree that innumerable industries and economies will likely experience seismic shifts following widespread amalgamation of these technologies.

Investing Strategies

Many authors have focused on investing strategies for cryptocurrencies and blockchain. Speed (2016) discussed optimal crypto spending habits. The author provided advice in a series of numbered paragraphs, each focusing on one area of interest. These included the need to understand the following risks: technological, business and economic, financial, and legal. Additionally, the author counselled that most projects would fail, and those investors should only engage in crypto currencies if they are financially capable and comfortable doing so and they only wager what they can afford. Finally, the author strongly suggested conducting sound research prior to investing, study of the crypto economics, and adoption of a long term buy-and-hold strategy rather than focusing on short term fluctuations and reactions.

Kauflin and Baldwin (2018) showcased the investing tips of a China-based crypto trader. The authors highlighted the trading practices of Shuoji Vincent Zhou and this cryptocurrency investment firm he started named FBG Capital. Originating in China, the firm has gone international and enjoys some of the highest reported returns in the ICO

investment market. According to the authors, the firm's investment strategies rely on rapid volume trading driven by market inefficiencies, insider relationships, and market hype. Initially, the founders focused on arbitrage exploitation by buying and trading tokens across platforms that offered differential prices for the same assets. As these markets became more efficient, however, the firm shifted its strategy to a relationship business whereby FBG has formed close connections to media outlets, token exchanges, and crypto startups. In this model, the firm conducts close research on entrepreneurs to identify viable investment targets. Then, they infuse firms with capital; afterwards, the firm pays media influencers like prominent bloggers to hype the venture while also convincing exchanges to list them. This causes the venture's value to bloat rapidly, and FBG then quickly divests before the market corrects itself. In addition to this pump and dump model, the firm also follows industry news such as regulatory changes to anticipate how these occurrences will affect crypto market prices. Moynihan and Syracuse (2018) explored obstacles toward creating crypto and blockchain mutual funds. The authors focused on the past, present, and future of cryptocurrencies in the mutual fund industry. Moynihan and Syracuse began by presenting an overview on blockchain platforms and digital tokens, including initial coin offerings. The authors then provided an industry overview of how many major financial sector participants are seeking to integrate the embryonic technology into their own operations. They discussed barriers to blockchain and cryptocurrency utilization by mutual funds, much of which stems from both uncertainties in the regulatory code and shortcomings of existential technology to meet mandatory legal requirement intended to safeguard mutual fund investors. The authors

lauded the rapid growth of the blockchain industry while also cautioning against unrealistic expectations, and they speculated that the greatest adoption of blockchain in the mutual fund industry may be more geared toward harnessing blockchain infrastructure for processing client information rather than as a portfolio asset option.

Despite Kauflin and Baldwin (2018)' cautionary narrative, Daly (2016) focused on an expected blockchain bull market. The author noted opinions from industry experts who attested that widespread adoption of blockchain technology is actually years away, despite optimistic reporting of advances in the field. While Daly noted that periodicals and industry reports show rapid adoption rates and lucrative potentials, particularly in the realm of asset clearance processes that are currently slow and require third party verification, other factors are slowing firms from practically applying distributed ledger systems. While mentioning several concerns, Daly noted two primary concerns: regulation and partnership uncertainty. Regarding the first, the author did not elaborate, but this is a much-discussed topic in other articles on the issue. Regarding the issue of partnership uncertainty, Daly noted that large organizations must choose between many tech firms to form strategic partnerships, and it is often difficult to differentiate the best coupling. The author cited a source that affirmed interoperability among numerous system options as a good decision rubric.

Lee and Yong (2018) highlighted Fintech ecosystems and business models, along with investment decisions and challenges. Lee and Yong discussed the emergence of financial technology, widely known as fintech, in the financial services sector, which they described as a paradigm shift. The authors posited fintech as the integration of

information technology into financial markets, which then upend traditional methods, protocols, and practices. Lee and Yong first provided a historical perspective on fintech and the formation of its own ecosystem. The authors also considered the various business models within that ecosystem, along with different investment types and decisions related to their growth and development. Lee and Yong finally investigated the numerous kinds of challenges that business may face in creating fintech solutions. The authors created a consideration matrix that delved into these challenges from technology and managerial standpoints, opposite challenges from startup versus established organization perspectives. Del Castillo (2018) wrote of the launch of a regulated Ethereum futures trading platform. The author described the most recent launch of Ethereum futures. Funded by Akuna Capital, the project will allow traders to take long or short positions on future Ethereum cryptocurrency prices. This represents an additional step toward cryptocurrency integration into traditional currency markets, as speculations will be hosted by mainstream institutions like the Chicago Mercantile Exchange and the Chicago Board of Exchange. This development for Ethereum occurred just recently, whereas futures trading of Bitcoin and XRP have existed since 2015 and 2016, respectively. The author provided commentary on the regulatory environment surrounding Ethereum futures, which must abide by those mandated for the wider derivatives markets.

Manta and Pop (2017) discussed current trends in digital finance pertinent to cryptocurrencies and blockchain. The authors positioned the currently climate as one where contemporary monetary ecosystems are being rapidly upended and updated based on the widespread development and adoption of digital tokens, then numbering greater

than 850 coin types in Europe at the time of writing. The authors noted an overall sentiment of caution among national, European, and international regulators regarding utilization of digital currencies in their myriad and often unregulated forms. In particular, the authors noted concern from governing authorities that the decentralized and anonymous nature of crypto tokens can be easily misused to fund money laundering and terrorist activities. The authors specifically analyzed Directives 2015/849 and 2009/101/EC of the European Union. The authors tended to provide a myriad of perspectives regarding crypto investment. The inherent uncertainty surrounding investment strategies, particularly concerning speculative markets, necessitates numerous and often divergent opinions regarding best practices for individual investors, specific market occurrences, and industry developments.

A subset of scholars has investigated ICOs and their fundraising outcome factors, along with crowdfunded equity offering outcomes. Wonglimpiyarat (2018) relied on an innovation system approach toward assessing challenges and dynamics of FinTech crowdfunding. The author conducted a review of the myriad challenges that face full development and implementation of FinTech crowdfunding mechanisms like crowdfunded equity offerings. The author focused on the dynamics and challenges of emergent capital markets in the United States, Asia, and Europe. The author conducted a case study on the Thai innovation environment currently dubbed Thailand 4.0. The author found that the Thai entrepreneurial sector suffers from barriers to innovation both regarding the nation's regulatory system and its operational capabilities. The author concluded that their findings are valuable to improved innovation in the FinTech

crowdfunding arenas globally, with particular emphasis on developing economies like those in Southeast Asia.

Fisch (2019) examined ICOs as a capitalization method for startups. The author conducted a primary investigation into the determinants of initial coin offerings to better predict amount of capital raised and other success factors. Fisch relied on signaling to identify how information signals put out by capital seeking startups might incentivize investors to provide seed funding. The author conducted an empirical study of 423 initial coin offerings between 2016 and 2018. The author found that certain startup signals do indeed affect amount of capital raised. Capital seeking firms that issued white papers with technological language and high-quality source code raised more money on average than firms that did not. Firms that patented their technology did not enjoy elevated capital returns during the issuance process. The author conducted research into firm-specific results to find that some initial coin offering outcomes resembled those found broadly in prior entrepreneurial finance literature; however, these observations did not hold universally. Given the lack of research on initial coin offerings, the author's contribution to the literature here is significant, and the study conclusions validate similar findings on the topic.

Adhami et al. (2018) conducted an empirical analysis regarding the reasons why new ventures choose crypto based funding. The authors in this study provided both a comprehensive description of ICOs as a capital fundraising phenomenon, along with an empirical study into the success factors of ICOs. Their research methodology consisted of a sample of 253 ICO campaigns; therefore, the authors found that ICOs enjoy an elevated

rate of success given the presence of three variables: source code availability, presale organization, and service availability or profit sharing for campaign participants. The authors in this study have provided a valuable contribution to the literature, particularly through their explanation of the ICO process and their primary research study, which was original to the topic.

Huang et al. (2020) conducted a quantitative study regarding the numbers and successes of ICOs across the world. They then compared results to identify success factors that influence ICO prevalence and outcomes, along with listing which countries have had relative success in their domestic ICO markets. The authors acknowledged the difficulty in conducting a study of this nature, as no global ICO register currently exists. They gathered their sample by exhaustively cross-referencing ICO lists across hundreds of nations. According to their initial hypotheses, ICOs are a function of well functioning capital markets and infrastructure. They selected degree of development in financial systems, debt markets, public equity markets, and private equity markets. The authors then cross-referenced all ICOs listed on ICObench with all numerous other public information sites. They identified 915 ICOs that finished from January 1, 2017, to March 31, 2018. Each ICO listed had to be identifiable by country of origin, with the full sample ranging from a group of 73 originating countries. Their dependent variable was the number of ICOs completed in each country during the study timeframe. Their explanatory variables were composite index ratings for each listed country according to the Financial Development Index, Banking Index, Equity Market Index, VC Index, ICT market development, ICO regulation, and availability of crowd funding platforms. The

authors found that a nation's market development represents a positive and significant coefficient on ICT market development. Sufficient and transparent regulatory frameworks were also a significant factor. They found no relationship between ICOs and venture capital or private equity funds. The authors found their hypotheses proven with some limitations. The US performed highest in terms of number of ICOs during the study period. Most of the other high performing nations ascribed to a commonly Western model of financial, regulatory, political, and socioeconomic design, which matches closely with the authors' study design assumptions. The primary exemption was Russia, which scored second highest on the list of overall completed originating ICOs during the study timeframe, despite scoring low on most independent variables. The authors noted that Russia did score high on population and mathematical capacity, and the authors concluded that ICOs may also be significantly influenced by mathematical or technical population expertise. They suggested that future researchers look into their findings.

Masiak et al. (2020) conducted a quantitative auto-regression study to assess whether market cycles affect ICO generation, along with the relationship between ICOs and cryptocurrencies bitcoin and ether. The authors started with a brief introduction into distributed ledger technology and the rise of ICOs as a capital seeking vehicle. They also enunciated their intended views for their study, which they suggested could benefit startups considering launching ICOs by better informing market participants in the macro-level forces affecting these markets. The authors then afforded a background section providing context in the ICO process including the pre-, main-, and post-ICO phases. They also conducted a literature review. Their unique study comprised 104

weekly ICO observations between January 1, 2017, and December 30, 2018. They also included three variables: total amounts raised in the ICO campaigns, the price of bitcoin, and the prices of ether. The authors also relied on two primary data sources for their study. CoinSchedule collects key information about many ICOs like amount raised, date offered, and links to the offering startups' web sites. CoinMarketCap offers information about daily bitcoin and ether prices. Their econometric test results showed a pattern of bullish (bearish) tendencies in ICO markets persisting an average of 4 weeks. They also found that innovations in bitcoin and ether affected ICO markets for an 8-week window. They attributed both cycles to the effects of market hype. The authors were not able to show a significant relationship between ICO growth rates and cryptocurrency returns, nor a relation between ICO volumes and cryptocurrency volatility. The authors suggested that startups may want to postpone ICO offerings until market conditions were favorable or, if that is not possible, focus on quality of crowdfunding tactics and product/service strengths. The authors did note limitations insofar as not considering exogenous variables, crowdfunding methods, macro trends in ICOs markets, discrepancies between ICO tracking sites, and post offering returns or volatility.

