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INITIAL EXCHANGE OFFERING AND THE PRESENCE OF UNDERPRICING

Bachelor Thesis
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Abstract

Cryptocurrency and blockchain entail various disruptive aspects, especially in finance. One of them is the formation of new financing mechanisms through the offer of tokens. Although they have opened new avenues for investors and allowed a vast number of entrepreneurs to raise a substantial amount of capital, the knowledge about their economic purposes and performance remains fragmented and heterogeneous. While initial coin offering (ICO) has been a more prominent focus in past studies, few to none encompass initial exchange offering (IEO). This paper is leveraged to address this gap and to provide a better understanding of IEO by primarily analysing the shift from crowdfunding, then, it considers the underlying technology and the wide variety of tokens. Subsequently, the main rationales are underlined, dividing into the incentives for both entrepreneurs and investors as well as challenges around the concept. Followed by an empirical examination and theoretical explanations for the findings of underpricing in this novel mechanism, in certain cases, results are connected to earlier ICO and IPO studies. For this research, a sample of 105 IEOs was manually collected and statistical descriptive tools, as well as a robust regression model, were conducted. It is discovered that the presence of underpricing is significant and IEOs are subject to heavy underpricing. Moreover, a set of variables that could influence the magnitude of underpricing was presented, suggesting for instance that greater issue size has significant effects whereas an optimistic market would likely increase underpricing.

Keywords: Initial Exchange Offering, Underpricing, Initial Coin Offering, Cryptocurrency, Investment Returns

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List of Abbreviations

ATH	All-Time High
BaFin	Bundesanstalt für Finanzdienstleistungsaufsicht
CBIRC	China Banking and Insurance Regulatory Commission
DApp	Decentralized Application
DLT	Distributed Ledger Technology
FCA	Financial Conduct Authority
FINMA	Financial Market Supervisory Authority
ICO	Initial Coin Offering
IEO	Initial Exchange Offering
IPO	Initial Public Offering
MSA	Monetary Authority of Singapore
SEC	Security Exchange Commission
SME	Small and Medium-sized Enterprise
ROI	Return on Investment

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1. Introduction

Nearly a decade has passed since the introduction of Bitcoin – the first cryptocurrency and blockchain technology. Its first commercial transaction was in 2010 for the purchase of two pizzas with 10.000 Bitcoins (Popper, 2015). Twelve years later, those Bitcoins are worth approximately \$381 million, more than the market value of Borussia Mönchengladbach (TransferMarkt, 2022). The swift growth of Bitcoin price has turned many of its adopters rich overnight and people have started to wonder whether they should jump on this bandwagon. This very question represents a challenging debate in today's investment market: enthusiasts think that these cryptocurrencies would continue to rise in value and that they would eventually replace fiat money, whereas sceptics like Warren Buffett (cited in Bove, 2022) call them “rat poison” with “no unique value at all”. Nonetheless, the entire blockchain-based tokens market is now valued at almost \$2 trillion¹ with around 16 thousand different assets, pressing the need for further understanding on the topic (CoinMarketCap, 2022a).

Since its inception, the revolutionary blockchain technology has been disrupting industries and creating new business models. As these ventures require financial capital to foster growth, emerging from this scene and its underlying technology, a new fundraising mechanism known as initial coin offering (ICO) was proposed by Willet (2012). This new concept rapidly expands, hereby, capital investment is exchanged for newly issued tokens directly between the company and investors. However, few compliance requirements and regulations are in place to control, as a result, any project could launch ICO, including scams and frauds. To mitigate the main problem of ICOs while preserving their advantages, initial exchange offering (IEO) started to rise in 2019, during the market downturn of its predecessor. Instead of having issuers administering the token offering themselves, the latter form of financing restores the role of an intermediary – taken by a cryptocurrency exchange. By adding an extra layer of due diligence and the reputation of an exchange, IEO is considered to be “the next evolution in cryptocurrencies” and outweighing ICO performance (Anson, 2021, p.110). To illustrate its success, Binance, one of the biggest IEO platforms, has presumably raised over \$121 million for 62 projects (Binance, 2022). Not only that many IEOs were successfully concluded in a matter of minutes, but they also have astronomic returns.

Despite the increasing interest and number of IEOs, little is known due to their recentness. Only a handful of studies about IEOs could be constated, focusing mostly on the comparison between different financing methods (Anson, 2021; Miglo, 2021;

¹ In 2021, it also reached a record of \$3 trillion (CoinMarketCap, 2022a).

Myalo, 2019). This exploratory research aims therefore to fill such a literature gap, through the analysis of IEOs and their intriguing returns. Thus, in addition to a literature review, it attempts to provide an answer on the presence of underpricing in IEOs along with possible explications for this event through a quantitative study. As underpricing signifies that issuers could have accessed a larger amount of capital and token offerings could yield effective gains for investors. The research may serve entrepreneurs in their pricing of tokens, while proposing investors with a supplementary tool to evaluate their investment.

Accordingly, the paper would initiate with a review of key aspects that shape IEOs. In the first step, it evokes the notion of crowdfunding, an established financing instrument that token offerings bear a resemblance. Afterwards, the underlying blockchain technology would be briefly explained to display IEOs' tokens development and subsequently the classification of tokens. ICOs would then be described prior to the analysis of IEOs, which includes its process and overview of the market. Thereafter, the economic rationales would highlight incentives of entrepreneurs, investors and set out current challenges faced by IEOs. To provide a theoretical framework on underpricing, a definition would firstly be given, followed by important theories of the phenomenon. Additionally, observed underpricing results in ICOs would be used as guidelines for the following empirical work. Finally, the paper states the findings, their discussions, and concludes on the research.

2. Overview of the IEO Concept and Underpricing

2.1. When Finance Meets Technological Revolutions

The birth of every technology and its adoption often engender numerous innovative approaches and concepts for businesses. For blockchain, among other things, it redesigns financial transactions while introducing the new category of cryptocurrency and token offerings. To understand the latter form of financing, it is of essence to consider crowdfunding, a financing method brought to finance by the internet revolution, as well as what the underpinning technology of IEO offers.

2.1.1. Crowdfunding

One of the most recognized challenges for every business project is to find financing support. Regardless of the funding instrument², this problem persists when businesses are in their early phases (Berger and Udell, 1995; Cosh, Cumming and Hughes, 2019;

² Common instruments at this stage are, for example, venture capital, angel investment and incubators.

Schwienbacher, 2019; Tomczak and Brem, 2013). A relevant option for entrepreneurs is through angel investors or venture capitalists, which often takes place after or along with their personal funds and available capital from private connections (McKaskill, 2009; Tomczak and Brem, 2013). However, as there is typically a stage when either the amount required is too small for these investors, lack of collateral or the project is in-between a stage of potential failure and success, consequently, it is deemed unattractive for large investors and many innovative ideas have been shut down (Casamatta and Haritchabalet, 2011; Collin and Pierrakis, 2012; Pope, 2011; Steinberg and DeMaria, 2012).

It is exactly this struggle for new ventures to obtain funding and the advent of Web 2.0 that has fuelled the rise of crowdfunding³ as an alternative method to raise seed capital, especially for start-ups and SMEs through the consolidated investment of multiple smaller investors instead of specialized ones (Moenninghoff and Wieandt, 2013; Tomczak and Brem, 2013; Schwienbacher and Larralde, 2010). The process takes place via online intermediation platforms⁴, allowing firms to obtain investment from larger audiences as well as recognition from future potential customers (Belleflamme, Omrani and Peitz, 2015). Separated into two main categories: reward-based crowdfunding, where investors receive a reward such as future products, and investment-based crowdfunding, where financial gains such as equity can be expected (Agrawal, Catalini and Goldfarb, 2011; 2013; Ahlers *et al.*, 2012; Belleflamme, Omrani and Peitz, 2015; Kuppuswamy and Bayus, 2013). The capabilities of crowdfunding have been thoroughly studied by many scholars, for instance, the work of Burkett (2011), Steinberg and DeMaria (2012), Calic and Mosakowski (2016), Koch and Siering (2015) or Mollick (2014). Indeed, the access to investment was unevenly distributed among different business areas before the concept of crowdfunding. Hence, the success of crowdfunding lies in its transformation from the traditional financial intermediary to a simple, accessible, yet low-cost website, especially in post-financial crisis time (Haas, Blohm and Leimeister, 2014). Schwartz (2016, p. 662) additionally states that “inclusivity is core to the nature of crowdfunding as a distinct form of capital raising.”

However, a major disadvantage of (equity) crowdfunding is illiquidity, i.e. investors face the problem of locked-in investment. While in traditional markets, secondary markets present as a common exit option where investors can sell their assets to other investors, crowdfunding's only exit options include share buyback schemes, trade sales⁵, or stock market sales after an initial public offering (Freedman and Nutting, 2015; Schwienbacher,

³ Defined by Ordanini *et al.* (2011, p.1) as an investment in a project through “a collective effort by people who network and pool their money together, usually via the internet”.

⁴ Popular crowdfunding platforms are for example Kickstarter and Indiegogo.

⁵ I.e. when a third party that acquires the startup purchases all outstanding shares.

2019). Even though some platforms⁶ were created to address this need for a secondary market for crowdfunded equity assets, it is important to note that firms are not required to disclose additional information, thus, these platforms remain only as a place where buyers and sellers can meet instead of how a public stock exchange⁷ would function (Lukkarinen and Schwienbacher, 2020). Additionally, they also employ stricter rules for users to avoid highly demanding legal regulations on trading systems and facilities that additionally, vary from country to country (Furnari, 2018; Lukkarinen and Schwienbacher, 2020). However, the shares of crowdfunding themselves are highly illiquid, given the difficulty for price termination as well as the size of the ventures⁸ (Andrieu and Groh, 2020; Lukkarinen and Schwienbacher, 2020). To counter these drawbacks, a wide range of scholars proposed blockchain technology as a potential solution (Ante and Fiedler, 2020; Sahdev, 2017; Schwienbacher, 2019).

2.1.2. Blockchain

Blockchain technology is created in 2009 by Satoshi Nakamoto⁹, following the global financial crisis and in some way, it represents an urge to bail out the instability of the existing financial system through the currency it is identified with (Nakamoto, 2008). It is the first official launch of a completely secured and autonomous digital currency, namely bitcoin, a cryptocurrency that aims to enable instant borderless transactions (Nakamoto, 2008). Interestingly, the idea is very close to what the economist Milton Friedman predicted in 1999 during an interview: “The one thing that’s missing, but that will soon be developed, is a reliable e-cash, a method whereby on the Internet you can transfer funds from A to B without A knowing B or B knowing A”. The popularity of bitcoin in the past decade in fact can be demonstrated through its skyrocketed value despite concerns about its excessive volatility, from nearly zero to an all-time high of roughly EUR 54.000 in November 2021 (Statista, 2022).

Cryptocurrency and its aim for disruption are empowered by the innovative blockchain concept. Of which, a public blockchain¹⁰ is a distributed ledger without requiring any central third-party intermediary because its data can be accessed and stored permanently by all network users, as well as providing them with the possibility for a peer-to-peer transfer of digital assets (Fanning and Centers, 2016; Nakamoto, 2008; Yermack, 2017). This process is permissionless¹¹ and has proven that under some

⁶ E.g. www.seedrs.com

⁷ A regulated market where all shares are listed and are allowed to trade.

⁸ Some markets' regulations restrict trading, e.g. in the United States, crowd-funders are restricted from selling their assets during the first year of ownership (SEC, 2016).

⁹ As the true identity remains unknown, the pseudonym of Bitcoin publisher is used to refer to its creators, whether it is an individual or group of people.

¹⁰ Hereinafter shortly referred to as blockchain.

¹¹ In contrast with a private and permissioned blockchain

conditions, is even more efficient than the traditional centralized system (Berentsen and Schär, 2018). By employing cryptographic signatures, authenticity and integrity are guaranteed along with the user's privacy. Additionally, being a shared ledger, past transactions are saved across the blockchain, meaning it is accessible to its users, yet manipulation is not possible. Therefore, qualifying Distributed Ledger Technology (DLT) is a secure, verifiable, and transparent system that can greatly strengthen financial transactions. In light of this, DLT has been recognized as a foundational technology and its revolution would probably even surpass the one brought by the Internet (Iansiti and Lakhani, 2017; Maull *et al.*, 2017; Nowinski and Kozma, 2017).

A few years after such creation, the concept of Bitcoin has been taken further by the second generation of blockchain, led by the Ethereum blockchain, with the goal to not only transacting cryptocurrencies but also other tokenizable values of physical or utility assets like music rights, shares of stock, loyalty points, commodities or even properties (Buterin, 2013; Chen, 2018). In other words, Ethereum's creators intend to design a general-purpose technological platform where other decentralized applications and digital assets that represent any kind of promise to its owner, to be built upon (Buterin, 2014; Wood, 2014). These digitizable values are commonly named tokens¹², which can also give the holder access to the respective blockchain platform and track for token's owner or balance of each token address. The introduction of the Ethereum blockchain thus paved the way for the development of smart contracts (Andoni *et al.*, 2019). In other words, additional complex information can be coded automatically onto blockchain transactions, enabling more than just an exchange of assets but rather an official agreement between both involved parties which can hold them responsible, i.e. a contract (Savelyev, 2017; Tapscott and Tapscott, 2016).