Hsieh and Opperman (2021) conducted a study of ICOs and their initial returns following issuance of cryptocurrencies/tokens. The authors based their study on the theory of initial returns, which asserts that IPOs generally exhibit underpricing due to information asymmetry at the time of offering. Information imbalances benefit investors with inside information while punishing those without it. The issuing venture also tends to enjoy potential value based on underpricing. Inside investors are able to leverage privy

knowledge to best select share issuances that are initially underprices, which they subsequently hold until market forces correct their prices upward. This results in the winner's curse whereby outside investors suffered from crowded out capital markets that generally only offer them investment opportunities with suboptimal return outcomes. This crowding out is only partial because uninformed investors stay in the market, suggesting at least some residual return opportunities. The authors postulated that similar dynamics from the IPO market also exist in the ICO market. The authors expressed the initial return equation as equaling price of issued share after first day less the price of share set by the ICO, divided by price of share set by the ICO. The authors gathered their sample and variables from CoinDesk.com, which provides ICO data and prices indices. They then cross-referenced ICOs listed between January 2014 and August 2018 against Coinmarketcap.com to compare crypto price changes from issuance. They also gathered additional information to support variable analysis from several other sources including white papers. They chose a final sample of 502 ICOs. They set the dependent variable as the initial return for each ICO. The authors segmented for time of issuance to control for aggregate changes in the cryptocurrency markets. They also established regulatory frameworks, gold, and stock markets as independent variables. The authors found that underpricing predominates in ICO markets even more so than in IPO markets, suggesting significant information asymmetry and market inefficiency in ICO markets generally. They also found that these characteristics can be moderated by presales and lengthy white papers. Shorter issuance durations, native coinage use, and independent block chain platform usage have a positive relationship on initial returns. The authors also found that

industry, regulation, and the larger cryptocurrency market movements significantly influence initial returns. They also found that the movements of traditional stock and gold investment markets have a positive correlation with ICO initial returns.

Benedetti and Nikbakht (2021) assessed returns and network growth of cross-listed tokens. Boreiko and Risteski (2021) discussed serial and large investor involvement in ICOs. Fisch et al. (2021) evaluated motives and profiles of ICO investors. Le Moign (2019) postulated ICOs as a new mode of finance in France. Demarco (2019) analyzed blockchains in capital markets. Cappa and Pinelli (2021) investigated ICOs and determinants of returns. Zhang and Gregoriou (2021) weighed return and liquidity tradeoff of including crypto assets in portfolio after China's crypto ban. Lambert et al. (2022) discussed security token offerings, and Campino et al. (2022) explored reasons for ICO success. Bogusz et al. (2020) studied crowdfunding and cryptos from social media.

Crowdfunded Equity Investing

Similar to Fisch's (2019) focus on ICO success factors, Mamonov and Malaga (2017) discovered success factors for startups seeking initial equity offerings via crowdfunding in the US. The authors investigated the success factors of crowdfunded equity launches. Owing to the lack of research in this emerging field, the authors specifically researched participants in Title III markets in the United States that, by regulation, allow non-accredited investors to gain ownership in capital seeking startups. They relied on a data set taken from 16 equity crowdfunding platforms. They identified 133 startups that collectively raised $11 million from crowdfunded equity markets. The authors assessed three risk variables: agency, execution, and market risks. Mamonov and

Malaga found that all three risk variables played a material role in the success factors of their participant firms. They also found that involvement of accredited investors in Title III public offerings (although not required by law) represented a critical component of early-stage success in these markets.

In contrast to Adhami et al.'s (2018) focus on reasons that startups choose to launch ICOs, Brown et al. (2018) discussed equity crowdfunding among startups. The authors conducted a study of 42 startups in the United Kingdom that relied on equity crowdfunding to finance their ventures. Their research method relied on a qualitative interview approach to gather and analyze feedback from the study participants on why they chose to rely on equity crowdfunding. They found significant disillusionment among the participants regarding traditional funding sources like banks or venture funds, which generally are not accessible to startups. The authors discovered additional benefits to entrepreneurial ventures from equity crowdfunding that exceed those merely attainable by capital injection. Given the behavioral tendencies of the study participants, the authors proposed utilization of an entrepreneurial bricolage as an appropriate theoretical lens from which to understand their behavior. The overall interest among scholars has been to assess factors that may affect offering outcomes. The predominant focus, then, has been in assessing what actions, advantages, and precursors may result in an offering that reaps large shares of capital compared to other firms seeking ICO-derived capital or crowdfunded equity. Some authors have also examined factors post-offering that may facilitate future access to capital, whether through subsequent offerings or access to angel investors.

Many of the topics of discussion pertaining to equity crowdfunding span a broad range of topics. Elder and Hayes (2021) provided a guide to equity crowdfunding. Colombo and Shafi (2021) discussed receiving internal equity following successful crowdfunded tech projects, while Troise et al. (2020) evaluated the role of intellectual capital in the growth of equity crowdfunded companies. Cabarle (2021) explored future tax benefits planning for regulation crowdfunding, and Coakley et al. (2022) assessed seasoned crowdfunded equity offerings. Cumming et al. (2021) provided an integrative model and research agenda toward equity crowdfunding and governance. Buttice et al. (2020) explored deal structure and attraction of venture capital investors to crowdfunded equity. Sanders (2020) reported that the SEC announced temporary rules for certain regulation crowdfunding offerings, and Gong et al. (2022) analyzed the influence of auditor attestation in Securities Based Crowdfunding for startups. dos Santos Felipe and Franca Ferreira (2020) assessed the determinants of the success of equity crowdfunding campaigns.

Some issues are regional in nature. For example, Woolard and Steigner (2020) leveraging social networks for offline crowdfunding in rural communities. Conversely, many of the issues pertaining to equity crowdfunding are of an international nature. Li (2022) analyzed regulation of equity crowdfunding in the US including remaining concerns and lessons from the UK. Cicchiello (2020) discussed the needs, challenges, and risks to harmonizing crowdfunding regulation in Europe while Battisti et al. (2020) covered equity crowdfunding and regulation implications for the real estate sector in

Italy. Balta and Greece (2021) postulated EU crowdfunding regulation as an investment model across the EU.

Certainly, one of, if not the, earliest examples of comparison between ICOs and crowdfunded equity markets was through the work of Block et al. (2021) who contrasted the two capital market types in detail. The authors placed a public call for research submissions pertaining to each market, and they highlighted findings in their publication, which weaved those investigations together into a cohesive narrative. The authors also tabulated comparison charts that matched and contrasted the similarities and differences between ICOs and crowdfunded equity campaigns. However, the authors did not conduct empirical research that directly compared the functioning of ICOs and crowdfunded equity campaigns via a single sample, nor did they analyze those sample results to draw combined quantitative findings. At the end of their work, the authors acknowledged that several unknowns currently exist between ICOs and crowdfunded equity, and they provided future researchers with several areas where research could be of great benefit. The authors have provided a valuable contribution to the literature, and I hope that my own research has been able to further those efforts.

Summary and Conclusions

Many scholars have studied both ICO and crowdfunded equity markets. Their collective attention focused on many areas of those markets like technology, regulation, opportunity and risk. A small but growing number of scholars have also investigated the factors that influence outcomes in those emergent primary markets, though these works are still small in relative scope and depth compared to other areas of interest.

Few if any scholars have compared direct outcomes between ICOs and crowdfunded equity via qualitative analysis in a single sample. This gap in the literature is problematic insofar as a dearth in cross-market comparison data inhibits the efficient operation of capital markets by depriving investors and entrepreneurs of critical historical information to help guide the complex decision-making processes involved with going public. These conditions force capital market participants to avoid ICOs and other emergent capital markets entirely or to enter upon their own risk. This outcome is a specific example of my previously identified social problem, which was that uncertainty in markets increases the likelihood of market failure due to volatility and suboptimal functioning.

I sought to close the current gap in the literature outlined previously by directly comparing ICO and crowdfunded equity markets via their outcomes, by testing the relationship of those outcomes to factors that may influence them, and to draw conclusions from those discoveries to assess the relative efficiency of the emergent capital market types. In Chapter 3, I outline the specifics of my research by describing its design, methodology, data analytics, and validity.

Chapter 3: Research Method

The purpose of this quantitative study was to compare a group of ICOs versus a group of crowdfunded equity offerings with the intent of identifying predictive factors on those funding outcomes. In this chapter, I outline the major components of my study. I describe my research design and rationale, including my population, sampling and sampling procedures, participant recruitment, data collection, archival data, and data analysis. I also explore potential threats to internal validity, external validity, and construct validity, along with ethical factors. I then close the chapter with a summary section.

Research Design and Rationale

My focus was on one primary binary control factor, which denoted whether the individual startups included in my sample chose to conduct an ICOs or a crowdfunded equity offering. The values for this control factor were either *ICO offering organization* or *crowdfunded equity offering organization*.

I had a single continuous, numerical dependent variable, which represented the amount of money that each startup in my sample was able to raise as part of their respective public offerings. The values for this response variable were denoted in whole dollars and cents.

I also evaluated eight secondary binary control variables which denoted whether the individual startups in my study provided different forms of material information to the investment community as part of their respective offerings: historical financial information, pro forma financial forecasts, detailed product descriptions, video of product

demonstrations, company website, company history, company leadership, and company investors. Each of these factors had a value that was either *Yes* or *No* depending on whether the startup made the information available to the investment community as part of their respective offering.

My research design and choice of variables connected directly to my research question: How does capital offering type predict the amount of funds raised while controlling for access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors? As such, I used univariate ANOVA (single dependent variable) with multiple control factors to assess if offering type (the primary control factor) predicted amount of funds raised (the single dependent variable) when controlling for investor access to historical financial information, pro forma financial forecasts, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors (eight secondary control factors).

I evaluated a sample of publicly available archival data, collected from the inception of my data archives to present. This design choice was consistent with the objective to determine if a difference existed in funding obtained using two primary capital market types. This is an issue that many scholars and practitioners have fiercely debated using subjective arguments while largely lacking objective data findings to support their assertions.

Methodology

In this section I outline the overall methodology of my study, including my population, sampling, data collection, archival data, and data analysis.

Population

The population consisted of startups that received initial capital funding via ICOs and those that received funding through crowdfunded equity offerings. The target population comprised the completed funding campaigns listed on the websites ICOdrops.com (2022), localstake.com, mainvest.com, and fundable.com (2022). The first site hosts and records ICO offerings, and the latter three hosts and records crowdfunded equity offerings. These websites provided a target population of 1,800+ completed campaigns.