Such development in turn ensues the emergence of decentralized applications (DApps), as they typically operate through smart contracts (Andoni *et al.*, 2019). DApps are applications that are built on top of a blockchain platform and can operate autonomously, instead of a computer system operated and owned by a single organization, hence the term decentralized (Andoni *et al.*, 2019; Johnston *et al.*, 2014). Its ownership is diluted and can be represented by the tokens distributed to the application's users (Johnston *et al.*, 2014). Along with Ethereum facilitating the tokenization of assets, several applications have already been incorporated into several operations and financial transactions namely logistics and trade (Cong and He, 2019). Hence, the vast disruptive potential of blockchain significantly expands, empowering the growth of diverse cosmos of projects as well as tokens.

¹² Unlike cryptocurrencies whose goal is to replace the traditional physical fiat money.

2.1.3. Diverse Perspectives on the Taxonomy of Digital Assets

The umbrella of digital assets covers many important and disruptive concepts, including cryptocurrency, coin, and token. These assets have gained enormous exposure over the last years due to their meteoric rise that turned many into millionaires. Stirring the public interest to trade and speculation of cryptos. Moreover, their popularity has been fostered through extensive promotion by influential figures, as well as governments' interest in the creation of their own digital currency¹³.

Although cryptocurrency, the pioneer of digital assets, can simply be understood as a privately issued currency to be used within an ecosystem as a medium of exchange, a sort of monopoly money, its universe has surpassed the mere currency applications (Dhaliwal *et al.*, 2018; Rohr and Wright, 2018). Also, it is important to note that there is no clear consensus on whether the term “token” and “coin” are synonyms, or if they actually designate two different crypto assets. Some scholars, like Beerbaum (2019), Momtaz (2019), Gurrea-Martinez and Remolina (2018), employ them interchangeably in their research. Conversely, other authors attempt to draw a distinction, for instance, Wu, Wheatley and Sornette (2018) state that coins operate on their independent blockchain¹⁴, while tokens operate on top of a coin platform. Under this angle, the name Initial Coin Offering becomes misleading as most of its offerings are meant for “tokens”, per this definition. On the other hand, Gandai *et al* (2021) and various other websites for cryptos distinguish coin as a payment method while token is considered as access to a product or service¹⁵. Meaning, “coin” is a synonym for “cryptocurrency”.

Nevertheless, tokens and coins are both typically created via capture of value and digitalization of assets, i.e. tokenization process. These digital assets are beyond tangible assets and can include copyright, voting rights, and utility. It enables these encrypted values to be traceable and operable in the blockchain system while attempting to reinforce the power redistribution across the network (Freni, Ferro and Moncada, 2020). While the Internet provides an era of free, fast, and efficient diffusion of information, blockchain strives to achieve a divisible, borderless, low-cost transaction of value (Easley, O'Hara and Basu, 2019). Blockchain also introduces the concept of scarcity, which potentially appreciates over time. Moreover, while economics observes and predicts outcomes, tokenomics works on design goals. Hence, token issuers can structure and define their set of rules, including their usage, policy as well as users'

¹³ I.e. Central Bank Digital Currency, see Bordo and Levin (2017) for more information on the topic or the European Central Bank's report on a digital euro (2020).

¹⁴ Also known as native coin or the official currency of a blockchain i.e. “native” to its own blockchain.

¹⁵ Given the diverse opinions on the terms, this paper will remain neutral and the usage of “token” will imply both token and coin in a generic sense, i.e. “token/coin”.

incentives. It becomes thus as essential as challenging to comprehend the fundamentals of tokens, due to their highly diverse features.

Several taxonomy frameworks for tokens have been proposed. Hacker and Thomale (2017) present one of the first and most commonly used classifications which characterize tokens into three main categories of currency, utility, and investment. Currency tokens¹⁶ are used for payment of other tokens, often a result of a new cryptocurrency launch, like traditional currency but they are decentralized, traceable, and transparent while utility tokens¹⁷ give functional usage, for example, to access a service or product (Hacker and Thomale, 2017). Investment tokens on the other hand usually consist of economic or administrative rights towards the business project, thus, they can be distinguished as equity, debt, or security tokens. Supporting this idea, many authors like Liu and Wang (2019) distinguish tokens into cryptocurrency, utility, and security. The distinction between utility tokens and security tokens is frequently made by some authors and jurisdictions such as the Financial Conduct Authority (2019) in their guidance of crypto assets¹⁸ or the paper of Howell, Niessner, and Yermack (2020).

However, Gurrea-Martinez and Remolina (2018) argue that such classification is misleading because a security token from a legal perspective can function as a utility token. Accordingly, Euler (2018) approaches tokens from five different perspectives: their purpose, utility, legal status, underlying value, and technical layer, thus, attempting to capture the heterogeneous character of tokens. Whereas Mougayar (2016) proposes to classify tokens upon three dimensions: role, features, and purpose while focusing on its business aspects and holders' incentives. Based on the former two studies, among others, comprehensive research on taxonomy is conducted by Oliveira *et al.* (2018) where they display an extensive literature study and expert interviews. The outcome consists of 8 archetypes¹⁹ to portray the recurring technical and business aspects of tokens.

Insofar as its novelty and broad scope of capabilities in terms of innovation, the conception of token's definition and taxonomy should probably be dynamically approached, accompanied with an iterative mindset. The topic is additionally crucial to be shed light on due to legal issues it entails, notably, in the regulation of token trading and offering markets (Annunziata, 2020). As a matter of fact, given that tokens can be

¹⁶ For instance, users often trade Bitcoin or Ethereum in exchange for other tokens.

¹⁷ Filecoin raised over \$250 million in 2017, its utility tokens are meant to give the right to use the cloud-based storage decentralised network (Burilov, 2018)

¹⁸ The third category of token according to this guidance is exchange tokens, which are used as a decentralized tool of exchange without traditional intermediaries (Financial Conduct Authority, 2019).

¹⁹ Archetypes include cryptocurrency, equity token, funding token, consensus token, work token, voting token, asset token and payment token (Oliveira *et al.*, 2018, p.10)

designed to function similarly to crowdfunding's pre-orders and investment, a new fundraising mechanism is soon captured by blockchain developers (Belleflamme, Lambert and Schwienbacher, 2014).

2.2. A New Age of Financing?

Crowdfunding has provided businesses and investors with vast opportunities, yet illiquidity remains a major disadvantage. Blockchain on the other hand enables faster, more secure cross-border transactions while tokens could contain inestimable types of asset and value. A combination of both attempts to further advance capital financing and gives rise to token offerings. In view of the cornerstone role played by ICO, it would be evoked to allow a better understanding of IEO, following by the process and the current market of IEO.

2.2.1. Initial Coin Offerings

Perceived as the technological upgrade of crowdfunding by using blockchain technology, ICO is defined by the European Markets and Securities Authority (2017) as "an innovative way of raising money from the public, using so-called coins or tokens". Additionally, it does not require intermediary and therefore cutting out most transaction costs while the issuing tokens can be publicly traded (Momtaz, 2021). Consequently, it emerges as a new lower-cost fundraising method for organizations, especially for blockchain-based projects (Chuen, Guo and Wang, 2017).

Since the widespread adoption of Ethereum's smart contracts, the market of ICOs exploded in 2017 and by the end of 2018, over three thousand firms have raised more than \$21 billion (Momtaz, Rennertseder and Schröder, 2019). Such technology facilitates the issuance and distribution of digital tokens coded on top of the blockchain in secured and controlled transactions (Buterin, 2013; Glaser, 2017; Xu *et al.*, 2017). The main features of this offering are its inexpensive yet efficient process, accessing larger pools of investors, and global outreach while enabling entrepreneurs to already build a user base (Adhami, Giudici and Martinazzi, 2018). Additionally, the issuance and sale of tokens have a manifold role that can be used by developers to accomplish both functional and socio-economic targets of their ecosystem (Dhaliwal *et al.*, 2018). Through token offerings, developers can engage or even cooperate with early token holders and further diffuse as well as develop the blockchain project (Dhaliwal *et al.*, 2018; Massey, Dalal and Dakshinamoorthy, 2017). As previously assessed in the taxonomy of tokens, although the complexity and variety of tokens are difficult to tame and legally control, it also means that its potentials are yet to be explored and for entrepreneurs, implying a multitude of business opportunities.

If one may attempt to compare ICO with past methods, crowdfunding would bear most similitudes. In fact, these mechanisms provide ways of fundraising from a vast number of different investors without requiring distribution of ownership or business control²⁰ (Venegas, 2017). Interestingly, the idea of fundraising with crypto was already described in 2014 based on crowdfunding, in a paper called “The Bitcoin Model for Crowdfunding” by Ravikant (2014 cited in Arnold *et al.*, 2019). In his work, similar to ICOs, the process of funding, collection and development can all be participated by all users of the blockchain in an anonymous way (Arnold *et al.*, 2019). Moreover, crowdfunding platforms have also considered shifting to the blockchain. In fact, Kickstarter has initiated with an announcement called “The future of crowdfunding creative project”, claiming to improve the launch of projects through blockchain as well as its participation (Chen and Hasan, 2021). However, an important difference between ICO and crowdfunding is the ability to bypass intermediaries of ICO thanks to blockchain infrastructure, while crowdfunding takes place on specific platforms. Furthermore, the liquidity and tradability in secondary markets that ICO offers, also increase its appeals to global investors (Massey, Dalal, & Dakshinamoorthy, 2017).

Despite vast motives in token’s offering participation, from early adopters, speculators to long-term investors, they all contribute to the shaping and advancement of a project while being exposed to important risks. While the ability to raise money seamlessly without many requirements, nor a working prototype, is an important advantage for issuers, it also indicates a lack of protection for investors (Venegas, 2017). Subsequently, although the name ICO appears to be alike with Initial Public Offering (IPO) and both are adopted to generate wealth and equity for firms, its processes are unmatched in terms of regulation and distribution (Ellis, Michaely and O’Hara., 1999; Chuen, Guo and Wang 2017). Under IPOs, firms are ensured to disclose truthful and accurate information through extensive compliance and requirements with, for instance, the Securities Exchange Act of 1934. Therefore, the process is extensive and requires multiple professionals on board to improve transparency, whereas ICOs do not have any official prerequisites or regulations, making them prone to numerous scams and frauds.

2.2.2. Initial Exchange Offerings: ICOs’ Successor

Along with the emergence of ICOs, exchange platforms began to cooperate and partner with promising projects by offering advantages such as direct access and token distribution. In fact, their reputation is committed to the project and they position themselves as a filter layer i.e., an intermediary is brought into the process (Allen, Fatas and Weder di Mauro, 2022). While under ICO, the founders of the project would sell the

²⁰ Such characteristics however also imply that investors receive limited compensation from the issuer compared to bearing risks.

tokens directly to the investors, under initial exchange offerings (IEOs), the organization would use the service of an exchange platform for cryptocurrencies to conduct their offering as means to differentiate their quality (Capatina, 2018). Consequently, the role of crypto exchange is no longer limited to a liquidity provider and where buyers are matched with sellers but has expanded towards a trusted intermediary for token offerings, while putting the exchange's credibility on the line. As put forth by Bunduchi (2008), general customer trust in exchange is highly sensitive and each service failure towards a specific customer may decrease its overall reputation.

Moreover, during IEOs, exchanges are not just directly involved in the verification and organization of projects, but they are also the key marketing partner role and ultimately the organizer of token offerings. Hereby, a project needs to satisfy certain prerequisites before its launch (Doe-Bruce, 2019). By conducting the sales through an exchange, all users of the trading platform can participate in the distribution of tokens. Thus, expanding the reach of the offering. The concept of IEO initiates in 2019, with the goal is solve past problems associated with ICO and consequently, among other benefits, improving the delay that frequently occurred in token listing post offering, while solving liquidity problems and reducing risks for investors. However, the re-introduction of intermediary also means that it erases ICO's solution to exclusion issues that are confined by past fundraising methods.

As previously assessed, crowdfunding platforms take a gatekeeper role and screen projects beforehand to prevent potentially failing start-ups, this also implies that they can fully control and limit certain projects whether through prerequisite establishments or arbitrary valuations. Ultimately, "a direct affront to the goal of inclusivity and unmediated access to the crowd" (Schwartz, 2018, p. 888). Therefore, crowdfunding's inherent gatekeeping tension presents both an advantage, for efficiency, and a drawback, for inclusiveness. ICO addresses this drawback through disintermediation and blockchain encryption. Though, the number of failures and frauds in ICO also signifies that too much decentralization and a complete open gate is not necessarily the ultimate option, echoing once again the dilemma (Zetsche *et al.*, 2017). Past resolution and public preference to this struggle could be illustrated by the case of crowdfunding. In fact, the SEC initially proposed crowdfunding platforms to radically include any fund seeker, the suggestion was criticized to be excessively harmful to the efficiency, resulting in a consent of the SEC for a pre-emptive screening of projects (Schwartz, 2018). Perhaps, it portrays the importance of efficiency over inclusiveness, which offers IEO, along with its improvements of several other crowd disadvantages.

In comparison with ICO, IEO attempts to decrease the fraudulent risk for investors through a rigorous screening process managed by the exchange, where only quality

projects would be listed to preserve the trading platform's reputation (Doe-Bruce, 2019). Moreover, as the offering occurs on an exchange, not only that it reaches a wider number audience (i.e. all the exchange users), thus reducing the marketing cost while increasing the effectiveness of token promotion, but also, the listing of the tokens post-IEO is therefore also faster. Nevertheless, certain processes of IEO remains obscure and they could exhibit important flaws of this mechanisms.

2.2.3. Process of Token Offerings

In spite of its novelty and constantly changing landscape, a sequential structure of token offering can be interpreted. Notably, the first introduction usually happens through a whitepaper where information about the project as well as its purpose to attract potential investors, which is equivalent to an offering memorandum (Aitken, 2017; Kranz, Nagel and Yoo, 2019). However, even though the scope and characteristics, e.g. mission, token's technical description, the relevant smart contract, and tokenomics²¹, are elements often discussed, the content of the paper is not fixed (Doe-Bruce, 2019). Contrary to other established funding mechanisms, where information flows are controlled, there is no official rule nor audit for the whitepaper. In fact, whitepaper serves as a signalling tool for investors, where a higher quality of discloser should also lead to a positive market attitude (An, Hou and Liu, 2018). Investment strategy, approach, processes and returns are therefore included to build credibility and trustworthiness. In some cases, yellow or beige paper can also be issued to give further technical specifications about the project (Yu, 2018).

In contrast to IEOs, after an initial introduction of the project via the whitepaper, ICOs' team would typically conduct a huge marketing campaign on their own, regarding the official launch of the ICO to most investors through social media. The project would have a website and landing page to attract and instruct investors on the funding process. Moreover, after the launch of ICO, the issued tokens would remain illiquid and unlisted until the organization contact and have their request processed by exchange platforms (Liu, 2022). On the other hand, the IEOs process underlines a joint effort of the project team and exchange in its promotion, since they both benefit from the offering's success and immediate exposure to users of the exchange. The duration is often planned for a few days, although some successful projects were concluded within in few minutes depending on the target cap and hype among investors. After which, the IEO tokens are directly listed and tradeable (Allen, Fatas and Weder di Mauro, 2022). For investors, the

²¹ Tokenomics is a term in the crypto world to define the system and environment of a token. To be precise, it highlights the principles, rules incentives of the token's ecosystem. Subsequently, the goals and visions of the crypto-blockchain are also portrayed in tokenomics.

entire participation can be done seamlessly through the exchange's interface, from notification of a launch to fund transfer, without requiring various blockchain wallets.

All these advantages come nonetheless with drawbacks as there is possibility a large fee²² or early token allocation charged for such a launch (Liu, 2022). Therefore, although IEO is a convenient financing process, it is uncertain if the overall cost is cheaper than ICO and if any auditing process occurred to examine for potential conflict of interest (Doe-Bruce, 2019). Moreover, as the entire launch of tokens happens exclusively on a specific exchange, cyber-attacks could happen, like the case of Binance, and damage the security of collected funds (Doe-Bruce, 2019). Bottom line, this new financing instrument remains controversial and immature, partly due to its recent existence for only a few years. It has however already allowed founders to raise billions of dollars from global investors. Moreover, one can argue that the introduction of IEOs serves as a catalyse to the plunge of ICOs, with the latter market witnessing a decline from 14 billion to 3 billion dollars during the same period (Haffke and Fromberger, 2020).

2.2.4. Overview of the IEO's Market

Perceptibly, the fall of ICOs and the development of IEOs are in conjunction. Though the first IEOs already took place in 2017 – during the peak of ICO. Offered by Binance Launchpad in December 2017, Gifto, a live streaming project, managed to reach its target of \$30 million within a few minutes (Grant, 2020). Followed by Bread, the second IEO that was also offered on Binance during the same period, which raised \$32 million, a project that aims to build a decentralized bank for its users to store and trade securely their digital assets (Grant, 2020). It is only until 2019, when the ICO market bursts that the novel fundraising method starts to capture the market share, with BitTorrent launched in January, marking the return of IEO which attempts to restore investors' trust. The project raised over \$7.2 million in roughly 13 minutes (Binance, 2019). Further successful projects²³ are depicted in Table 1.

Table 1: Ten Largest IEO Projects by Fundraised and their Capitalization as of 19.01.2022

Name	Platform	Fund Raised (in M\$)	Current Market Cap (in M\$)
GateToken	Gate.io	83.00	984.55
Gifto	Binance	30.00	33.58

²² It remains vague how the fees are calculated, most papers only indicate that IEO fees are high, see for example Myalo (2019). Other websites suggest for it to be negotiable and between 150.000 to 1.000.000 dollars on major exchanges (Prosvirkin, 2020).

²³ Although some authors mentioned Bitfinex to be the IEO with the highest funding amount (1 billion dollars), the funding was privately held by Bitfinex, an exchange company itself, for its own token. Such activity is not in line with the definition of IEO and therefore, is excluded from the scope of IEO in this paper. Moreover, no other source for such a funding result could be found except for Bitfinex shareholder's claim.

Bread	Binance	20.00	43.23
Toko Token	Gate.io	7.50	81.74
Bittorent	Binance	7.20	2350
VeriBlock	Bittrex	7.00	2.68
Perlin	Binance	6.70	34.46
Voxies	Binance	6.00	132.58
WINKLink	Binance	6.00	371.2
Fetch AI	Binance	6.00	326.65
Band Protocol	Binance	5.85	224.37

Source: Own illustration based on cryptorank.io

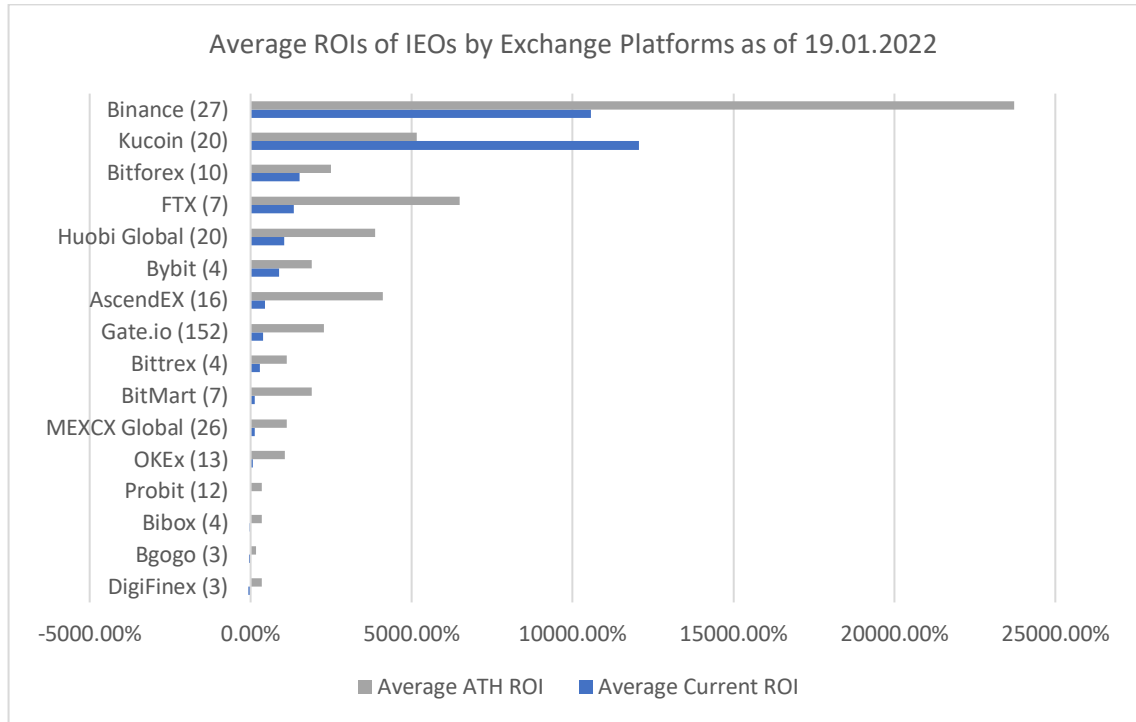
The most popular and reliable exchanges which also incorporate IEO launches for their users include among others, Binance, Gate.io, OKEx, Huobi, Kucoin, and Bittrex. As depicted in Figure 1, impressive IEOs' ROIs are observed on exchange platforms, notably, as of January 2022, Binance is leading with an average all-time-high (ATH) return of over 23000% and an average current ROI of over 10000%. However, most of these crypto platforms are not available worldwide, e.g. users from Serbia, Bosnia, or Iran cannot participate in the Binance exchange, OKEx is not available for the United States due to regulatory and compliance issues (Silva, 2022; Rosenberg, 2022). In fact, countries like China, Japan, and Malaysia even ban their citizens from trading, to different degrees²⁴, on these exchanges. Though, giant exchanges like Binance start to work with regulators²⁵ to offer more compliant services (Mathis, 2021).

Furthermore, as displayed in Table 2, various projects have not only successfully raised huge amounts of funding, but their returns appear to also be highly lucrative. The Polygon, a layer-2 scaling of the Ethereum blockchain, aiming to connect blockchains while improving the speed and costs of the network launched in 2019 via an IEO on Binance, which raised \$5 million. Since its launch, despite high fluctuations, the token reached an ATH ROI (over 110,000%) at the end of 2021, and a current ROI of roughly 78,000% (the highest among IEOs) for a market cap of over \$15 billion. Similarly, is the case of Axie Infinity, an online game that is currently trading at \$72.39, over 720 times higher than its initial token offering price and also having the highest record of ATH ROI at roughly 160,000%. On the other hand, GateToken, a startup that raised a record of \$83 million for its exchange tokens, has a current ROI of over 1,700%.

²⁴ Malaysia bans Binance completely while Germany, Italy and the Netherlands are banned from offering derivatives trading (Lim, 2021; Silva, 2022).

²⁵ e.g. the UK's Financial Conduct Authority (FCA)

Figure 1: Average Current and ATH ROIs of IEOs by Exchange Platform as of 19.01.2022



Source: Own illustration based on cryptorank.io

Table 2: Most Successful IEOs Tokens by ROI and ATH ROI as of 19.01.2022

Name	Platform	Amount Raised (\$)	Current ROI	ATH ROI
Axie Infinity	Binance	2,970,000	72,612%	164,599%
Polygon	Binance	5,000,000	78,018%	110,489%
The Sandbox	Binance	3,000,000	51,040%	100,361%
Elrond	Binance	3,250,000	26,773%	83,303%
THORChain	Binance Dex	490,000	17,100%	66,271%
Ecomi	Bitforex	780,000	1,017%	17,154%
Harmony	Binance	5,000,000	8,942%	11,929%
APENFT	Huobi Global	288,000	3,764%	11,914%
Bittorent	Binance	7,200,000	2,225%	11,699%

Source: Own illustration based on cryptorank.io

2.3. Economic Rationales

As IEO positions itself as a better alternative to ICO, particularly, from an investor's perspective as it eliminates beforehand fragile projects, its rising popularity and important amount raised also signify issuers' interest in IEO. However, it remains debatable to which extent such a financing method could benefit both parties and calls for an examination of their incentives as well IEO's major risks and challenges to control them.

2.3.1. Entrepreneur's Incentives

2.3.1.1. Efficient Fundraising Mechanism

Token offerings arise from the lack of funding options, especially for blockchain-based projects as it is challenging to grasp its technology as well as solutions, thereby, hindering the ability of blockchain pioneers to raise funds from traditional financial institutions (Blemus and Guegan, 2019). Moreover, Schücker and Gutmann (2020) outline that not only do venturers need to break the prejudices against cryptocurrencies, but they also require a longer time horizon to be developed than what venture capitalists usually expect. In the case of venture capitalists stepping in, early seed round capital generally is exchanged with a significant amount of equity, IEOs on the other hand, enable issuers with the possibility to return investors with utility access, instead of giving up parts of the business (Cumming, Johan and Pant, 2019). Moreover, IEOs are not bounded to only the early stage but can be conducted at different project phases. In addition to the impressive amount raised of former projects, which unquestionably inspired fund-seekers to use this new funding opportunity, as previously outlined in the market overview chapter.

On the other hand, limitations from territorial borders that usually obstruct the funding process are further removed with IEOs, i.e. although the geographical dispersion in the funding context has been significantly elevated with the Internet, a relatively inexpensive tool, yet blockchain reshapes it further with faster, more secure and even cheaper transactions (Agrawal, Catalini and Goldfarb, 2010; Danmayr, 2014). Notwithstanding, many scholars argue that this financing method remains far from truly global due to many differences among each country's regulations, obstacles in cross-border activities, and its dependency on trusted third parties (Danmayr, 2014; Haas, Blohm and Leimeister, 2014; Moenninghoff and Wieandt, 2013).