Sampling and Sampling Procedures

My study relied on publicly available archival data of both ICOs and crowdfunded equity campaigns. Selection criteria for those data required that all campaigns chosen for the study had been fully completed, were not listed according to any outcome bias, and provided sufficient information about each selected campaign that meaningful conclusions could be drawn according to a cross market perspective.

Data were available from four primary sources. The website icodrops.com (2022) is one of the largest hosting sites for ICOs globally, allowing an online forum for startups and investors to meet, learn about one another, and decide to partner via capital injection into the respective crypto ventures. The site also maintains historical data, including material information about past ICO offerings that have occurred through the website.

Selecting *Ended ICOs* on the upper right corner of the homepage yielded a listing of all finished campaigns. As of January 24, 2022, this site has produced a listing of 1,305 completed ICOs that have run on the site since July 2014. This listing included important information about each offering including the name of the startup, its site rating, industry/category, total amount raised, fundraising goal, and the campaigns closing date. Site users can also click through the listed company names in the listing to access a profile page for each of the startups, which offers more detailed information about each venture, coupled with additional links to their respective webpages.

The websites fundable.com (2002), mainvest.com (2002), and localstake.com (2022) are online platforms for ventures seeking crowdfunded equity for capital injection. The sites offer selection criteria that allows the user to edit the listing of startups they are interested in exploring, including several hundred completed campaigns. Clicking through the listed firm names allows the site users to access much material information about the listed firms and their respective offerings, along with links to their individual websites.

These individual listings on each website represented my target population. Because I had access to the entire target population, I initially intended to conduct a full census of the sites, but later chose to sample from them for time and viability concerns. I used G*Power (Faul et al., 2007) to compute the statistical power for this census, based on a target population size of $N = 1888$, level of significance of $\alpha = .05$, numerator $df = 1$ (factor levels [2] – 1), number of groups = 9 control factors x 2 levels each = 18, and

small effect size $f = 0.10$. A post hoc computation of statistical power $(1 - \beta)$ was .991 (less than a 1% probability of failing to detect a true effect among the control factors).

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

All data collection occurred via the four websites. Because the startups listed on those sites have chosen to list their offering results publicly, I did not plan any direct communications with the sample startups, nor did I release information about specific startups or their respective offerings. I instead relied only on the information that those entrepreneurs and the website hosts had already provided for public use, so there was not a need for the individual startups to provide informed consent for this specific study, nor was there a need for formalized exiting procedures like debriefings or post-study follow up.

All data collection occurred via tabulation of the offering results listed on the four websites, coupled with material information about those offerings like company-specific details needed to adequately address my research question. These company-specific data included company close of campaign date, and binary outputs denoting the availability of material information that investors would need to make informed decisions pertaining to those individual offerings including access to historical financial documents, pro forma financial forecasts, and other information like product descriptions, company websites, company leadership, and key investors.

Data were input to an Excel spreadsheet where all information is be available for future analysis. I conducted quantitative analysis using SPSS, and the data contained in the spreadsheets were easily importable into the analytic tool.

Data Analysis Plan

Data structure captured from the websites was identical and included the following:

- company name
- campaign closing date
- amount raised
- historical financial data
- pro forma financial forecasts
- product descriptions
- company website
- product video/pictures
- company history
- leadership
- current investors

My research question was, how does capital offering type predict the amount of funds raised while controlling for access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors?

For each of the nine control factors (one primary and eight secondary), the following were the hypotheses that were tested to address the RQ:

H_{j0}: There is no difference in mean funds raised due to control factor *j*.

$\mu_{j1} = \mu_{j2}$ where μ_{j1} is the mean funds raised with control factor *j* at Level 1, and where μ_{j2} is the mean funds raised with control factor *j* at Level 2; and $j = 1, 2 \ldots 9$.

H_{jA}: Mean funds with control factor *j* at Level 1 is not equal to mean funds raised with control factor *j* at Level 2.

$\mu_{j1} \neq \mu_{j2}$.

For each pair of control factors, *j* and *k*, the following are the hypotheses related to the two-factor interaction (2FI) equal to *j***k*.

H_{f0}: The interaction of factors *j* and *k* is equal to zero.

$j*k = 0$.

H_{fA}: The interaction of factors *j* and *k* is not equal to zero.

$j*k \neq 0$.

I used univariate ANOVA to assess if offering type (primary binary control factor) predicted amount of funds raised (continuous, numerical dependent variable) when controlling for investor access to historical financial information, pro forma financial forecasts, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors (eight secondary, binary control factors). These secondary control factors had values of *Yes* or *No* outputs denoting whether the information was provided as part of the offering.

ANOVA was the statistical technique used to identify relationships between categorical (nominal) control factors, or independent variables, and a single continuous (numerical) dependent variable (Warner, 2020). The technique is used to assess differences in dependent variable means among different groups defined by control

factors and their values, along with possible interactive effects between the control factors. The benefit of this technique is that relationships identified may be used to predict dependent variable outcomes based on actual control factor values. This ties back to my study methodology, which utilizes ANOVA to identify the relationship between the study's control factors (offering type and access to material information) and dependent variable (funding outcomes).

Threats to Validity

External Validity

Threats to external validity existed regarding actual amounts raised and actual availability to material information by investors. An assumption of the data analysis plan was that access to material investor information could be verified via a search of internet resources found on the ICO and crowdfunded equity websites, along with that information found on the company-specific websites associated with each offering. This assumption held true pertaining to a weak EMH, which affirms that efficient market valuations incorporate all historical data. This assumption also held true pertaining to a semi-strong EMH, which affirms that efficient market valuations incorporate all historical and public information material to investment decisions.

The assumptions outlined in my data analysis plan did not hold true for a strong EMH, however, which affirms that efficient market valuations incorporate all historical, public, and private information material to investor decisions. My study design was not able to assess availability to private information to the investment community by the market participants in my sample. It is possible that the entrepreneurs who have launched

offerings on the host sites may have held private relationships with their investor bases, and it is equally possible that the individual startups may have shared private information (i.e., financial data or other material information) to the investors who have chosen to take a stake of ownership in those ventures without making that information also available to the wider public. Given this threat to external validity, any outcomes of my research should be interpreted as pertinent to a weak or semi-strong EMH but not necessarily to a strong EMH.

Internal Validity

Threats to internal validity existed in relation to possible differences between the target population and the global population, although the actual existence and level of threats are difficult to determine. The websites listed previously are online investing platforms for crowdfunded equity and ICOs, respectively. Those sites host initial offerings across a wide array of industries. I also pursued a purposeful strategy of including a sample of completed campaigns listed on the sites, regardless of funding outcomes to avoid any preference or bias toward those campaigns that have performed well. It is therefore a reasonable assumption that results rendered from the target population should correspond to the aggregate outcomes of the global population. This assumption is difficult to prove, however, as many other factors may cause target population behavior to differ from global population behavior. It is difficult to know what may cause startups to choose alternative sites to host their initial offerings and if those factors are merely arbitrary or rooted in rational causes. Causes may include access to the

sampling sites in remote areas or perhaps preference for other sites based on industry, country, regulations, or some other factors entirely.

To mitigate internal threats, any conclusions drawn from the study should be noted as *probably but not necessarily* representative of the vast, diverse, and extremely complex global ecosystems surrounding ICOs and crowdfunded equity offerings, and future researchers should be encouraged to test findings on other sites, as well.

Construct Validity

A potential threat to construct validity exists through potential for reader misinterpretation of the outcomes of the study. A critical limitation is the fact that ANOVA may be extremely useful in identifying factors that predict the dependent variable, but readers should take care not to interpret my findings as representing any form of causality between the primary and secondary control factors and the dependent variable, as predictive factors may not represent causality. It is very possible that the research may identify differences in funding outcomes based on access to material information available to the investment community, and my findings may suggest overall market efficiency based on transparency. It may be incorrect to assume, however, that investor behavior is directly affected by transparency, as it is equally feasible that those startups that provide access to this information are simply more efficient and organized than those that do not, and that the former tend to run better and more organized crowdfunding campaigns in general. My findings would merely show a relationship rather than a cause of those outcomes. Perhaps the best method to mitigate a threat to construct validity was to directly point out these limitations here and in the conclusion of

my study and to encourage future researchers to explore ways of testing for causality, if possible.

Ethical Procedures

Because my study relied on secondary data that is available to the public, ethical considerations, and agreements to gain access to data were very real but also minimal. I was able to gather data for analysis without written approval from the website owners/managers. This was also the case regarding the owners of the startups listed on those websites, as I did not make any direct contact with them nor do I plan on publishing any individual outcomes from their respective launches, although this information is already publicly transparent and available to interested parties. I did not rely on recruitment materials, nor did anyone participate in the study directly.

I plan to keep the data anonymous and secured on my personal computer, which will not be available to view without formal request from Walden officials. After publication of the study, I plan to transfer the data onto a backup device, which will be secured.

There were no conflicts of interest, as I was in no way associated with the websites, nor any of the startups listed on them. I was also neither personally, professionally, financially, or in any other way invested in any stakeholders of those organizations.

Summary

My population comprised companies that used the global ICO and crowdfunded equity markets, and my target population consisted of those companies listed on the

websites listed previously. My sampling method relied on publicly available secondary data found on those sites that represent completed primary capital market offerings and their associated outcomes. I compared those data first by capturing their respective information in an Excel spreadsheet, which I then exported into SPSS for statistical analysis. I used univariate ANOVA to assess if offering type (ICO or crowdfunded equity) predicted funding outcomes, while controlling for access to material investor information. These outputs enabled the detection of relative efficiency in the markets of interest. Threats to external validity related to the inability of my study to gauge access to privy information by investors in those markets. Threats to internal validity existed concerning the generalization of the target population to the global population, and results were incapable of proving causation due to the need for construct validity. Ethical concerns were minimal because the research relied on publicly available secondary data. I kept all data secured, private, and aggregated. In Chapter 4, I present my results.

Chapter 4: Results

The purpose of this quantitative study was to compare a group of ICOs versus a group of crowdfunded equity offerings with the intent of identifying predictive factors of those funding outcomes. My research question was as follows:

How does capital offering type predict the amount of funds raised while controlling for access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors?

For each of the nine control factors (one primary and eight secondary), the following were the hypotheses that were tested to address the RQ:

H_{j0}: There is no difference in mean funds raised due to control factor *j*.

$\mu_{j1} = \mu_{j2}$ where μ_{j1} is the mean funds raised with control factor *j* at Level 1, and where μ_{j2} is the mean funds raised with control factor *j* at Level 2; and $j = 1, 2 \ldots 9$.

H_{jA}: mean funds with control factor *j* at Level 1 is not equal to mean funds raised with control factor *j* at Level 2.

$\mu_{j1} \neq \mu_{j2}$.

For each pair of control factors, *j* and *k*, the following were the hypotheses related to the two-factor interaction (2FI) equal to *j***k*.

H_{f0}: The interaction of factors *j* and *k* is equal to zero.

$j*k = 0$.

H_{fA}: The interaction of factors *j* and *k* is not equal to zero.

$j*k \neq 0$.

In this chapter, I provide my data collection effort, study results, and a summary and transition into Chapter 5.

Data Collection

The timeframe for data collection began on June 11, 2022, when I received Walden's Institutional Review Board's (IRB) approval to move forward with my final study (06-10-22-0617361). Data collection ended on September 14, 2022, which was the date that I completed gathering all of my publicly available data from the websites icodrops.com (2022), localstake.com (2022), fundable.com (2022), and mainvest.com (2022). Because my study's data derived solely from publicly available sources, recruitment and response rates were not a consideration in the study.

In Chapter 3, I identified two publicly available data sources for my study. The website icodrops.com provides historical data from completed ICOs that the site has hosted since its inception. The website startengine.com (2022) provided similar historical data for crowdfunded equity campaigns that it hosted. However, startengine.com recently stopped providing post-offering information, which caused me to identify and rely upon three other sites instead: localstake.com (2022), fundable.com (2022), and mainvest.com (2022). Each of these sites provides historical information on crowdfunded equity campaigns, just as startengine.com did. This allowed me to move forward with my research with few alterations. An added benefit of integrating the three replacement sites into the study was that they collectively provided arguably more diversified data than those provided previously by startengine.com, which helped to strengthen the study's validity to the macro crowdfunded equity ecosystem.

The baseline descriptive and demographic characteristics of the four websites are as follows. The site icodrops.com is one of the world's largest ICO website hosts, with historical listings from July 2014 to present. The site offers historical information on the more than 1,530 ICOs (as of August 14, 2022) it has hosted since inception. The ICOs listed fall along a myriad of industries, which icodrops.com categorizes into broad groupings like *platform*, *predictions*, *blockchain service*, *protocol*, *network*, *gaming*, *finance*, *marketplace*, and so on. Given this wide array of ICO venture types, a full survey of icodrops.com rendered a broadly representative depiction of the global ICO ecosystem.

The crowdfunded equity site, localstake.com, as of mid-2022 listed 43 completed campaigns on its website. The site helps U.S. based entrepreneurial startups with a strong local connection or mission from an array of several industries to connect with accredited investors who may contribute capital in exchange for one of four arrangements: revenue share loans, preferred equity, convertible debt, and traditional loans. The site fundable.com hosts crowdfunded equity campaigns from a variety of U.S. based startups across several industries. Entrepreneurial campaigns listed on the website may connect with accredited investors, and, as of early July 2022, the site hosted historical campaign results for 119 ventures. For a minimum amount of $1,000, investors have the option of providing capital in exchange for either rewards (meaning a startup-specific incentive) or equity, convertible equity, and debt, depending on the offering specifics. The site mainvest.com provides historical information on roughly 200 (as of mid 2022) crowdfunded equity campaigns. The site primarily helps small, brick-and-mortar

businesses based in the United States to connect with accredited and nonaccredited investors alike to raise capital via equity and debt offerings. Minimum investment amounts are set by each startup and average about $100. In combination, a full survey of the three sites, localstake.com, fundable.com, and mainvest.com, rendered a broadly representative sample of the U.S.-based crowdfunded equity ecosystem.

My original data collection plan was to conduct a full census of the websites. Due to time and feasibility considerations, I altered the data collection plan to create a randomized sample of those sites, instead. My sampling plan is described in the following sections, including my study population, target population, and sample.

The population in my study was the global crowdfunding market, which was estimated at $13.5 billion in 2021 and is projected to grow to $28.2 billion by 2028, exhibiting a compound annual growth rate of roughly 11.8 percent (GlobeNewswire, 2022). That population includes several sub populations, including the respective ICO and crowdfunded equity markets.

Conceived in 2012, the first ICO launched in 2013 and the market grew exponentially year to year, eventually reaching a peak in 2018 of $7.8 billion raised by 1,253 ICOs (Zerocap, 2022). The website Coin Insider (2022) recorded 3,336 ICOs as of April 26, 2022, and the website CoinMarketCap.com (2022) logged 20,562 cryptocurrencies issued from these launches. The market for equity crowdfunding became legalized in the United States in 2017, which catapulted the fledgling marketplace from $74 million in 2018 to $211 million in 2020 (Arora, 2021).

Secondary data on the four websites were available to inform my study's

variables, covering roughly 5 years (2017 to 2022) for those records listed on icodrops.com. There were 1,861 records in the target population. The website icodrops.com provided publicly available secondary data from 1,499 completed ICOs, and the sites localstake.com, fundable.com, and mainvest.com provided similar data for 362 completed crowdfunded equity campaigns. There were issues with recent changes to website access, and assembling the data for each record (i.e., informing the control factors and dependent variable) was tedious and time consuming. For efficiency, I decided to randomly sample from the original data set, using the Excel random number generator. An a priori sample size was calculated using G*Power v. 3.1.9.7 (Faul et al., 2009), with the following parameters and excerpt from G*Power:

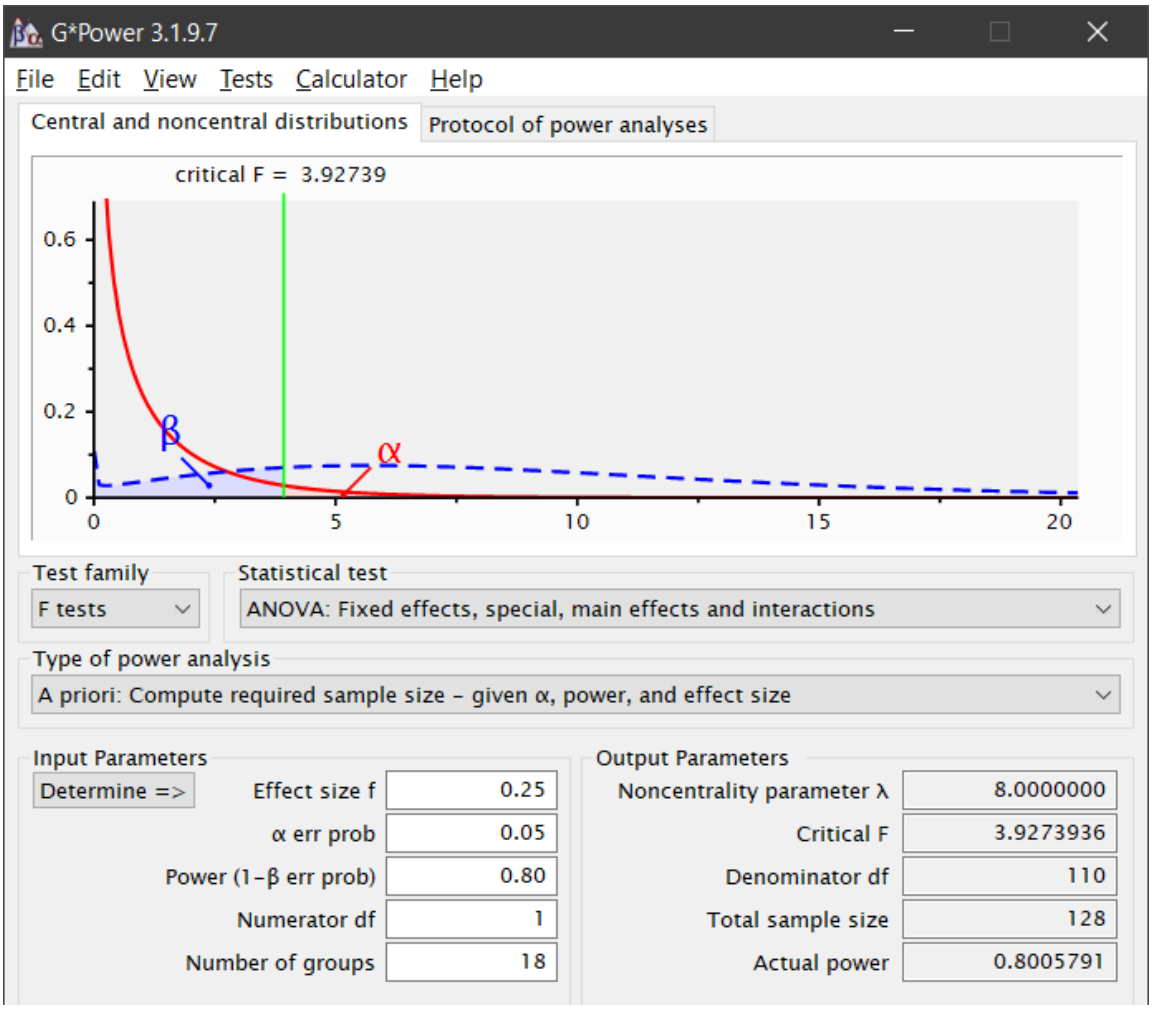
- Parameters: *F* tests; ANOVA: Fixed effects, special, main effects, and interactions
- Effect size (Cohen, 1988) = $f = 0.25$ (medium)
- $\alpha = .05$, Power = $1 - \beta = .80$, numerator $df = 1$, number of groups = 18

  total sample size = $n = 128$

Those inputs rendered the following graphical outputs in SPSS, as depicted via Figure 1.

Figure 1

*A Priori Sample Size Calculated Using G*Power v. 3.1.9.7*



An initial sample of n = 148 was selected from the original data set using a random number generator. The sample was intended to account for the likelihood that some of the sampled records may have needed to be discarded for different reasons, like broken links, missing information, or violations of ANOVA assumptions, and still meet the minimum sample size. Of those 148 records, 10 lacked complete information and I removed them for a trimmed preliminary sample of 138 records.

Data were cleansed to address a number of issues. Data were re-coded to be compatible with SPSS, so that a *yes* value = A = 1; and a *no* value = B = 0. In that way, the *reference* response (value of 0) was the *no* response. Of the control factors, product descriptions (*PDS)* had all *yes* values, historical financial data (*HFD)* had all but one *no* values; and pro forma financial projections (*PFP)* had all *no* values. For that reason, these three control factors were eliminated. Another check of the data revealed the presence of outliers in the dependent variable. Consistent with conventional criteria (Levine et al., 2011), an outlier was defined as a value = sample mean ± 3 standard deviations. An initial scrub eliminated four records. A subsequent scrub, with a re-defined outlier value after the first scrub, eliminated 19 more records.

The final data set had n = 115 records with no missing or corrupt data, with no outliers, and with viable control factors. A post hoc power analysis, with the same parameters as the a priori sample size calculation, yielded a power = $1 - \beta = .76$ or the ability to detect an effect = .26 with the original statistical power (.80) and confidence ($1 - \alpha = .05$). This was considered acceptable risk and the analysis proceeded.

Study Results

There was one dependent variable in this analysis, and therefore a single analytical, multi-stage effort. The dataset was provided, and then prepared for analysis, using Excel. The dependent variable (funds raised, or *FNDS*) was a continuous, numerical variable expressed as integers (whole dollar amounts) ranging from $7,500 to $125.640 million, with a mean = $10.377 million and standard deviation = $19.863 million. The eight original control factors were categorical with two levels each. The

primary control factor of interest was type of fund source (*TYPE*) with two values: crowdfunded equity (*CFE*) and initial coin offerings (*ICO*). The other control factors were either *yes* or *no*, pertaining to whether the startup company provided various forms of information. Because the control factors were categorical, and the dependent variable was numerical, univariate analysis of variance (ANOVA) was chosen as the statistical methodology.