Given the current stage of IEOs, the minimal official requirements, particularly when compared to those of traditional mechanisms such as IPOs, also highlights a significant advantage for developers. Notably, on conventional stock exchanges for secondary markets, there occur various costs to be paid to third parties, including admission fees, broker commissions, or even annual exchange fees, estimated to cost up 0.4% and even higher in developing countries and emerging markets (Domowitz, Glen and Madhavan, 2001). Furthermore, the complying procedures are unquestionably lengthy and inefficient (Chen, 2018). Thus, IEOs allow start-ups to evolve quickly, ultimately early traction with more efficient access to promising capital amounts.

2.3.1.2. Market Insights

Besides, the offering of tokens arguably enables the team to assess the market potential since it does not aim at accredited investors but rather future users and adopters. In fact, when consumers are given the opportunity to acquire the role of investors, it

simultaneously allows developers to use their knowledge (Ordanini *et al.*, 2011; Kleeman, Voß and Rieder, 2008). The market demand and business model can thus, be tested and values can be assigned to their project. It also serves as marketing means and generates interest with each evaluation, news, or discussion about the product by investors. Such early engagement with consumers was empirically evident to not only build loyal supporters but also to efficiently increase visibility and usage (Burtch, Ghose and Wattal, 2013; Mollick and Kuppuswamy, 2014).

Another advantage that offers IEOs is the idea of “wisdom of crowds”, a sociological theory which is first discussed by Surowiecki (2004). In his work, he demonstrated that a collective opinion of a group can be “wiser” than that of an individual, even if he or she is an expert. Following this line, many authors argue that collaborative wisdom, commonly occurring in internet funding, is an essential component of the digital revolution, insofar as reshaping society (Willfort and Weber, 2016). The benefits arising from this mechanism is expected to solve most of the problem that start-ups encounter like market testing, quality signalling, and pricing (Hienerth and Riar, 2013; Macht and Weatherston, 2014). More precisely, authors like Martin (2012), Nasrabadi (2015) and Furnari (2018) underline that potential investors on these platforms would likely discuss and give feedback about the idea or product, enabling its founder to improve future products and its success. Nevertheless, the notion of crowd wisdom benefits not only fund-seekers but also investors.

Similarly, due to a composition of a variety of crowds from all over the world with different cultures, the concept of “cross-pollination of idea”, can take place. It was pointed out that innovation is further fostered in a diverse milieu, with various groups of people (Fleming, 2004; Hewlett, Marshall and Sherbin, 2013). Additionally, as the success of a campaign directly benefits investors, through associated financial rewards, they are therefore likely to market it within their network (Nasrabadi, 2015). Successful crowdfunding is then, in these regards, crucial for the long-term horizon of the business project as it provides not only capital but also clients and supporters for the fund seeker. Overall, although the aforementioned advantages are regarded from the issuer’s perspective, it is important to note that they implicitly benefit investors as well.

2.3.2. Investor’s Incentives

2.3.2.1. “Quick Rich” and Psychological Motives

It is crucial to examine investors’ incentives for IEOs investment and contribution in projects, in order to have a better understanding of IEOs valuation. Whereby, investors can be generally characterized by a statement since 1896 by Fisher (p.379), who emphasized that “every chance for gain is eagerly watched. An active and intelligent

speculation is constantly going on". This statement highlights how speculation and high-risk investment have been omnipresent because of incentives to enrich and acquire gains of investors. Supporting this idea, studies in more traditional asset investments have pointed out that investors suffer from risks arising from biases such as the representative bias, mental accounting bias, the disposition effect, and also overconfidence (Chen *et al.*, 2007; Bailey, Kumar and Ng, 2011). In fact, incentives to gain are further highlighted in the context of cryptocurrency investments, in spite of high volatility and uncertainty, thus, one can expect to see the presence of these biases at larger degree in IEOs compared to the traditional market.

In the token market, there is undoubtedly a high chance of fraud and project failure in addition to a lack of legal protection. However, similar to crowdfunding, various scholars attempted to explain their success and investor motives by applying behavioural economic theories (Basu, Basu and Austin, 2021; Koch and Siering, 2015; Ling and Qin, 2015). Prominently is the prospect theory, by Kahneman and Tversky (1979), suggesting how people are generally loss averse under uncertainty. The theory states that investors usually judge their investment decisions based on what they could potentially gain or lose instead of probabilistic outcomes²⁶. Furthermore, the prospect theory also predicted a fourfold pattern which indicates a risk-seeking attitude over a low probability of gain, due to the fear of losing a potential gain (Kahneman and Tversky, 1979; Rogers, 1998). In other words, their assessment of gain and loss is asymmetric and not related to the probability of such events and provides an important explanation in the context of gambling and lottery (Rogers, 1998). Accordingly, it is comparable to the case of investors in new business projects where there is a small possibility of high economic returns despite the high probability of losing them (Furnari, 2018). Within crypto investments, Hackethal *et al.* (2018) also confirm in their study the existence of behavioural biases among crypto investors, especially of media sentiment. Other IEOs specific practices such as an implementation of a hard cap, intending to protect investors and to address the whale pump and dump scheme²⁷, could be expected to generate further incentives as it displays a scarcity aspect to the offer.

Herding behaviour is defined as the situation when "rational people start behaving irrationally by imitating the judgments of others while making decisions" (Kumar and Goyal, 2015). In other words, it is when a decision is made upon interaction with other individuals, or groups, that an individual would not have made alone but rather a result of imitation of other's decision and action (Banerjee, 1992; Christie and Huang, 1995

²⁶ For example, even if the probability for losing a certain amount is small, they would overweight the potential of losing this amount, over the probability for it to happen.

²⁷ Further discuss in chapter 2.3.3.1.

Hirshleifer and Hong, 2003). Various scholars demonstrate in their studies a herding effect in cryptocurrency market decisions, especially for leading coins like Bitcoin and Ether, strong herding was found (Bouri, Gupta and Roubaud, 2019; Theis, 2021; Vidal-Tomas, Ibanez and Farinos, 2019). Interestingly, Bouri, Gupta and Roubaud (2019) note that herding's tendency increases with the rise of uncertainty in the market. Empirical evidence gathered by Poyser (2018) also supports these findings.

On the other hand, Fisch *et al.* (2018) further revealed in their study, in which token investors were surveyed, that the potential gain of value is not their only incentive. In fact, motives related to ideology and technology are also crucial in their investment decision and although these investors had a high-risk appetite, they typically possess financial and technological knowledge (Fisch *et al.*, 2018).

2.3.2.2. Liquidity and Accessibility

The limited presence or even total absence of a secondary market poses unquestionably a problem for crowdfunding investors (Murray, 2015; Schwartz, 2012; Signori and Vismara, 2016). In fact, such a shortfall results in a risk factor that impedes crowdfunding to thrive fully. IEOs, therefore, propose to investors a twofold advantage, given that they are easy, less costly to participate yet highly efficient since IEOs tokens are almost directly available for trading on the exchange platform (Ofir and Sadeh, 2020). Various scholars have suggested that tokenization is the key to easing the illiquidity problem from an economic perspective by generating an abundant secondary market directly post fundraising event, though, legal obstacles might still prevent it (Ante and Fiedler, 2019). Moreover, these crypto exchanges allow continuous trading with significant liquidity regardless of market hours and time zone (Kaal and Dell'Erba, 2017). Put differently, IEOs provide liquidity much faster than their predecessors and permit early capitalization of profits.

In the traditional capital market for ventures, there usually exists a hierarchy, whereby innovative projects remain unknown to the public. As a result, crowdfunding is created to counter the situation of venture funding being mainly invested by a small group of experts and elite investors. Similarly, ICO provides equal access to all investors also through the possibility of direct participation. Whereas IEO is often decided based on a lottery model – regarded as a fairer auction system for tokens since late and smaller investors are not discriminated against in the process (Boreiko, Ferrarini and Giudici, 2019). Moreover, given the borderless nature of crypto transactions on the blockchain, investors from all around the world can participate in token sales regardless of their location (Takahashi, 2020).

Another alluring aspect for investors, highlighted by Mollick (2014) in the crowdfunding context, is the comparatively low price per share, which is also the case of IEO. In conjunction with a smaller required amount of investment, such advantages are revealed to enable less-wealthy individuals to increase the diversification of their portfolios and thus, favouring financial inclusion (Klein, 1973; Jeni, Lyman and Nava, 2017). Klein (1973) also adds that lower unit prices of assets allow investors to achieve more accurately their target portfolio. Moreover, according to Muscarella and Vetsuypens (1996), markets with lower price and smaller split of stock allow more liquidity. Following this line, the token offerings of assets shall leverage these advantages and positively benefit investors, considering its divisibility. Indeed, tokens on the blockchain can be divided into smaller fractions, for instance, a bitcoin is divisible by eight decimals, i.e. to 100,000,000 units (Grill, 2017). Insofar as accessibility is a major advantage for investors, a lower entry barrier also implies the engagement of more inexperienced investors who may not have the capability or expertise to assess the involved risks.

2.3.3. Risks and Challenges around IEO

2.3.3.1. Malignant Behaviours

Like many things, most advantages come with drawbacks. Although virtual connections introduce many benefits, some information actually requires physical interaction to be delivered, for instance, the determination or trustworthiness of the founding team, as well as their interpersonal dynamics, which are often considered as predictive factors of venture success and evaluated by professional investors (Gaspar and Glaeser, 1998). As a matter of fact, the internet is also where false information can easily be spread due to its capabilities to reach a big audience at a very low cost (Agrawal, Catalini and Goldfarb, 2013). Furthermore, some authors point out that the possibility to access other's investment decisions, i.e. free riding, and the relatively small amount of investment, all of this leads to a lack of incentives for crowd-funders to perform their due diligence (Agrawal, Catalini and Goldfarb, 2013; Furnari, 2018; Jones and Moncur, 2020). Consequently, this problem attracts criminals to use crowdfunding as means to scam. Such risk of fraud thus presents a drawback of investing in online funding platforms and endangers the possibility to raise capital for issuers through investors' fear of fraud or moral hazard (Furnari, 2018). Nonetheless, efforts have been made by crowdfunding platforms, by screening projects beforehand, and also via the aforementioned "wisdom of crowd" to minimize potential risks. Only a few cases of fraud happened, among which most of the time the creator of a failed project faced punishment despite his initial incentives while investors got their investment back, relative to the amount of successful funding (Jones and Moncur, 2020; Markowitz, 2013).

To further illustrate the pertinence of fraudulent issues, the SEC launched in 2018 a test mimicking coin offering named Howeycoin. Which consists of an eight pages long whitepaper describing its relevancy through a project plan, the solution to the stated problem, token information, and even future return predictions²⁸. They even included fake celebrity endorsements, team members, and other typical topics of an offering. When an investor wants to participate in the project, a redirect link towards SEC's investor website appears to raise awareness about scamming issues in token offerings. Hereby, it illustrates the need for investors to be properly informed and educated on the potential risks in the context of token offerings. Joo, Nishikawa and Dandapani (2019, p.16) further insist on an urgent call for regulations to control malignant activities in "what has potential to be otherwise the best solution of financing for businesses".

Moreover, aside from exposure to insider trading, there exists an infamous market manipulation involving the pump and dump scheme. Although such a concept was introduced since the creation of the stock market, the unregulated yet abundant crypto market has revitalized this practice. Explained by Kramer (2005) and Kyle and Viswanathan (2008) as when a large share of an asset is purchased by an investor or group of investors, with the intention to artificially inflate the price, due to the increasing price, smaller retail investors are drawn to the asset. Such snowball effect persists until the so-called "whale" decides to sell its position to profit from the overvalued crypto by investors with fear of missing out (La Morgia *et al.*, 2021). A major example of this scheme in the crypto world is namely Dogecoin, which was created as a joke, yet it managed to reach an ATH ROI of over 9,600% (Chohan, 2021; CoinMarketCap, 2022b). In their study on the phenomenon, La Morgia *et al.* (2021) further underlines the feasibility to organize such fraud in a meticulous way²⁹, with internet platforms like Telegram and Discord, or even Reddit with their incredible success in pumping GameStop stocks to over 1,900%. While such market manipulation can lead to severe legal punishment in the traditional market, it remains uncontrolled in the token trading world. However, the U.S. Commodity Futures Trading Commission (US CFTC, 2018) has announced a program supporting whistleblowers against these schemes as an effort in the crypto scene.

Therefore, even though everything happens on the web and the "wisdom of crowds" can be expected via community discussions or even websites whose purpose is to review, investors should perform due diligence and gather as much information on the project as possible, to understand its prospect and reduce speculation. Undoubtedly, all these

²⁸ See HoweyCoins.com for more information on the mock test.

²⁹ In fact, there is not only structured communication but also a hierarchy of members for the affiliate program, with time advantage to purchase earlier and increase their gains (La Morgia *et al.*, 2021).

risks obstruct not only the reliability of a specific project but the general perception of the crypto and IEO projects. It becomes difficult for promising businesses to distinguish themselves while avoiding market manipulation harms in absence of authoritative control and regulation.

2.3.3.2. Regulatory Approaches in Token Offerings

Indeed, despite an increasing rise in popularity and interest in the domain of investment, considering the recentness of IEO, multiple legal questions remain unanswered. Since its inception, regulators have been trying to investigate and restrain the associated risks for retail investors. It is therefore of interest to briefly go through current legal perspectives on IEOs. Considering the relative lack of underlying tools to evaluate the IEO projects, most authorities have issued a warning to investors to beware of involved risks while trying to overcome the challenges of token classification, which is necessary to provide relevant measures.