To perform a preliminary test of assumptions, I ran an initial ANOVA with the full set of control factors, using the SPSS *General Linear Model > Univariate* method (one dependent variable). I selected the numerical dependent variable (*FNDS*) and the categorical control factors as fixed factors. Because the design was not balanced (varying sample size per group), I chose to build the model terms, and chose Type III sum of squares. I selected post hoc homogeneity tests (Levene's test), and I saved unstandardized residuals. These are the assumptions of ANOVA that I assessed:

- The dependent variable was a continuous, numerical variable.
- Each control factor consisted of two or more categorical and independent groups (levels or values).
- Independence of observations
- No time-related relationship between observations (randomized data collection, checked with scatterplot of the dependent variable over time which revealed no visible pattern)
- No significant outliers (as already discussed)

Experimental errors (residuals) were checked in the beginning, and again post hoc, and were approximately normally distributed (a histogram of residuals and a normal Q-Q plot revealed no significant departures from normality and is presented in Figure 3). Homogeneity of variance for each combination of groups/levels/values (Levene's test of equality of error variances) was checked with the original data set, and after each scrub of the data to remove outliers and control factors. Levene's test evaluates the null hypothesis that the variance in the residuals is equal for all groups, as shown in Table 1. In the test, the null hypothesis was rejected, resulting in the conclusion that there was evidence that the variance was not equal. A scatterplot of residuals versus the main control factor, *TYPE*, corroborated the results from Levene's test and is presented in Figure 4. To address this violation in the assumption of homoscedasticity, the first remedy was to remove outliers. A second remedy was to use another statistical test, a *t* test of means for different groups, to assess the difference in dependent variable means for the two groups defined by the main control factor, *TYPE*. Finally, a review of the data set revealed that there was a significant imbalance in samples from the two groups defined by *TYPE*: 84 for *ICO* and 31 for *CFE*. In addition, the values for the dependent variable, *FNDS*, revealed that far more of the high values were associated with *ICO*, thereby exacerbating the imbalance in the data. This imbalance is depicted in Figure 2. In retrospect, it would have been beneficial to perform a stratified sample, based on the stratum, *TYPE*. However, some of the imbalance in the data were due to eliminating variables and records, and so the extent of the imbalance was not known before data collection. Secondly, due to the challenge of creating the data set, obtaining more was impractical.

Therefore, the decision was to proceed with the analysis, and offer prudent cautions about the reliability of the ANOVA results and conclusions.

Figure 2

Funds Raised by Chronological Reference Number

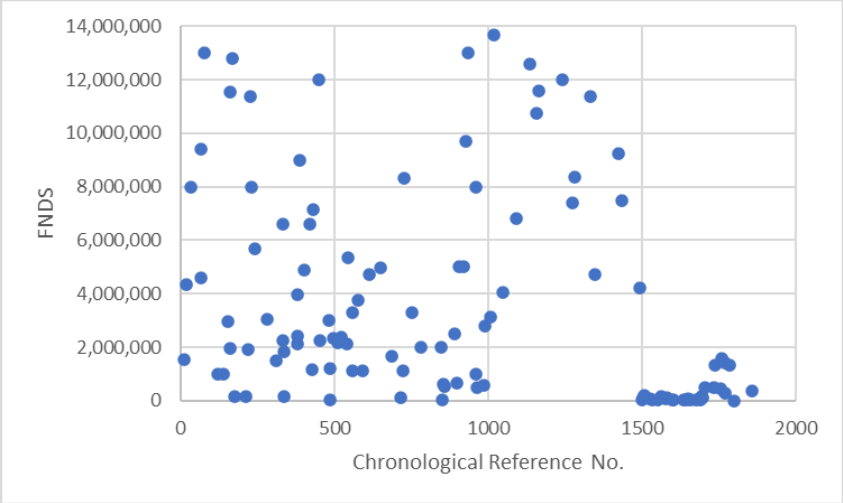


Figure 3

Residual for Funds Raised by Frequency Across Sample

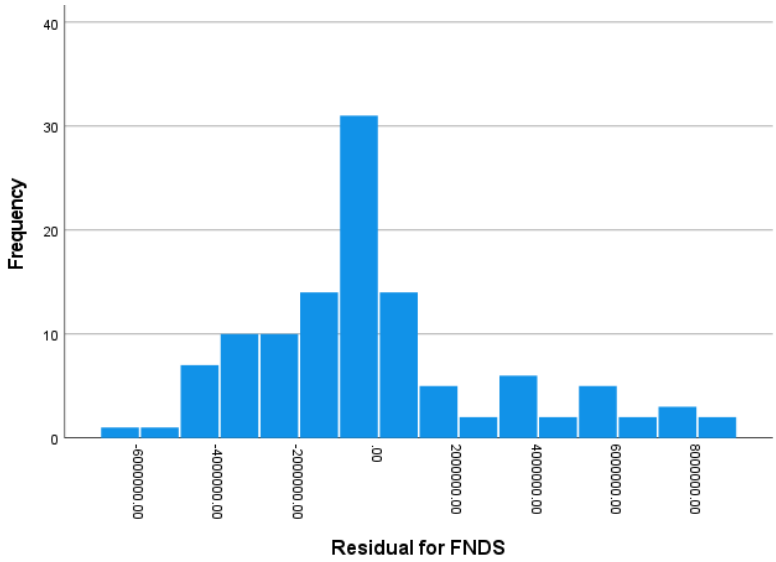


Table 1

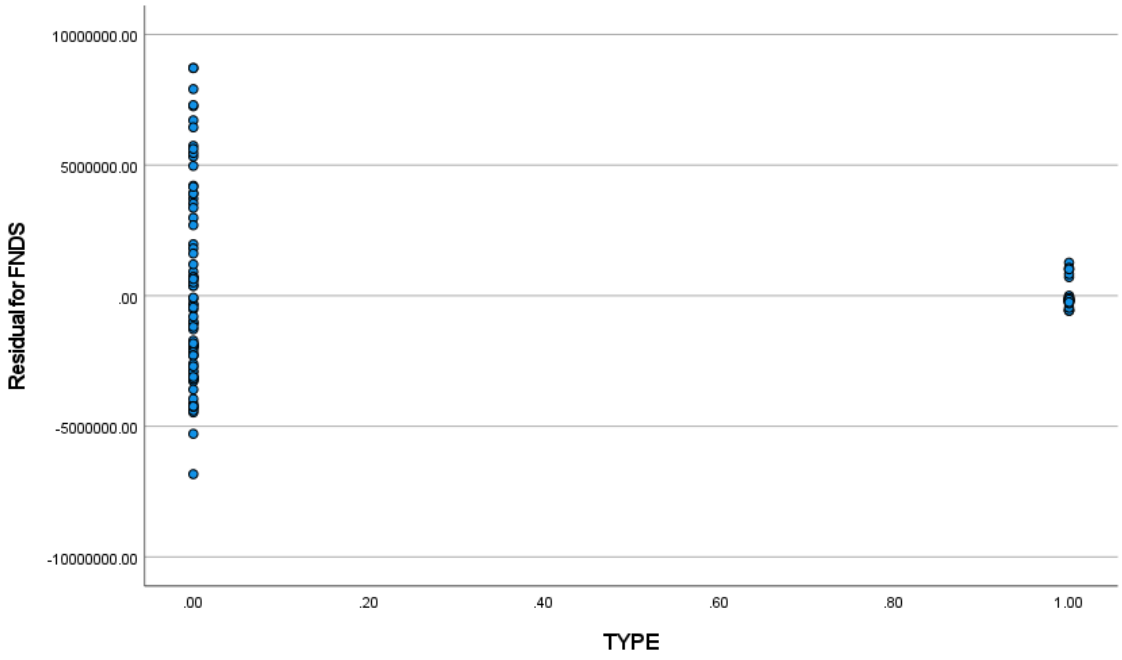
Test of Dependent Variable Error Variance

Dependent Variable: FNDS			
F	df1	df2	Sig.
5	11	103	0

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

Figure 4

Residual for Funds Raised by Offering Type (ICO or CFE)



ANOVA Model-Building

I employed the SPSS *General Linear Model > Univariate* method with one dependent variable (*FNDS*) and the five categorical control factors as fixed factors with

Type III sum of squares. My intent was to use *purposeful sequential model building* employing a series of ANOVAs on various combinations of control factors to find the best predictive model. Because there were only five control factors, I began my analysis with all of the control factors and the 10 two-factor interactions (2FIs). Recent research (see, for example, Heinze & Dunkler, 2017) has argued for avoiding missing variable bias in predictive model-building. This occurs when an arbitrary and overly stringent variable selection criterion is used, like .05. While a level of significance = $\alpha = .05$ is appropriate for testing the hypothesis of the significance of the overall model, it is overly restrictive in model specification. To combat the potential for missing variable bias, Heinze and Dunkler (2017) suggested a more liberal variable selection criterion and a focus on the contribution of each variable to the model's goodness of fit (adjusted R^2).

I evaluated each successive model, considering the influence of each predictor (p value compared to the variable selection criterion; and partial η^2) and a measure of goodness-of-fit (adjusted R^2), to decide which control factors to add or eliminate after each run. To avoid missing variable bias, I used .20 as the variable selection criterion (Heinze & Dunkler, 2017). The process progressed incrementally, run to run, with iteration and various combinations of control factors until the best model was found (highest adjusted R^2, and all terms [control factors and 2FIs] significant [$p <$ variable selection criterion]).

Of note is that the only 2FI remaining at the end of the model building analysis consisted of two original control factors that were not found by themselves to be statistically significant influences on the dependent variable, *FNDS*. Instead, the

combination of these two control factors was found to be an influential predictor. In other words, the combination of these two control factors (their cross product: *COL* × *INV*) acted as a distinct predictor of the dependent variable. Their relationship is shown in Figures 5 and 6 showing non-parallel lines and corroborating the presence of the 2FI. The 2FI indicated that various combinations of *COL* and *INV* predicted distinctly different levels of funding. For example, when both were *yes*, there was an average level of funding. When either *COL* or *INV* were *yes*, but not both, there was a relatively high amount of funding. When *COL* and *INV* were both *no*, there was minimal funding.

Figure 5

Estimated Marginal Means by Company Leadership and Investors

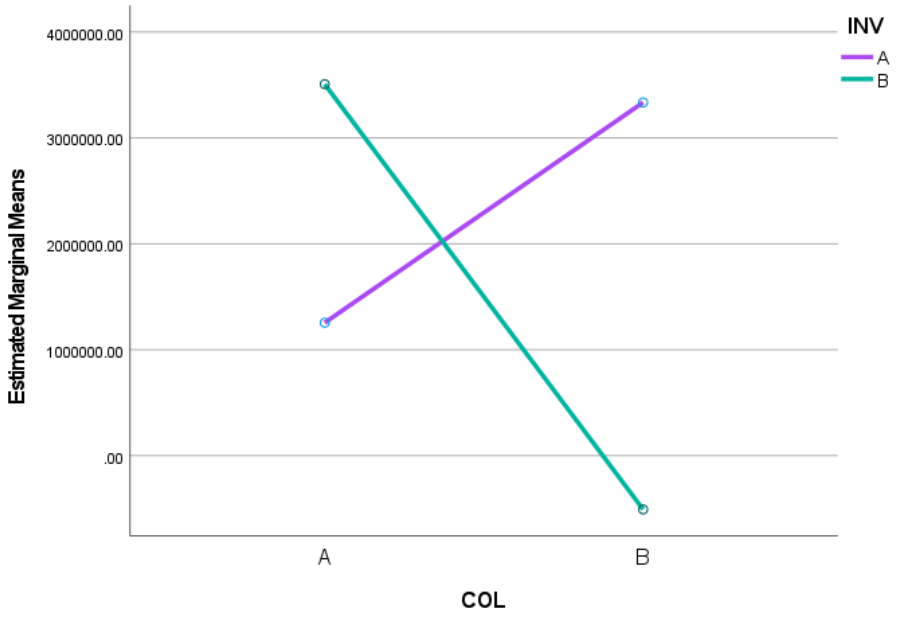
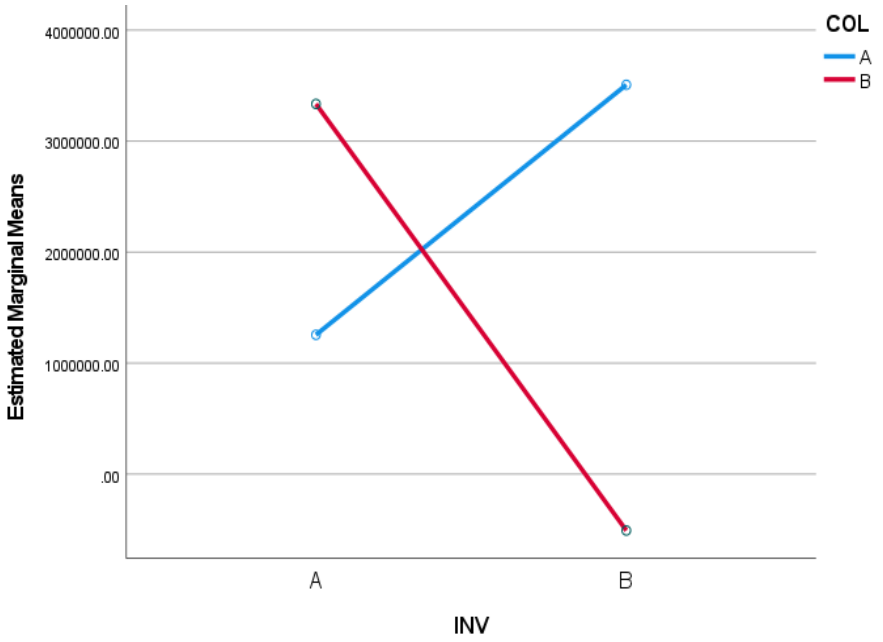


Figure 6

Estimated Marginal Means by Transparency of Investors and Leadership



Selecting and Expressing a Final Predictive Model

The final predictive model from ANOVA can be expressed as a mathematical equation for all factors (control factors) in the model:

$\hat{Y}_{ijk} = \mu_Y + \alpha_i + \beta\gamma_{ij} \cdots$ where

$\hat{Y}_{ijk}$ = the predicted value of the dependent variable (*FNDS*) for record *k* within the group that corresponds to level *i* of factor A (*TYPE*) and level *j* for the 2FI, B*C (*COL*INV*)

μ_Y = the population grand mean of *Y* values

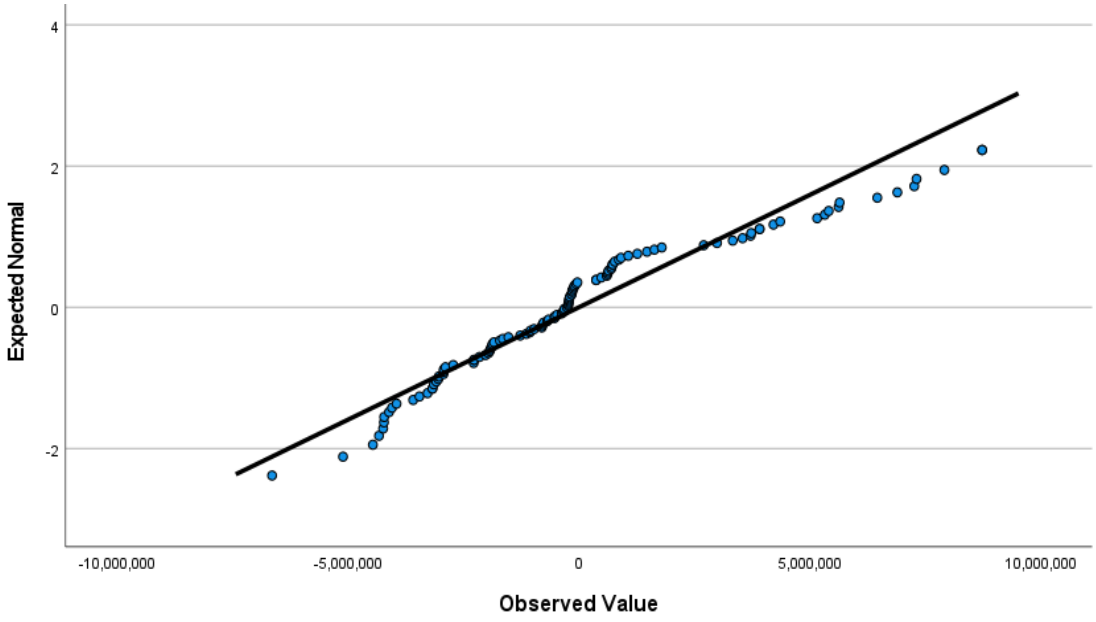
α_i = the effect of the i^{th} level of factor A (*TYPE*)

$\beta\gamma_{ij}$ = the interaction effect for the *i*, *j* cell (interaction between factors B and C, or *COL*INV*)

The equation indicates, the value of *FNDS* for any record (case, combination of values for the control factors) is predicted to be the sum of the grand mean; the effects of factor A (*TYPE*); and the interaction between factors B and C (*COL*INV*). The coefficients in the predictive equation represent the estimated effects in the ANOVA model (a_i, the effect of the i^{th} value of *TYPE*). The difference between the actual value of Y_{ijk} and the estimated or predicted value ($\hat{Y}_{ijk}$,) is the error term, or the residual, for the *k*th record, and is presented in Figure 7.

Figure 7

Expected Value by Observed Normal



The effect for each significant predictor in the final model for this analysis can be derived from the parameter estimates in Table 2:

Table 2

Significance of Funds Raised by Control Factors

Dependent Variable: FNDS

Parameter	B	Std. Error	t	Sig	95% Confidence Int. Lower Bound	95% Confidence Int. Upper Bound	Partial Eta Sq.
Intercept	2452150	979782	3	0	510452	4393848	0
[TYPE=CFE]	-5919648	926960	-6	0	-7756665	-4082630	0
[TYPE=ICO]	0[a]						
[COL=A] * [INV=A]	1763288	1088505	2	0	-393873	3920450	0
[COL=A] * [INV=B]	4015775	1203774	3	0	1630177	6401373	0
[COL=B] * [INV=A]	3843235	1329003	3	0	1209463	6477007	0
[COL=B] * [INV=B]	0[a]						

ANOVA Hypotheses

There are multiple hypothesis tests to perform in ANOVA. When evaluating more

than two control factors, the number of hypotheses increases accordingly. This is the proper form of ANOVA hypotheses for two control factors (factors):

- The hypothesis of *no difference in the dependent variable due to factor A*:

H_0: $\mu_1 = \mu_2 = \cdots = \mu_i \cdots = \mu_m$ (means for all *m* levels of A are equal)

where the number of levels of factor A = m

against the alternative:

H_1: not all μ_i are equal.

- The hypothesis of *no difference in the dependent variable due to factor B* (which, as an example, has two levels):

H_0: $\mu_1 = \mu_2$ (means for both levels of B are equal)

where the number of levels of factor B = 2

against the alternative:

H_1: $\mu_1 \neq \mu_2$ (general form: not all μ_i are equal).

- The hypothesis of *no interaction between factors A and B*:

H_0: the interaction of A and B is equal to zero.

against the alternative:

H_1: the interaction of A and B is not equal to zero

In this analysis, hypotheses were tested using the *F* test (and its *p* value). The *F* test assesses whether a factor predicts the dependent variable (i.e., the dependent variable means are different for various treatments). The hypothesis test results are in the Tests of Between-Subjects Effects table (Table 3).

Table 3

Tests of Between-Subjects Effects

Dependent Variable: FNDS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Sq.
Corrected Model	6E+14	4	2E+14	14	0	0
Intercept	2E+14	1	2E+14	16	0	0
TYPE	4E+14	1	4E+14	41	0	0
COL * INV	2E+14	3	5E+13	5	0	0
Error	1E+15	110	1E+13			
Total	3E+15	115				
Corrected Total	2E+15	114				

Note. a. R Squared = .344 (Adjusted R Squared = .320)

The results of the ANOVA hypothesis tests are as follows:

- The individual control factors were analyzed considering the *F* test, associated *p* value (Sig.), and model selection criterion (.20). For each of the five control factors other than *TYPE*, the null hypothesis was not rejected. There was insufficient evidence to conclude that the alternate hypothesis was true, that there was a difference in mean *FNDS* due to each of these control factors.

- For the control factor, *TYPE*, the null hypothesis was rejected. There was sufficient evidence to conclude that the alternate hypothesis was true, that there was a difference in mean *FNDS* due to *TYPE*.

- Likewise, for each of the 10 2FIs that were analyzed other than one,

considering the *F* test, associated *p* value (Sig.), and model selection criterion, the null hypothesis was not rejected. There was insufficient evidence to conclude that the alternate hypothesis was true, that there was a difference in mean *FNDS* due to each of these 2FIs.

- For the 2FI, *COL*INV*, the null hypothesis was rejected. There was sufficient evidence to conclude that the alternate hypothesis was true, that there was a difference in mean *FNDS* due to *COL*INV*.
- Factor interactions were also evaluated graphically, and only *COL*INV* was evident.

Interpreting, Testing, and Using the Final Model

Various statistical outputs of SPSS can be used to interpret the results:

- Based on the results depicted in the SPSS Tests of Between-Subjects Effects in Table 3, the final predictive model was a statistically significant predictor of the dependent variable, *FNDS* ($F = 14.414$, $p < .001 < \alpha = .05$).
- Based on adjusted $R^2 = .311$ from the same table, the predictive model accounted for approximately 31% of the variation in *FNDS* for the data set. While this might be considered a strong outcome, it does indicate that approximately 69% of the variation in *FNDS* was attributed to noise (statistical variation) or other explanatory factors.