However, various degrees of approach towards both tokens in general and more specifically token offerings have been taken by different countries. In fact, most countries favour a more progressive approach through regulation and imposition of frameworks to deal with tokenized assets and their trading. In particular, when it constitutes financial securities, Singapore and Switzerland treat it according to the relevant authority's regulations (FINMA, 2017; MAS, 2017). In fact, in the guidelines for ICOs of the Swiss FINMA (2017), the authority illustrates acknowledgement and support for the advantages that blockchain could offer to financial markets. The SEC (2019) also announced that digital assets can be treated as securities offerings in the U.S and thus, can be enforced by federal securities laws. Likewise, the FCA – UK government regulator for financial activities and the German *Bundesanstalt für Finanzdienstleistungsaufsicht* (BaFin) also provided guidelines and held the position of treating token offerings as securities depending on aspects and rights of its holder³⁰ (FCA, 2017; BaFin, 2018). As previously stated in the overview of the market, the FCA is also currently working with Binance, a major token exchange, to find common grounds on the treatment of tokens and their offerings. Moreover, a statement regarding the authorization of crypto derivatives³¹ and its requirements of compliance with the EU's regulation and the FCA's Handbook was also issued (FCA, 2018).

Conversely, several jurisdictions have decided on a firmer stance, notably in China, where tokens, their offerings, and exchanges are completely banned (CBIRC, cited in Kaal, 2018). South Korea also applied a ban on ICO in 2017, although there is a

³⁰ In their statement on ICO, a case-by-case analysis was given to assess if ICO is under the FCA or BaFin jurisdiction.

³¹ As they are "capable of being financial instruments" (FCA, 2018).

possibility for it to be lifted, given its Financial Services Commission's vice chairman's view to include ICO in the country's Capital Market Act (Avan-Nomayo, 2021). Despite being one of the powerhouses in crypto, Russia is still delayed on its regulation³² as its Central Bank favours a complete ban and exclusion of crypto from the Russian financial system, while some political figures claim that such a position inhibits Russia from profiting from its technology (Alper, 2021).

2.4. Bridging the Gap in IEO Literature

The previous chapters investigated the main incentives and advantages of IEO for entrepreneurs and investors while displaying its many risks arising from an unregulated and new market. Notably, it also stresses the interest of fund-seekers in conducting IEO, and investors in its participation, emphasizing the need to understand the pricing of tokens as it directly affects the capital raising amount and the investment return. Given the high-risk environment and lack of controlling measures, an analysis of underpricing becomes essential to explore IEO and its performance while also assisting issuers and investors.

2.4.1. The Underpricing Phenomenon

Underpricing is a topic of great interest for scholars in the field of financial economics. The relevancy of this commonly known phenomenon lies in how it usually stands as a major problem for issuing companies whilst being an opportunity for early investors. Defined as when the issued asset is priced below market value and resulting in an adjustment of price on the listing day. In other words, it is when the closing price on the first trading day is higher than the offer price and results in a positive return (Ibbotson, 1975; Lim and Saunders, 1990). Although it is arguably relevant to attract investors, it might not be a fully deliberate intention of issuers because it also displays an inefficiency for them, of which, the issuer could have raised a higher capital amount (Brau and Fawcett, 2006; Ibbotson and Jaffe, 1975). Loughran and Ritter (2002) and other scholars also refer to this problem as "leaving money on the table".

The studies for underpricing are widely documented and subject to thorough research in the field of IPOs. To name a few, the average initial returns of IPOs are recorded at 7% for the US's market in the 80s to 65% during the dot-com bubble by Loughran and Ritter, (2002), while Ghosh (2005) also discovered the presence of underpricing in the Indian market, although at a lower degree. It is therefore a common phenomenon throughout the world of finance and its extent varies significantly by country. Consequently, not only

³² A federal draft for the law on digital financial assets has been presented since 2018, containing proposals for a regulatory system of crypto assets activities and ICO (Ministry of Finance of Russia, cited in Kaal, 2018).

underpricing is documented, but many theories have also been developed to explain its origins and potential causes (Baron, 1982; Beatty and Ritter; 1986; Carter and Manaster, 1990; Miller and Reilly, 1987; Rock, 1986). To highlight the magnitude of this phenomenon in IPOs, according to the yearly updated study of Ritter (2021), for a sample of 309 IPOs³³ in the U.S, an aggregated amount of \$27,98 billion was left on the table in 2021³⁴.

Contrast to that of IPOs, crypto offering's literature exploring underpricing is highly limited, given the infancy of the concept. Although the number of studies on this topic in ICOs is expanding, it remains very restricted. In the specific case of IEOs however, it appears that as of the time of this study, it is the first to analyse the presence of underpricing. Considering such a shortage in IEO's research, it becomes essential to consult studies and theories of underpricing rooted in IPOs, because despite their important distinctions, it allows to lay out the fundamentals. In fact, the main theories for IPOs underpricing can be categorized into four major groups, as documented in the thorough work of Ljungqvist (2007), which are asymmetric information, institutional, ownership and control, in addition to behavioural explanations. However, there exists a significant difference between IPOs and IEOs, meaning that not every one of these concepts would be applicable. For instance, institutional theories deal with legal liability or tax arguments, while IEOs belong to an unregulated framework. Moreover, as IEOs tokens usually do not provide ownership control³⁵, the respective topic is also irrelevant. Providing that ICOs currently are the closest instrument to IEOs, empirical findings and discussion regarding underpricing and token performance in this context would additionally be revoked.

2.4.2. Grounding IPOs Underpricing Theories

2.4.2.1. Information Asymmetry

To explain underpricing, it is necessary to discuss the concept of information asymmetry which is undergrounded in many underpricing models' development. Firstly put forth by Akerlof (1970) in his Nobel Prized research of "The Market for Lemons"³⁶, in which he argues that the presence of asymmetric information between buyers and sellers can impede the quality of a market. According to his study, sellers exploit the lack of information from the buyers' side and try to sell low-quality products as high-quality,

³³ Except for banks

³⁴ Furthermore, between 1980-2021, Ritter (2021) found that the aggregated amount left on the table is over \$229 billion for a sample of 9.084 IPOs.

³⁵ When tokens deal specifically with ownership rights, voting rights, and dividends, they are offered through another mechanism called Security Token Offerings (STO) and is subject to a different set of requirements.

³⁶ Lemon is American slang for a defective car.

resulting in quality uncertainty (Akerlof, 1970). Information asymmetry, therefore, affects the transaction's conditions and the relationship among involved parties, posing a challenge to the efficient operation of markets across many areas. More precisely, it is an assumption of unequal knowledge among three main parties in an offering, the issuer, an underwriter in IPOs or exchange platform in IEOs, and the investors (Ljungqvist, 2007).

Following this line, the model of Rock (1986) for underpricing, also known as the adverse selection theory or the "winner's curse", becomes essential, indicating asymmetric information between informed and uninformed investors, and underpricing is its competitive outcome. While the former, possesses information on the true value of the company and not the latter (the larger group), in addition to the existence of undervalued IPOs and overvalued IPOs (Lim and Saunders, 1990). Therefore, informed investors would only invest in undervalued offerings which give them returns while uninformed investors will bid regardless of the quality and resulting in them being sole demanders for overpriced IPOs³⁷, with both groups of investors to be found in the distribution of shares for undervalued IPOs (Ljungqvist, 2007). So, they are the main "winners" of unattractive offerings and face the so-called "winner's curse". Eventually, uninformed investors or the larger group would leave the scene, causing a problem for the success of offerings³⁸ (Beatty and Ritter, 1986; Chowdhry and Sherman, 1996; Kothari, Warner and Eckbo, 2007). Consequently, to avoid such failure, underpricing takes place to attract and to ensure that uninformed investors can also be rewarded.

An extension of this theory is the ex-ante uncertainty³⁹ theory, suggesting that the level of underpricing is higher when there is greater uncertainty about the forecast value of the firm and its asset, as underpricing allows to compensate and attract uninformed investors (Beatty and Ritter, 1986; Koh and Walter, 1989; Levis, 1990; Keloharju, 1993; Michaely and Shaw, 1994). Some even consider it as the key driver of underpricing. In other words, in a market with high uncertainty and risk, which is the case of IEOs, one can expect significant underpricing (Miloud, 2003). Common proxies for valuation uncertainty are measures of a firm's age, size, industry, and also gross proceeds (Beneviste *et al.*, 2003; Megginson and Weiss, 1991; Ritter, 1984). Interestingly, the latter characteristic is shown to have a strictly negative relationship with underpricing (Habib and Ljungqvist, 1998).

³⁷ Hence the term "winner's curse", which designates the case when uninformed investor "wins" the allocation of IPOs instead of informed investors who consider it as overvalued (Keloharju, 1993).

³⁸ Since the demand from informed investors alone is insufficient to cover the entire IPO market (Kothari, Warner and Eckbo, 2007).

³⁹ Referring to the uncertainty in the firm's value or performance post issue.

Similarly, Baron (1982) developed the principal agency theory which highlights information asymmetry between the intermediate underwriter and the issuer, ultimately result as well in underpricing (Huang and Levich, 1998; Soana and Regalli, 2010; Bond, Edmans and Goldstein, 2012). In fact, since investment banks in IPOs are granted valuable information for price settings insofar as allocation decisions, some scholars such as Loughran and Ritter (2004) have voiced their concerns about the drawbacks, i.e. agency problems, of such arrangements. They argue that in presence of gain-seeking, there is competition for allocation of under-priced shares and therefore, investment bankers can profit from underpricing. One can speculate the same consequences with exchange taking over the role of intermediary in IEOs. In fact, the tendency and magnitude of this problem can be even higher. According to Ljungqvist (2007), such agency conflict is accentuated in greater ex-ante uncertainty because then, the services of intermediaries become even more valuable. Moreover, while the author recognizes that in IPOs, banks are incentivized to maintain a low level of underpricing as their fees are linked to proceeds, he conjectures that underwriters' private benefits in such a scenario outweigh their loss of underwriting fees. In IEOs, it remains unclear how the arrangement between exchanges and developers conceives, i.e. if there are countervailing incentives for exchanges to keep underpricing low.

2.4.2.2. Signalling Theories

Undoubtedly, to mitigate uncertainty and underpricing, it is of interest for buyers to acquire more information and for issuers to signal quality (Löfgren, Persson and Weibull, 2002). It is particularly relevant in the context of financial investments in start-ups, where it is far more challenging to access their underlying true quality compared to later-stage companies (Kirsch, Goldfarb and Gera, 2009; Plummer, Allison and Connelly, 2016). Furthermore, from the issuers' perspective, it represents an involuntary cost and hence, incentives to reduce information asymmetry through optimal action (Habib and Ljungqvist, 2001). It is argued that although such signalling actions can be costly, issuers would still pursue until the break-even of marginal cost and benefit⁴⁰ (Habib and Ljungqvist, 2001; Ljungqvist, 2007).

Accordingly, based on the assumption of asymmetric information, signalling theory elaborates on the judgment of investors when it is difficult or even impossible to directly assess the quality as well as the effort undertaken by the issuer party to reduce such asymmetry (Benlian and Hess, 2011; Spence, 1978). Hereby, several scholars argue that underpricing can be used as means to signal quality from high-quality companies, since money left on the table during underpricing can be recovered in the future once

⁴⁰ The marginal benefit here does not imply underpricing but rather the potential loss of wealth in the event of underpricing (Habib and Ljungqvist, 2001).

the true quality would be revealed, whereas a low-quality firm is incentivized to overprice its shares by fear of future quality detection - which would not allow it to recover the loss (Allen and Faulhaber, 1989; Ibbotson, 1975; Welch, 1992). Although such a method does not completely eliminate uncertainty, Fabrizio (2000) asserts that it increases the chance to be positively perceived by investors. Ibbotson (1975, p. 264), who provided the original intuition for signalling theories, also coined this underpricing phenomenon to “leave a good taste in investors’ mouth”.

Multiple works also point to a possibility to add value through the engagement of a third party, whose reputation is then used to signal quality and to reduce information asymmetry, i.e. certificate or warranty from experts like underwriters, auditors, and venture capitalists (Beatty and Ritter, 1986; Megginson and Weiss, 1991; Michaely and Shaw, 1994; Titman and Trueman, 1986). However, empirical evidence in IPOs on this topic remains mixed and varied depending on the period of the study, e.g. Beatty and Welch (1996) indicate a sign reversal, since the 1970s, from negative to positive in the relationship between underpricing and reputable underwriters. Hypotheses for this include a change in bank’s strategy to purposely underpricing IPOs and obtaining gains or that they have lowered their criteria in IPOs selection, thus, increasing their average risk profile as well as underpricing (Ljungqvist, 2007; Loughran and Ritter, 2004). Though, such a shift is suggested to be part of the endogeneity biases, since the choices of underwriters and banks are made by optimizing agents, to put differently, banks do not randomly agree to publicize a company and vice versa (Fernando, Gatchev and Spindt, 2005; Habib and Ljungqvist, 2001).