Because the control factor, *TYPE*, was included in the final, significant model, there was evidence that *FNDS* was influenced by the type of fundraising. Since there was a need to be cautious of this conclusion due to the violation of homoscedasticity, I

conducted a *t* test of means using the Two Sample Assuming Unequal Variances routine in Excel, as shown in Table 4:

Table 4

Two Sample Assuming Unequal Variances

	CFE	ICO
Mean	346075	4756464
Standard Deviation	506085	3971506
Observations	31	84
Hypothesized Mean Diff.	0	
df	90	
t Stat	-10	
p (T ≤ t) one-tail	0	
t Critical one-tail	2	
p (T ≤ t) two-tail	0	
t Critical two-tail	2	

The null hypothesis was that the difference in means = 0. Based on the *t* test, its *p* value (one-tail or two-tail), and a level of significance = α = .05, the null hypothesis was rejected. There was sufficient evidence to conclude that there is a difference in mean

FNDS between *CFE* and *ICO* (in this sample, $346,075 compared to $4,756,464, respectively). This is corroborated in the Mean Values Funds Raised for Various Combinations of Control Factors table from SPSS. Table 5 shows the mean values of *FNDS* for various combinations of the control factors:

Table 5

Mean Values Funds Raised for Various Combinations of Control Factors

Dependent Variable: FNDS

TYPE	COL	INV	Mean	Std. Deviation	N
CFE	A	A	7500.00		1
		B	366097.41	517508.20	29
		Total	354144.17	512704.74	30
	B	B	104000.00		1
		Total	104000.00		1
	Total	A	7500.00		1
		B	357360.83	510753.94	30
		Total	346075.00	506085.37	31
ICO	A	A	4177400.00	3715575.34	45
		B	6798125.00	4491326.78	16
		Total	4864803.28	4064253.77	61
	B	A	6295384.62	3530617.55	13
		B	2095000.00	2710827.06	10
		Total	4469130.43	3786597.07	23
	Total	A	4652120.69	3751655.61	58
		B	4989230.77	4493714.65	26
		Total	4756464.29	3971506.01	84
Total	A	A	4086750.00	3725145.99	46
		B	2653040.56	4091731.73	45
		Total	3377772.80	3955122.39	91
	B	A	6295384.62	3530617.55	13
		B	1914000.00	2640851.38	11
		Total	4287250.00	3809047.66	24
	Total	A	4573398.31	3768008.01	59
		B	2507871.88	3840522.28	56
		Total	3567576.74	3926162.17	115

The final model can be used to predict a value for the dependent variable (*FNDS*) based on the values of the predictors in the final model, using the parameter estimates shown in Table 6 from SPSS. Predicted values of the dependent variable can be compared to actual values from the data set as a method of validating the predictive, mathematical model.

Table 6

Parameter Estimates

Dependent Variable: FNDS

					95% Confidence Int.		Partial
Parameter	B	Std. Error	t	Sig	Lower Bound	Upper Bound	Eta Sq.
Intercept	2452150	979782	3	0	510452	4393848	0
[TYPE=CFE]	-5919648	926960	-6	0	-7756665	-4082630	0
[TYPE=ICO]	0[a]						
[COL=A] * [INV=A]	1763288	1088505	2	0	-393873	3920450	0
[COL=A] * [INV=B]	4015775	1203774	3	0	1630177	6401373	0
[COL=B] * [INV=A]	3843235	1329003	3	0	1209463	6477007	0
[COL=B] * [INV=B]	0[a]						

Note that for each of the categorical control factors, SPSS coded their values for the purpose of executing the least squares approach to the general linear model. Therefore, for each control factor, there was a baseline value whose coefficient was zero. All other coefficients reflected the difference in mean value of *FNDS* compared to the baseline case.

As an example, *FNDS* can be predicted for the case when *TYPE* = *CFE*, *COL* = *yes* = *A*, and *INV* = *no* = *B*. The predicted value of the dependent variable was computed as follows (rounded to the nearest whole dollar):

Predicted *FNDS* = 2,452,150 + (-5,919,648) + (4,015,775) = $548,277.

Because of the lack of homoscedasticity, caution should be used in making predictions of *FNDS* based on the data set, and extrapolating conclusions regarding the relationship (influence, predictability) of the control factors with the dependent variable. One control factor was a statistically significant predictor (*TYPE*), meaning the difference in mean *FNDS* due to a different fundraising method was statistically significant. A combination of two original control factors (*COL* and *INV*) was found to be a significant influence on *FNDS*, even though neither was a significant predictor by itself.

It is possible that other factors may be found to explain the variation in *FNDS*. While exploring every possible predictor for *FNDS* was outside the scope of this analysis, it does represent a possible future research topic.

Summary

My research question was as follows: How does capital offering type predict the amount of funds raised while controlling for access to the offering companies' historical

financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors?

Analyzing my study results provided answers to my research question. My first result was that ICO offerings raised greater mean funds than crowdfunded equity offerings. Additionally, I found no significant influence on amount of funds raised due to access to the offering companies' historical financial data, pro forma financial projections, detailed product descriptions, video of product demonstrations, company website, company history, company leadership, and company investors, respectively. Finally, my results showed that there is a statistically significant influence on amount of funds raised due to access to the offering companies' leadership and/or investors when considering these factors in combination with one another. I found that companies seeking crowdfunded capital injection enjoyed greater mean capital injection if they provided public access to either their company leadership or their investors. However, companies providing public access to both their leadership and investors suffered reduced mean funds raised.

These research results yielded three key findings. The first key finding was that offering type matters in crowdfunded capital markets, with investors favoring crypto crowdfunding over equity crowdfunding. The second key finding was that crowdfunded capital investors exhibited information disinterest to company information that is traditionally considered material within capital markets, as reflected in my secondary control factors. My third key finding was that investors in crowdfunded capital markets

prefer selective company information, shunning those that offer too little or too much. In Chapter 5, I interpret my findings in light of current scholarly research, along with discussing limitations of my study and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative study was to compare a group of ICOs versus a group of crowdfunded equity offerings with the intent of identifying predictive factors of those funding outcomes. In this quantitative study, I used ANOVA to compare the amounts of money raised by a group of startups that recently completed ICO offerings, versus a group of startups that recently completed crowdfunded equity offerings. The primary control factor denoted whether each startup in the study relied on an ICO or a crowdfunded equity offering, and this primary control factor was therefore binary. The dependent variable was a continuous numerical variable measuring the amount of money that each startup in my study raised, whether via ICOs or crowdfunded equity. I also examined the influence of secondary binary control factors, expressed as *Yes* or *No*, that signified whether each startup in the sample provided investors with video of product demonstrations, company history, company leadership, and company investors. By conducting these tests, I sought to discover whether participants in ICO and crowdfunded equity markets behaved efficiently.

Regarding my results, only the primary control factor, type of fund source (*TYPE*), was a significant predictor of the dependent variable, funds raised (*FNDS*). The two-factor interaction between access to information on company leadership (*COL*) and information on company investors (*INV*) indicated that various combinations predicted distinctly different levels of funding. No secondary control factors exhibited significant influence in funds raised.

There were three key findings of my research. First, investors in crowdfunded capital markets preferred crypto offerings over equity offerings and, therefore, considered offering type materially important. Second, those same investors did not consider broad access to company information, as captured by my secondary control factors, to be materially important. However, this information is generally considered critical in traditional capital markets. Third, the investors preferred, as shown through greater propensity to invest, companies that provided limited and selected information about their leadership or their past investors. However, companies that offered either both or neither information suffered suboptimal fundraising results. These findings provide important insights into the professional and practical aspects of crowdfunded capital market dynamics, while simultaneously challenging and enriching the broader scholarly literature pertaining to the topic.

Interpretation of Findings

From a professional perspective, my study's key findings lead to important practical interpretations. Regarding the disparity in funding outcomes between the ICOs and crowdfunded equity campaigns in my sample, the critical lesson for market participants is that investors consider type of offering to be important, with a much larger share of their capital being directed toward crypto offerings as opposed to crowdfunded equity offerings. The underlying reasons for investor preference are still unclear, possibly relating to a greater public interest in cryptocurrencies compared to traditional equities, the different mix of industries and human capital within those respective markets, or differences in the makeup of each market's respective stakeholders. While those

underlying causes are of valid interest to future researchers, the important lesson to practitioners today, whether they be investors, entrepreneurs, regulators, or any other stakeholders, is that capital flows seem to favor ICOs, and ICO offerings on average will likely raise more than crowdfunded equity offerings.

That crowdfunded capital market investors exhibited indifference to company information bears important interpretations and implications for those market participants. Many have affirmed the assertion that providing investors with information and transparency will likely optimize fundraising outcomes, like Adhami et al. (2018), Fisch (2019), Ahlers et al. (2015), Gruner and Siemroth (2019), and Mamonov and Malaga (2017). However, my findings suggest otherwise, owing to the insignificant influence of the individual secondary control factors in my study. Investors in crowdfunded capital markets (the majority in my sample being ICO investors) seemingly consider this information to be materially irrelevant when making investment decisions in those spaces. The only exception to this broad information indifference pertained to the investor preference to see either company leadership or prior investors, rather than neither or both. One possible explanation is that capital market investors reward limited information but punish both full opacity and greater disclosure, reflecting an investor preference for information minimalism. These findings bear important implications for any parties interested in optimizing fundraising results in professional practice.

My research findings broadly challenge the prevailing consensus in the literature toward signaling, which holds that investors in crowdfunded capital markets are motivated by signaling factors. Researchers have investigated the existence of signaling

factors in crowdfunded capital markets. For example, Adhami et al. (2018) found that ICOs enjoy an elevated rate of success given the presence of three variables: source code availability, presale organization, and service availability or profit sharing for campaign participants. Fisch (2019) discovered that ICOs that issued white papers with technological language and high-quality source code raised more money on average than firms that did not. One may reasonably infer from my findings that ICO markets therefore function according to some level of efficiency, as investors seemingly weigh public information like those listed previously when deciding if and/or how to participate in crypto offerings.

Other scholars have argued that crowdfunded equity markets exhibit similar efficiencies. Gruner and Siemroth (2019) along with Ahlers et al. (2015) found that entrepreneurs communicate with investors via signaling in these markets. Mamonov and Malaga (2017) found that investors responded to material information provided by startups during the crowdfunded equity process. Similar to the studies on ICOs previously, this research suggests that investors participating in crowdfunded equity offerings base their decisions, at least in part, on the presence, and possibly quality, of publicly available information. These findings align with the general definition of market efficiency according to Fama (1970) and other EMH theorists who define the term according to the ability and propensity of market participants to absorb and analyze relevant information when making rational and self-interested market decisions.

My results, however, challenge these past findings. In fact, companies offering greater transparency did not enjoy greater fundraising success than those that did not

offer transparency. Moreover, none of the individual information sources were influential on fundraising outcomes.

Market behavioralists and crowdfunded capital critics like Lichfield (2018), Quiggin (2013), and Ibrahim (2015) have broadly challenged the assumptions of EMH. My findings strengthen their case that recent and exponential growth in crowdfunded capital markets, particularly regarding ICOs, is driven more by herd mentality and other irrational factors, rather than by efficiency. My findings show a lack of influence on funds raised as a function of the company information provided. This is noteworthy particularly given the basic and fundamental inclination to inform the public of the offering companies' journey and makeup.

The underlying reasons behind capital market investors' disinterest in traditional startup information may stem from any number of sources. One possible reason may be that investors suffer from general information aversion due to factors like stress, information overload, low financial literacy, etc. This may also explain why investors in my study sought only limited information in the form of either company leadership or company past investors while simultaneously turning from those who offered both forms of info, which may have been too much for their prospective investors to ingest and analyze. Conversely, those same investors may have rationally opted not to invest in startups with higher relative transparency because the information they provided may have exposed underlying weaknesses in those startups and possibly in the market, overall. It is also possible that, perhaps due to the fundamental differences in function and form

between traditional and crowdfunded markets, that participants in the latter seek out non-traditional information not captured in this study.

A compelling question following my findings is to consider whether investors who choose to participate in crowdfunded capital markets are driven largely by herd behavior, or whether they are actually weighing salient data and information in a rational manner. My findings suggest that information matters regarding crowdfunded capital outcomes, but what information actually matters to investors, why it matters, and whether its perceived importance is actually rational remain unsettled questions. The discovery that investors much preferred funding ICOs rather than crowdfunded equity campaigns may be due to herd behavior and supported by the work of Bogusz et al. (2020) who found that online interest around crypto dominated social media discussions pertaining to crowdfunding topics broadly. It is also possible that investor preference for information related only to company leadership or past investors is a sign of herd mentality, as those investors may be seeking first-mover advantage by selecting startups that have yet to fully develop, or at least announce, either their leadership teams or their investor bases. Conversely, it is possible that investors were rationally drawn more to ICOs than crowdfunded equity campaigns due to perceived greater opportunity for ROI in the former owing to industry differences compared to the latter.

The question of herd influence in crowdfunded capital markets, therefore, remains unanswered. Given the ongoing implosion of crypto markets worldwide, and in the wake of major crypto failures like FTX (Forbes, 2022) these questions seem even more

pressing, especially considering the much larger share of capital flowing into ICO markets compared to crowdfunded equity, as revealed by my findings.

Amid the polarized debate concerning the perceived merits, opportunities, dangers, and shortcomings of crowdfunded capital markets, my findings offer nuanced and complex insights that may inform the ongoing discussions around ICOs and crowdfunded equity offerings. My findings suggest that some level of efficiency exists in crowdfunded capital markets. The influence of the interaction between access to an offering company's leaders and/or investors on the amount of funds raised suggests that participants in crowdfunded capital markets do, indeed, consume and analyze public information when making investing decisions in those spaces. Investors also seem more attracted to ICOs than crowdfunded equity offerings, which means that preferences exist among investors regarding different types of crowdfunded capital markets. However, the discovery that investors responded positively to access to either a company's leadership or their investors but negatively to access to both (or neither) is a surprising and thought-compelling insight, which may both bolster and challenge the assumptions of crowdfunded capital adherents and detractors, alike.

Rather than settling the debate, my findings enrich the discussion by providing important insights into future research. Future research, however, must remain informed of the limitations to my current study, along with the recommendations that it suggests for future investigators.

Limitations of the Study

A primary limitation of my study was that it investigated correlation not causation. I discovered intriguing relationships between my dependent variables, the primary control factor, and the secondary control factors; however, it is not possible to draw valid assumptions about the causes of those relationships, which could be many. One possible influence not captured in my study, albeit a possible cause of my results, is the influence of insider or privy information on funds raised. If investors seemingly do not consider access to a company's video of product demonstrations, company history, company leadership, and company investors to represent materially important investing information, then it is possible that those investors already possess this information via private channels, possibly due to direct contact with the leadership of those capital seeking companies. A limitation in the secondary data I collected was that most of the sites did not offer a breakdown of how many investors each offering enjoyed, nor how much each investor contributed. This information may have informed whether companies enjoying significant success benefited from one or a few privy investors. Although controlling for outliers in my study may have eliminated a few cases of insider knowledge, the issue still remains a limitation.

Conversely, the results are also limited in their ability to discern rational versus behavioral decisions among the study's investors. Although my results may suggest a large degree of irrational psychology, like potential herd behavior, regarding the lack of significant influence of access to company information on funds raised, it is not possible to draw firm conclusions simply from correlations alone.

A related limitation is that my study relied entirely on publicly available secondary data, so I did not have direct access to input from market participants to know why they made the decisions that they did. A similar limitation exists in that my study was entirely quantitative, versus qualitative or mixed methods, which may have rendered direct contact with crowdfunded capital market participants.

My results captured mean funding differences between ICOs and crowdfunded equity offerings. The reasons for those rather large differences are still a matter of debate, given the reasons discussed previously. The small size of my sample also makes discerning relationships in funding outcomes between the two offering types and my secondary control factors difficult. A larger sample may mitigate this limitation.

Recommendations

Regarding my study's limitations in identifying the influence of privy information or behavioral psychology on my sample's funding results, I recommend that future researchers investigate the influence of direct communications with crowdfunded capital market participants. The use of qualitative surveys among company leadership and investors in crowdfunded capital markets may render valuable insights and discoveries into why and how they make the decisions that they do. Qualitative interviews and focus groups with key stakeholders, like company leaders and investors, may also render valuable insights that remain beyond the scope of my work in this study. Qualitative methods may also assist future researchers in identifying the possible influence of privy information on investment decisions in crowdfunded capital markets, which was a limitation in my study. If future researchers investigate the similarities and differences of

ICOs versus crowdfunded equity offerings, I recommend a larger sample that more closely balances the two types of offerings. Researchers interested in determining causality may also consider sampling through controlled experiments that are more capable of these discoveries. These efforts may help to determine the actual drivers of crowdfunded capital outcomes, whether they are based primarily on behavioral influences, access to insider information, or some other reasons entirely.

A key finding from my study was the large difference in mean funds raised between ICOs versus crowdfunded equity campaigns, with the former enjoying a considerable funding advantage over the latter. However, identifying the reasons was beyond the scope of my research. Any number of reasons may account for larger amounts of capital flowing toward ICOs compared to crowdfunded equity, including differences in types of firms that respectively gravitate toward those different markets, along with divergent public attitudes toward the directions of long term economic growth and innovation. Future researchers should investigate these results and work to identify their causes.

A second key finding from my research was that none of my secondary control factors had a significant influence on funds raised, including investor access to assumedly important information like video of product demonstrations, company history, company leadership, and company investors. However, the specific reasons behind this information indifference are still unclear. I urge future researchers to investigate why investors may not consider access to this information important, and whether prevailing attitudes are rational or not. Crowdfunded equity markets remain promising in a variety of ways,

including their potential to transform and improve the world's socio-economy, but they also harbor many risks. Future researchers could strengthen the promise and mitigate the peril by investigating my findings further.

A third key finding from my research was the discovery that the interaction between access to company leadership and company investors was a significant influence on funds raised; however, investors gravitated toward companies that only provided access to one or the other and shunned those that offered both or neither. Future research into this phenomenon utilizing surveys, focus groups, interview, and controlled experiments may help to explain the reasons for this unexpected outcome.

Implications

My study promises many opportunities for positive social change. Many individuals and families have entered into the crowdfunded capital space, including both the ICO and crowdfunded equity markets. These market stakeholders include those who are seeking capital for startups and entrepreneurial endeavors but who lack access to traditional capital markets. This lack of access may stem from entrepreneurs' inability to make connections and contacts with accredited investors, which are needed to participate in traditional capital markets like IPOs. Many entrepreneurs from economically marginalized backgrounds and experiences may suffer from these restrictions, thus making it more difficult to thrive and succeed. Many entrepreneurs and startups also lack the proof of success needed to meet and adhere to many traditional underwriting requirements prior to launching an IPO or from seeking capital via some other traditional means. My findings may inform startups and innovators in terms of what kinds of

ventures investors, whether accredited or not, may be interested in supporting withing the crowdfunded capital sector. For example, my results show that a strong propensity among the investment community exists to participate in crowdfunded capital markets, most especially in the ICO markets. Individuals and organizations may also benefit from my findings by understanding what information investors seek when launching crowdfunded offerings, along with what information they are not seeking. These insights may improve success outcomes for entrepreneurs who need starting capital.

Similar opportunities for positive social change also apply to the investment community. Both accredited and nonaccredited investors alike have chosen to participate in crowdfunded capital markets, especially the ICO sectors. My findings may help other investors to know what information fellow investors are interested in seeing, thus improving the odds that they select to support enterprises that enjoy viability among the larger investment community.

My findings should also inform investors of the potential perils and challenges of entering into crowdfunded capital markets, as well. As my results show, crowdfunded capital markets function in ways that are difficult to explain compared to traditional equity markets, and it is often difficult to know what ventures will likely receive funding aside from one's own, or which ones will likely survive long term, simply from perusing the information and data that are typically considered fundamental in traditional equity markets. My study should inform investors who wish to participate in ICO and crowdfunded equity markets that they enter with a large degree of peril to their own fortunes, albeit perils that also come with many opportunities. Until crowdfunded capital

markets are better understood within the literature, a large amount of risk and mystical thinking will always exist around them, and my findings may underscore this point for all who wish to participate in them.

My study may benefit the larger crowdfunded capital markets, along with the broader stakeholder communities that they serve. Though crowdfunded capital markets harbor much risk and uncertainty, they also promise much opportunity and transformation potential. The better entrepreneurs, investors, employees, regulators, scholars, and the general public understand the dynamics of these markets, the more likely it will be that those exchanges and technologies may provide tangible benefit to our collective lives. Though my results have not answered all questions surrounding the myriad uncertainties of crowdfunded capital, my findings do add to a share of the existing knowledge, which may inform others moving forward.

Conclusions

With the torrid and tumultuous rise of crowdfunded capital markets, the public and academic narrative surrounding ICOs and crowdfunded equity offerings continues to unfold along often sharply disagreeable, even divisive, lines. Despite much criticism and skepticism regarding the safety, sustainability, and viability of crowdfunded capital markets, innumerable investors, entrepreneurs, and stakeholders have and continue to participate in those spaces, often with little or no guidance regarding best practices or reasonable expectations. My study provides a valuable contribution to the scholarly literature, research, and body of knowledge by providing new discoveries and novel insights into the often-mysterious functioning of crowdfunded capital offerings. Scholars

and practitioners alike may glean useful knowledge from my research, particularly when attempting to understand or navigate different kinds of crowdfunded capital markets (i.e., ICOs versus crowdfunded equity). Through this knowledge, those participants may achieve greater results, enjoy better outcomes, and accomplish optimal innovation in these emergent, enigmatic, perilous, and promising marketplaces.

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