Nonetheless, to reduce underpricing, other indicators were suggested to be reliably used as a signal. One example would be through the retention rate of assets by issuers, which signals to the public confidence of the entrepreneur in the viability and performance of the firm (Grinblatt and Hwang, 1989; Leland and Pyle, 1977). In fact, such parameter is often visibly presented in whitepapers as well as the tokenomics of IEOs with the aim to supposedly portray tokens allocation of a project, however, following this light, it can likely be used in a strategic way to signal quality.

2.4.2.3. Investor Sentiment and Market Cycles

In addition to the prior concepts, the role of sentiment is also widely acknowledged in investment. It is assumed in behavioural theories that there are irrational investors and as a result, the price increases beyond its true value (Baker, Ruback and Wurgler, 2007). Indeed, IPOs were found to experience informational cascades since subsequent investors can make their bids based on offering bids, rather than their own information while presuming that earlier investors in IPOs have more information (Ljungqvist, 2007;

Welch, 1992). Therefore, in presence of information cascades, underpricing can take place to trigger the perception of successful initial offerings, ultimately a positive cascade according to Ljungqvist (2007). However, he also mentions that a cascade does not form when there is free communication among investors.

Furthermore, the performance of IPOs can largely vary depending on time periods or in other words, the existence of hot and cold markets and the dramatic variation in the number of IPOs (Pastor and Veronesi, 2005; King and Banderet, 2014). Such cyclical patterns were observed since the eighties by Ibbotson and Jaffe (1975) based on their average performance in the first month. Whereby, a market is qualified as “hot” when there is a high concentration of IPOs coupled with high levels of underpricing due to increased optimism to attract investors from other offers (Ibbotson and Jaffe, 1975; Ritter, 1984; King and Banderet, 2014). In this light, Lowry, Michaely and Volkova (2017) also find a positive correlation between underpricing and investor sentiment. On the other hand, Baker and Wurgler (2000) suggest that firms try to time the market and exploit investor optimism, hence the large number of IPOs. Notwithstanding, some scholars argue that the market’s optimism cannot be fully captured and capitalised it in their offer price (Ljungqvist and Wilhelm, 2003; Ljungqvist, Nanda and Singh, 2006). While Helwege and Liang (2004) show that the number of IPOs and the level of underpricing in a month are not associated with each other⁴¹.

Contrastingly, a market is “cold” when there are stock market dips, with a small number of firms going public, negative investor sentiment towards new IPOs and also less underpricing (Helwege and Liang, 2004; Henry and Gegoriou, 2013). Other scholars also found that the global financial crisis and the higher level of uncertainty in the stock market can alter the underpricing situation in the capital market⁴² (Chudik and Fratzscher, 2011; Henry and Gregoriou, 2013; Leow and Lau, 2015). Consistently, Hall (2010) highlights that investors post-crisis become more risk-averse, added by the findings of King and Banderet (2014) that the global financial crisis gives rise to pessimism in investors.

2.4.3. Overview of ICOs Empirical Studies

2.4.3.1. Evidence of Underpricing

As previously examined, one of the most prominent causes of underpricing is due to information asymmetry and prior studies in traditional markets have shown strong support that this relationship is positive as well as significantly correlated. Additionally, in a study about underpricing in IPOs with regards to technology, Kennedy, Sivakumar and

⁴¹ Based on the US market, for the period between 1975 and 2000.

⁴² Moreover, during the “coldest” months of the global financial crisis, only two IPOs were conducted in the US, i.e. an unprecedented slump according to Henry and Gegoriou (2013).

Vetzal (2006) found that there is greater ex-ante uncertainty and also greater underpricing in the high-tech sector. Hence, in the context of token offering, the heavy implementation of new technology can result in unevenly shared knowledge among informatics experts and ordinary investors. Therefore, underpricing can reasonably be expected in the context of token offerings to a great extent.

Indeed, the small yet growing number of literature in ICO provides strong support for this, insofar as underpricing is found to be at a higher degree compared to IPOs. The analysis of Adhami, Giudici and Martinazzi (2018) underlines an average underpricing of 140 ICOs, between 2014 and 2017, to be 919.9% despite 34.7% of the sample size being negative and a median of only 24.7%, i.e. investment in ICOs seems to correspond with the atypic high-risk high reward pattern. These findings are consistent with those of Hsieh and Oppermann (2021). For 502 observations⁴³, they found an average of initial return at 110%, which is not only higher than the return of 15.67% of IPOs during the same period but also significantly higher than IPO's highest annual average underpricing value (71.2%) in the US market during the dot-com bubble (Hsieh and Oppermann, 2021; Ritter, 2022). Similar results are revealed by Benedetti and Kostovetsky (2018) when even after assuming a 100% loss for tokens that are not listed within two months⁴⁴, a representative ICO investor still has an average return of 82% based on 416 offerings between 2017 and 2018.

Several scholars also uncover comparable findings, namely, Chanson *et al.* (2018), Yuryev and Molnar (2018), Felix and von Eije (2019), Lee, Li and Shin (2019). However, while the majority of studies examine underpricing regarding its general definition in IPO literature, i.e. the difference between issuance and opening prices, another possibility is to evaluate the difference between opening and closing prices (Ljungqvist, 2007; Momtaz, 2020). Although both measures capture important financial aspects, the focus is on different points in time with the former underlining investors' incentives in ICO at all and the latter about market's liquidity (Momtaz, 2020). Accordingly, to reflect liquidation, Momtaz (2020) unveils an average underpricing level of 8.2% and a median of 2.6% for first-day initial returns, much lower than prior results. Herewith, apparent evidence of underpricing in ICO also indicates an inefficient market, coinciding with prior research on the efficiency of cryptos (Urquhart, 2016; Al-Yahyaee, Mensi and Yoon, 2018).

Interestingly, most studies related to ICOs were conducted during its momentum, meaning around 2018. On one side, this implies that a number of the sample sizes were likely overlapped, and when multiple sources concluded on similar findings, it might be

⁴³ For the period 2014-2018 (Hsieh and Oppermann, 2021).

⁴⁴ And also adjusting for asset class's return (Benedetti and Kostovetsky, 2018).

because of this very reason. On the other side, the results of underpricing and its variables during a boom period could be distorted and to be cautiously interpreted.

2.4.3.2. Predictors of Underpricing

Various research attempts to offer explanations to this phenomenon in token offerings by searching for its determinants and components, frequently drawing from the IPO literature. These studies usually conclude on many of the same predictors revolving around information asymmetry.

First and foremost, since the network size plays a role in the token's value, it represents the need to attract investors as they will likely support the network and benefit from both the platform and the increasing price (Cong, Li and Wang, 2021). In other words, a necessary critical mass for the success of a project can be obtained by pricing tokens lower to increase their network, supported by the results of Momtaz (2020). He additionally indicates that in presence of strong country restrictions, underpricing tends to take place as a way to attract investors. Furthermore, underpricing is also regarded as issuers' attempt to induce market liquidity and their relationship is found to be positive by several scholars (Lyandres, Palazzo and Rabetti, 2019; Momtaz, 2020). Howell, Niessner and Yermack (2020) also state that liquidity serves as an important signal of quality especially when there is no other commercial success measure. All of which play important roles in explaining incentives for ICOs underpricing.

Subsequently, a parameter that is shown to significantly and negatively influences underpricing is presales (Benedetti and Kostovetsky, 2018; Felix and von Eije, 2019). It is a common practice in token offerings to conduct private or public presales which offer investors more bonuses or lower prices due to higher risk-bearing (Howell, Niessner and Yermack, 2020). The existence of such investment rounds allows developers to validate the (smaller) market demand of tokens and enable the issuer to determine a suitable price (Howell, Niessner and Yermack, 2020; Lee, Li and Shin, 2022). Conversely, it is suggested that presales might indicate negative signals such as insecurity of issuer and tendency for market manipulation schemes like pump and dump or Ponzi scheme with high bonuses (Amsden and Schweirer, 2018; Li and Mann, 2018). However, some empirical studies fail to find an association between token offerings' success and presale (Amsden and Schweirer, 2018; Momtaz, 2020).

Similarly, the issue size is demonstrated to have a serious negative relationship with underpricing, since it is argued that there is less information asymmetry in larger ICOs (Lyandres, Palazzo and Rabetti, 2019; Felix and von Eije, 2019). Contrastingly, Momtaz

(2020) finds evidence for issue size to have a positive relationship with underpricing⁴⁵. While according to the study of Howell, Niessner and Yermack (2020), underpricing is further discovered to be positively associated with liquidity and trading volume, possibly because a larger issue implies more money involved in the process. Chanson *et al.* (2018) also uncover a greater level of underpricing when the hard cap is reached (i.e. oversubscription). Conducting a similar experience in the search for the effects of uncertainty, Fish (2019) however finds mixed results while Hsieh and Oppermann (2021) find no influence of issue size on underpricing.

External quality ratings are often assigned to new token offerings. Moreover, the effects of quality signalling in ICOs were found to have positive effects to reduce asymmetric information and are strongly related to ICO's success (Boreiko and Sahdev, 2018). In which, they used venture capital participation as a proxy for signals. Other signals often deal with parameters such as retention rate, which is pointed out to signal low quality when with a low retention rate and vice versa, same to what was reported in the past for IPOs (Lee, Li and Shin, 2022; Lyandres, Palazzo and Rabetti, 2019; Ibbotson, Sindelar, and Ritter, 1994). Consistently, external ratings display a similar positive relationship with quality (Lee, Li and Shin, 2022). In the work of Felix and von Eije (2019), they found retention rate and third-party rating, as proxies of quality signalling, to reduce underpricing but not significantly.

Likewise, in the case of IPOs, factors such as market sentiment and optimism are also analysed to provide explanations for ICOs returns and pricing. In a study of two different market periods, Allen, Fatas and di Mauro (2022) discovered a strong correlation of ICOs performance with those of Bitcoin or Ether during periods of market bust, while little correlation was found for optimistic periods. They further conjecture that investors behaved irrationally and saw tokens as not only speculative vehicles but also as Bitcoin alternatives. Following this line, Drobetz, Momtaz and Schröder (2019) reveal a positive correlation between market sentiment and initial returns. While unveiling similar positive effects of market sentiment on underpricing, Felix and von Eije (2019) however found a negative sign for hot market.

Given that an essential conductor for crypto's frenzy is social media multiple authors also examine whether these variables play a role in ICO's underpricing. While Chanson *et al.* (2018) do not find any support for social media⁴⁶ but rather the important effect of public discussion forums⁴⁷, Benedetti and Kostovetsky (2018) show a significant impact of

⁴⁵ Though, it is important to note that Momtaz (2020) measures underpricing differently as previously discussed in 2.4.3.1.

⁴⁶ Measured with variables such as twitter's number of followers and activities.

⁴⁷ Online threads

Twitter followers on market capitalization yet intensive tweets can lead to reversals due to overreaction. They also analysed the effect of a firm's age, considering its influence on IPO's underpricing but no relation is found (Benedetti and Kostovetsky, 2018). Other platforms' presence like Telegram is also examined and shown to have a significant correlation with the success of the project and liquidity (Amsden and Schweizer, 2018; Howell, Niessner and Yermack, 2020).

2.5. Derivation of Hypotheses

2.5.1. The Existence of Underpricing

The previous analysis of underpricing literature and ICO evidence captured this phenomenon at different levels, oscillating between 110%⁴⁸ to even 919.9% (Adhami, Giudici and Martinazzi, 2018; Momtaz, 2020). A number of studies have also demonstrated the effect of various factors on the phenomenon of underpricing, whether it is strategically done or unintentionally by the fund-seeker. Therefore, considering the current context of IEO, one can conclude that underpricing also exists in this novel method. It is thus important to examine whether such prediction holds, especially in consideration of the scarcity of research on this topic. In other words, an empirical study will be conducted to evaluate the existence of underpricing in IEO and its predictors. Drawing from discussions of underpricing theories as well as empirical results of influential factors and the IEO's circumstances, conjectures could be depicted.

Information asymmetry theories suggest that its presence leads to underpricing, and a higher degree of asymmetry increases underpricing. Consequently, it could be argued that not only does underpricing exist in IEO but also, it would be at a greater level than in IPOs. In fact, given how IEOs are insufficiently investigated, in addition to the relative lack of issuer's experience and their unfinished product, compared to later-stage firms in IPOs and the heavily regulated IPO market. Furthermore, underpricing seems to be further aggravated by investors' fear of missing out and herding behaviour, given its hype. However, exchanges in IEOs attempt to reduce risks and asymmetric information, while also playing the role of a reliable intermediary, signalling theories indicate that underpricing in IEO would thus be lower than in ICOs. Hence, the first hypothesis is regarding the existence of underpricing in IEOs with:

H₁: Underpricing is significantly present among IEOs in the data sample.

Additionally, the level of underpricing compared to IPO shall be assessed to provide partially a relative image of underpricing. Note that IEOs are essentially accessible to all

⁴⁸ Excluding the result of 8.2% of Momtaz (2020) since he measures underpricing as in the difference between closing and opening price of first-day trading.

users of the respective exchange, regardless of their location as long as the platform is available for the country, and the projects often intend to be borderless. Therefore, the geographical location is trivial and not often specified. IPOs on the other hand, usually go public in a specific market. Whereby, it seems like there is no global IPO underpricing data, therefore, such phenomenon in IEOs would be compared to the US's IPOs study of Ritter (2022a), provided that it presents one of the most extensive data in underpricing. The data is updated yearly since 1980 for over 9000 IPOs in the US, in which underpricing is depicted at 18.9%⁴⁹ on average (Ritter, 2022). Given the wide fluctuation of average underpricing in ICOs, a postulation between IEO's underpricing compared to ICO would be refrained.

H₂: The level of underpricing is higher in retrieved IEOs compared to that of IPOs (between 1980 and 2021) in the US.

2.5.2. Possible Estimators

2.5.2.1. Information Asymmetry

Following this line, one shall investigate the relation of variables translated from theories of underpricing. In consideration of ex-ante uncertainty theory, a lower offer price or underpricing of tokens allows to attract uninformed investors in addition to the informed ones, and thus, increase the possibility to sell out the entire offer of tokens. As it is to be expected that the token markets are filled with informed investors in terms of computer science and information technology, who could even efficiently check the open-source codes and understand the entire project as well as its viability. While given the fear of missing out and other aforementioned herding behaviours, uninformed investors are also numerous and would randomly subscribe between "good" and "bad" offers. Moreover, they are essential to fundraisings' success and market liquidity, according to the adverse selection theory (Rock, 1986). The signalling theory also indicates that perhaps issuers strategically under-price their shares to signal quality. It is, therefore, to be expected the following hypothesis:

H₃: The offer price is negatively correlated with the level of underpricing.

On the other hand, among the possibilities to reduce information asymmetry and enable issuers to efficiently capture token values, it would be interesting to examine the effect of a token presale on underpricing level. Such structure of IEO is comparable to the conduct of sequential IPOs, which are documented to enable issuers to efficiently price the offer (Welch, 1992). In fact, the presale of tokens before the offering is also shown

⁴⁹ For equal-weighted average with criteria such as IPOs with offer price above 5 dollars. Further criteria can be found in the study of Ritter (2022a).

to greatly reduce underpricing or initial return in ICOs (Hsieh and Oppermann, 2021). It is expected to give issuers further insights into the market and gauge market demand, thus, enabling them to determine a more appropriate price for their IEO (Adhami, Giudici and Martizzani, 2019).

H₄: The level of underpricing in IEO is lower when a presale took place.

Another variable that plays a role in information asymmetry is the issue size. Similar to presale, past research suggested that larger issues have a significant negative effect on ICOs. Moreover, IPO studies regarding information asymmetry and underpricing, also indicated that larger issue is negatively related to underpricing (Beatty and Ritter, 1986; Ghosh, 2005). Possible reasons are elaborated by Dorsman, Simpson and Westerman (2013) in their paper, stating that since information about the value of a larger issue is more of interest, these are consequently more studied and ultimately it diminishes information asymmetry as well as ex-ante uncertainty of larger issues.

H₅: The issue size of an IEO negatively relates to its level of underpricing.

2.5.2.2. Quality Signals

Another factor that is related to the signalling theory is the role of a third party, which could be employed to elevate asymmetric information and thus, the level of underpricing. In this light, two variables arise. The first is the rating of the project by an external party, where a higher rating could enable fund-seekers to increase their price and reduce underpricing. However, it appears that most website publicizes their rating once the IEO is announced, so prior to the determination of the offer price, and thus, even evaluating the project with regard to its offer price. Therefore, the suggestion of signalling theories does not seem to apply to the way the rating is generated in IEOs. It becomes more appropriate to assume, that a higher rating in IEO would attract more investors and increase the level of underpricing.

H₆: The rating of IEO positively affects the level of underpricing.

Secondly, though it was not relevant in ICOs, the role of exchange can be expected to have an influence on IEOs. In fact, the reputation of an exchange is comparable with the reputation of an underwriter, which is suggested to correlate with the level of underpricing. Similar to external rating, the intermediary's credibility could enhance transparency and serve as a quality signal (Carter and Manaster, 1990; Michaely and Shaw, 1994). As exchanges supposedly vet the projects prior to their launch, they also publish their own report capturing essential details. Although the whitepapers and source code may be openly available, they often contain technical explanations while the reports of exchanges seem to target the larger public. Moreover, one can observe that some

exchanges launch IEOs more frequently than others. For example, while Binance publishes once a month, Gate publishes new offerings almost daily. This perhaps illustrates that a more reputable exchange takes time to screen and produce more comprehensive reports. Information asymmetry and underpricing can thus be expected to decrease.

H₇: An exchange's reputation negatively relates to the level of underpricing.

Moreover, the retention rate of tokens by the issuer team could also signal quality. In fact, such behaviour in combination with underpricing, as previously studied, indicates to the public a certain level of confidence in the project's long-term performance and value (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989). Since the issuers are assumed to have excess information about their project compared to investors (Papaioannou and Karagozoglu, 2017). Such a signal shall increase investors' interest and trust in the project, so the market demand for tokens and the magnitude of underpricing. Respectively, token is commonly used to reward people participating in the development of a project such as advisors, therefore, if the project is poor, retention of token would be futile.

H₈: The retention rate of tokens by the team and advisor positively relates to the level of underpricing.

2.5.2.3. Market Influences

Market sentiment is found to impact underpricing in both IPO and ICO, with a positive association between investor optimism and the degree of underpricing. Its importance in underpricing of IPO was highlighted by for example Loughran and Ritter (2002). In ICOs, it is further revealed that the hype around offerings was strongly linked to major cryptocurrencies like Bitcoin and also to the entire crypto market performance (Ciaian, Kancs and Rajcaniova, 2018; Masiak *et al.*, 2019). It is then reasonable to expect that when market sentiment is increasing in optimism, it would also increase IEO's returns. Issuers, on the other hand, might not be able to capture such behaviour, underpricing would therefore rise.

H₉: The market sentiment is positively related to the level of underpricing.

Accordingly, a period of hot market is defined as when there is a high concentration of offerings and usually happens when the market is filled with optimism. Moreover, given that there are more alternative options for investments, the under the price of issue could be strategically implemented to differentiate and attract investors. Conversely, certain IEOs intentionally take place during those periods to profit from optimism and therefore, increase their price. However, past studies suggest that such capitalization of sentiment

would not be successfully implemented, and underpricing would still occur (Campbell *et al.*, 2008; Ljungqvist, Nanda and Singh, 2006). Resulting in a seventh hypothesis that is:

H₁₀: The level of underpricing is positively related to the number of IEOs occurring in the period.

3. Empirical Examination

3.1. Data and Sample Construction

In order to test the aforementioned hypotheses, a sample consisting of 105 different IEOs taken between December 2017 to January 2022 was manually collected and exported to SPSS as well as JASP to perform all econometric and statistical analyses. Due to the nonexistence of any database for the accurate listing of all IEOs, the relevant data for this analysis were retrieved primarily from the respective exchange of the IEO. Any missing data point was then searched and gathered from the project's whitepaper and other crypto websites.

More precisely, most IEOs' information was collected directly from the IEO platform of popular exchanges with large database such as Binance and Huobi. Then, websites that list IEOs across various exchanges were also observed to complement information as some platforms stop displaying IEOs data past a certain date. From these listing websites, IEOs' announcements of smaller exchanges are also collected, as an attempt to elevate the bias arising from the collection of data only from popular exchanges. After that, these projects' data were searched and retrieved directly from their respective exchange or whitepaper, assuming that their information is most accurate.

Missing data and external input were taken from websites such as CryptoTotem, CoinMarketCap, and Coincodex. More specifically, ratings came from CryptoTotem, exchange's reputation from Coincodex, and hot market from all the above. Indeed, due to the relatively new fundraising method and unregulated market, the data could not be retrieved from academic-level sources. Nevertheless, CryptoTotem and Coincodex were chosen because of their relatively large dataset for IEOs and the possibility to obtain further explanations through communication with its support. CoinMarketCap is a commonly used source based on past empirical research (Felix and von Eije, 2019; Fisch and Momtaz, 2020; Lee, Li and Shin, 2022; Momtaz, 2020). Finally, the CCI30 index is taken directly from its official website⁵⁰.

⁵⁰ CCI30.com

Moreover, during the process, the absence of various variables' input and inconsistency of data led to an elimination of a project to safeguard the quality of the sample. For instance, the closing price and trading volume could be missing because of various reasons: the specific IEO was actually cancelled after its announcement, the token was not listed, removal of historical data due to a change in the project's token, or it was delisted from the exchange. Even though a random sampling technique with a larger sample size would have been most appropriate to represent the IEOs population in this study, due to lack of adequate sources and information, in addition to time constraints, a non-random sampling technique was conducted instead. The obtainable sample consists of 105 IEOs occurred between December 2017 and January 2022.

3.2. Methodological Approach

3.2.1. Variables

3.2.1.1. Underpricing

Defined as when there is a positive return on investment of shares or coins at their offer price. Thus, the phenomenon is to be measured based on the standard method in IPOs as well as the majority of ICO studies, which is:

$$UP = \frac{P_c - P_o}{P_o} \quad (1)$$

where UP is the underpricing level, P_c is the closing price and P_o is the offering price of the issue. Note that however, unlike the traditional stock market, tokens can be traded continuously across the globe and are not bounded to opening hours. Thus, there is no official closing price of a day. Pursuing the line of solution of other scholars (Felix and von Eije, 2019; Hsieh and Oppermann, 2021), the last price, displayed by the respective exchange on the listing day, is taken as a proxy for the "closing price of listing day" parameter.

Considering the highly volatile crypto market and past evidence of strong price influences by major cryptos, additional correction for underpricing is also conducted against a benchmark (Masiak *et al.*, 2019; Momtaz, 2021; Yi, Xu and Wang, 2018). The equation when adjusted for the market shall be:

$$UP_A = \frac{P_c - P_o}{P_o} - \frac{M_c - M_o}{M_o} \quad (2)$$

where UP_A is the adjusted level of underpricing, P_c , P_o , like in equation (1), M_c and M_o are the market closing price and opening price, respectively. Moreover, the market value is measured on the listing day, proxied by the CCI30 index. Such index represents the market portfolio of the 30 largest tokens by market capitalization, covering 81.6% of the

entire crypto market as of the beginning of 2022 and previously used as benchmarks in ICOs' empirical studies (Aslan, Sensoy and Akdeniz, 2021; CCI30, 2022; Felix and von Eije, 2019).

3.2.1.2. Independent Variables

A set of variables is comprised after thoroughly examining not only the characteristics of IEO but also, the phenomenon of underpricing. In consideration of how underpricing essentially arises from IPO, many theories were offered in IPO literature to explain the phenomenon. Therefore, many variables are constructed and grounded from them. Additionally, as ICO, the IEO's relative, has been in the picture for a longer time, a number of empirical works regarding its underpricing determinants could be found. Consequently, as demonstrated in the derivation of hypotheses, ICO literature enables a better selection of variables, those that are relatively more applicable and substantial for the token context⁵¹.

Consistently, three independent variables were employed to test for the hypotheses related to information asymmetry (H_3 , H_4 , H_5). The first one was the offer price variable, which would be given in dollars. When a dollar value was not directly displayed, for example, where the offer price was expressed only in Ether, the exchange rate⁵² of Ether on the announcement date was taken and the value was then transformed into dollar, based on this rate. Secondly, was the presale variable, collected mainly from the research report of the exchange, as well as the project's whitepaper and the rating website to ensure accuracy. When a presale was held prior to an IEO, it would be assigned a value of "1", if not, "0" would be given. Thirdly, was the issue size. The data were retrieved from the IEO exchange platform. Hereby, the number of tokens offered would be multiplied by the dollar value of the offer price for consistency across all values. The variable would be expressed in million dollars.

Rating, exchange reputation, and retention rate were variables used for H_6 , H_7 , and H_8 . Of which, rating would be defined as an external rate of IEO project. Notably, "low", "medium", and "high" were converted into a scale of "1", "2", and "3" respectively. When a rating was marked on not available, "0" was given to the project. Exchange reputation was the number of criteria that an exchange met, provided by Coincodex, such as possession of certain licenses or membership of some organizations (see appendix A.1 for further information). Finally, the retention rate implied the percentage of tokens that

⁵¹ See appendix A.2 for a summary of all variables.

⁵² Calculated based on the opening price of the cryptocurrency since no official daily exchange rate or average price data could be obtained.

were kept by the project team and management. This information was usually included in the research report and whitepaper.

The last two hypotheses (H_9 , H_{10}) require market sentiment and hot market. Following the ICOs approach, the 15-day market return of the CCI30 index was calculated for the former market sentiment (Momtaz, 2020). The value was assessed for the listing day and retrieved from the website of CCI30. For the latter variable, while ICOs literature often predefined hot market as a period where they could observe a surge in the number of ICOs based on websites such as CoinSchedule, most of them are unfortunately no longer available. The current websites also do not provide practical access to such a view of overall IEOs. As a result, building upon the definition of density of offerings in a time period, the variable was translated into the number of IEOs that occurred within fifteen days prior to the IEO and was bounded to those in this dataset.

3.2.1.3. Control Variables

Past empirical works for underpricing consist of a number of frequent control variables. Among others, is the ERC20 variable. ERC20 is one of the pioneering standards in tokens, originate from the Ethereum blockchain, requiring tokens to conform to a list of rules prior to its construction on Ethereum. Although there are other technologies as well as the possibility to develop their own, ICOs studies indicate that it is the most prominent application (Momtaz, 2021). Momtaz, Rennertseder and Schöder (2019) figured that roughly 88% of the token market share are ERC20 based tokens in addition to the statistically significant positive effect of the variable on first-day returns. Accordingly, ERC20 seems to be an important character to control and to reduce information asymmetry as well as underpricing, coded with “1” when the token is based on ERC20 and “0” if otherwise.

Likewise, is the duration variable. It is the length of the launch and the number of days that a token is offered during IEO extracted directly from the exchange. Given that there is no rule of thumb, it varies from IEO to IEO as well as exchange. Such a factor was not only expected to negatively correlate with ICOs but also with crowdfunding returns (Chanson *et al.*, 2018; Cumming, Johan and Pant, 2019; Mollick, 2014). A possible explanation for this is that a longer duration could indicate a lower market demand (Chanson *et al.*, 2018).

The trading volume was also revealed to have much association with ICO underpricing and liquidity of the secondary market (Howell, Niessner and Yermack, 2020). Though it is only revealed post offering, it was suggested to be a relevant control variable as its positive relationship with underpricing was also reflected in IPOs and ICOs underpricing studies (Felix and von Eije, 2019; Miller and Reilly, 1987; Schultz and Zaman, 1994).

The variable would be expressed in million dollars based on the number of tokens traded on the first listing day and retrieved from the exchange on which the IEO took place.

Lastly, to encourage investors, IEOs issuers could include programs such as rewarding and bonus programs. Although these rewards can take many forms, they usually lead to the gain of tokens or discounts of other utilities related to the same ecosystem. Adhami, Giudici and Martizzani (2019) suggested that such a structure may influence the outcome of ICOs, moreover, it can be expected to increase market demand for the token. Given its potential to positively influence returns and upon the study of Felix and von Eije (2019), the bonus program is taken as a dummy control variable as well. Denoted as “1” when a rewarding scheme was offered before the IEO and “0” if not.

3.2.2. Descriptive Statistics and Statistical Significance

The descriptive statistics would be analysed to provide an overview of data as well as its implications. Moreover, since one of the primary research goals is to examine the average level of underpricing, such measure can be significantly influenced by outliers and requires extra attention in presence of extreme values. In fact, considering that the sample was a non-probability sample, it is therefore biased, and outliers can be expected. The analysis of descriptive values should therefore be interpreted with caution, in particular for measures like arithmetic mean. Thus, median values shall also be carefully reported. However, all the data points were thoroughly checked to ensure that no entry errors could occur.

It is however insufficient to provide conclusions with such statistics. Therefore, significance tests would be conducted to give further insights into the validity of values. Hence, to evaluate empirically the existence of underpricing in IEOs, the conventional t-test shall be conducted and allow to test the null hypothesis of this paper. Keeping in mind that underpricing is defined as when the first-day return is positive, H_0 implies therefore that:

$$\frac{P_c - P_o}{P_o} \leq 0 \quad (3)$$

And the existence of underpricing (H_1) implies that:

$$\frac{P_c - P_o}{P_o} > 0 \quad (4)$$

Hence, the alternative hypothesis is set to strictly greater than 0 while the null hypothesis would specify that the mean is less or equal to 0. Furthermore, the t-test presupposes that this assumption (H_0) holds true in the sample population. Therefore, if this test displays a significantly low value of p (typically ≤ 0.05), the null hypothesis would be

rejected and the alternative hypothesis would be strongly supported. Similarly, for H_2 , the t-test would test against the value of average IPO's underpricing (0.201).

Regardless, such a test is parametric and assumes a normal distribution. Although the Central Limit Theorem underlines that notwithstanding the distribution of population, when the sample size is larger (equal to or above 30), it would approximate a normal distribution of means (Kwak, 2017; Le Cam, 1986). Nonetheless, a normality test shall take place to check whether the robustness of the t-test fully remains. The Shapiro-Wilk test is employed as it is revealed to be the most powerful normality test for distribution (Razali and Wah, 2011). The test however demonstrates a significant deviation from normality since the probability for normality, when testing for both unadjusted and adjusted underpricing, was found at less than 0.1%.

In the presence of non-normality, several scholars highlight the possibility for a non-parametric test such as the Wilcoxon signed-rank test and the bootstrap technique (Dwivedi, Mallawaarachchi and Alvarado, 2017; McDonald, 2009). Thus, they are conducted to enable a better interpretation of results. Essentially, Wilcoxon is comparable with the t-test except that it evaluates the median. Hence, in order to compare IEO's underpricing and IPO's underpricing, the test would be testing against the median of IPO's underpricing. The median value is 7.1%, provided by Ritter (2022b) via email exchange, the author of the same extensive underpricing report of the US IPOs for the mean data as well as many other previously assessed studies. On the other hand, the bootstrap t-test allows computing for the original t-test⁵³ with the difference that it resamples the data, by sampling with replacement. The test would be performed by SPSS, for a number of 10,000 samples (Chernick, 2007).

3.2.3. Multiple Regression

3.2.3.1. The Model

To investigate possible determinants of the underpricing, consistent with the method applied by a vast number of studies regarding underpricing in both IPOs and ICOs, a multiple linear regression would be applied for statistical inference and estimation of parameters. This method enables not only the depiction of which influence a set of explanatory variables has on the dependent variable but also, it allows to test the statistical significance of those parameters (Auer and Rottmann, 2015). Note that although predictions, which guess the outcome a random value, are usually constructed on the estimated parameters, it comes with greater uncertainty and requires a large

⁵³ Given that the original t-test assumes normality distribution, bootstrapping or resampling process provides a larger sample size and thus, converges the sample towards the Central Limit Theorem.

sample as well as resources for efficient modelling (Kiefer, 1987; Hahn and Meeker, 1991). Hence the interest of this paper is rather on the testing of hypotheses regarding parameter estimates⁵⁴ and the change in underpricing in association with the change of predictors⁵⁵ such as rating.

The regression analysis will be applied based on the following equation:

$$\begin{aligned} Adj_UP_i = & \alpha - \beta_1 \times OfferPrice_i - \beta_2 \times Presale_i - \beta_3 \times Issuesize_i \\ & + \beta_4 \times Rating_i - \beta_5 \times ExchangeReputation_i \\ & + \beta_6 \times RetentionRate_i + \beta_7 \times MarketSentiment_i \\ & + \beta_8 \times HotMarket_i - \beta_9 \times Duration_i + \beta_{10} \times TradingVolume_i \\ & + \beta_{11} \times ERC20_i + \beta_{12} \times BonusProgram_i + \varepsilon_i \end{aligned} \quad (5)$$

where i represents the different IEOs in the sample, α is the constant defining the interception of the linear line and the underpricing axis, β represents a coefficient of parameter i.e. rate of change in underpricing in function of the changes in independent variable and finally, ε is error term or unexplained variation.

3.2.3.2. Assumptions Testing

In consideration of the usage of real data, which commonly fails to meet assumptions⁵⁶, testing for assumptions becomes therefore necessary for the acknowledgement of shortfalls as well as the potency of the model, prior to the generation of claims. They include the absence of non-linear patterns, independent errors (autocorrelation), little to no multicollinearity, homoscedasticity, and normal distribution (Theil, 1971; Schmidt and Finan, 2018).

Non-linearity implies that the relationship between residuals and the dependent variable has a rather “curved” pattern (de Souza and Junqueira, 2005). Such assumption was tested via a scatterplot as shown in appendix B.1 and is accepted. Moreover, the problem of autocorrelation arises when the error terms are correlated, and the estimators would not be asymptotically efficient. The assumption is investigated with the Durbin-Watson test (appendix D.1), resulting in 2.060⁵⁷, which is between the critical upper value and 2, as a result, nearly no autocorrelation could be detected (Dufour and Dagenais, 1985; Savin and White, 1977).

Multicollinearity is essentially defined as when there are high correlations between the independent variables (Ho, 2006). According to Raykov and Marcoulides (2012), such a condition needs to be tested in regression analysis since its presence implies the usage of redundant information in the model and resulting in an ineffective estimation of

⁵⁴ i.e. coefficients

⁵⁵ Predictor variable is not to be confused with a prediction of the outcome value.

⁵⁶ Although some assumptions are more relevant for fitting a predictive model of future outcome value than to estimate parameters (effect in the change of x-variable to y-variable).

⁵⁷ Whereby 2.0 indicates no autocorrelation.

coefficients in the model. Therefore, to test for multicollinearity, both the analysis of correlation coefficients and the Variance Inflation Factor (VIF) would be performed with SPSS (appendix D.2). If the correlation coefficients are greater or equal to 90%, one can conclude that multicollinearity exists and adjustments are required (Dohoo *et al.*, 1997). While for the VIF test, multicollinearity is determined when the tolerance is less than 0.1 and when VIF is above 10 (Chen and Rothschild, 2010). Consequently, the results indicate an absence of multicollinearity as the highest correlation is of offer price and retention rate for -40.3% (appendix B.5).

On the other hand, theoretical residuals were often questioned whether they should be tested for normality since only observed residuals are available for testing. Among scholars, there is disagreement on whether the test still remains relevant and should be done (Goldstein, 2009). Some even argue that such an assumption is barely important, and they do not recommend inducing for it since overall regression line estimation remains unbiased⁵⁸ regardless of distribution (Ferré, 2009; Gelman and Hill, 2006; Schmidt and Finan, 2018). Nevertheless, a violation of such has implications on inferences, given its importance for confidence interval and efficiency of prediction (Paul and Zhang, 2010). For this sample, a test of normality via the Shapiro-Wilk and Q-Q plot indicates that this assumption is violated (appendix B.2 and B.3). Although potential remedies (e.g trimming or winsorizing outliers) could take place, outliers are retained in this dataset due to the paper's role of exploratory research in the field of IEO and the lunatic world of crypto, justifications for treatment of outliers would likely fall short.

To test for homoscedasticity, which means equal finite variance among variables in a set of data, otherwise, it is heteroscedasticity (Jamshidian and Jalal, 2010). Although the resulting estimators in presence of heteroscedasticity remain unbiased, yet they are no longer efficient (Carrol and Ruppert, 1981; Hayes and Cai, 2007). Therefore, the modified and original Breusch-Pagan shall be used to test for this scenario. Such tests suggest heteroscedasticity. Note that although the preceding assumptions test already indicated unbiased coefficients results from the ordinary least squares (OLS) regression, the robust standard errors method⁵⁹ shall be additionally done to obtain consistent estimators and enable more conservative claims (Croux, Dhaene and Hoorelbeke, 2004; Hayes and Cai, 2007; Long and Ervin, 2000). This technique is argued by Hayes and Cai (2007) to allow an estimation of coefficients without constraint on error terms structure. Furthermore, they also highlighted the advantage of HC3 method regression, which would thus be the selection for this model in SPSS.

⁵⁸ Meaning, the expected values of estimators fit the parameter values.

⁵⁹ Also known as the heteroscedasticity-consistent standard errors in the linear regression model (HCCM).

3.3. Results

3.3.1. Descriptive Analysis

Appendix A.3 contains an overview of all descriptive results on the collected dataset. First and foremost, the average level of underpricing could be observed at a substantial level, that is 8.476 (847.6%). Put differently, the tokens of the collected IEOs could be traded at 847.6% of its offer price on its first trading day. The table also displays that the variable's maximum return remarkably reaches 14,447%, implying an incredible short-term return for participants of this project. The smallest value of underpricing on the hand is discovered at -76%. While the median remains high (229%), it is much lower than the mean and highlights the skewness of the distribution. In other words, the average level of underpricing seems to be largely affected by a number of extremely high initial returns. The skewness of 5.027 further indicates that the distribution is skewed with a long right tail. The measurement of kurtosis also shows a high peak of distribution (32.608). The market-adjusted underpricing however is comparatively lower, at 757.6% for the mean. Similarly, the median is found to be only slightly lower than for unadjusted value, at 224%. Interestingly, the lowest return here is -965%, suggesting a large market movement on the listing day of this IEO while the maximum is at 14,424%.

In addition to positive results of arithmetic mean and median, it was also detected that 90.48% of the observations are comprised of underpricing values, with an average of 949.89% among positive IEO returns. Thus, a vast majority of the offerings were presumably profitable when accounting for short-run performance. Conversely, only 9.52% of the retrieved IEO led to a loss, and the return was on average at -26.7% among all negative returning IEOs. Hence, it appears that the sample size is subject to the underpricing phenomenon, and tokens issued via this mechanism tend to perform well on their first trading day. Moreover, offer price is on average at \$0.88, with a large range of minimum price at \$0.00000013 and maximum at \$26.76. Issue size and trading volume are on average respectively at \$6.91 million and \$78.75 million while the duration is around 5 days.

The results for statistical significance also indicated a strong presence of underpricing among these IEOs. In fact, the one-sided t-test (appendix C.2), showed that underpricing is significantly present for both raw and market-adjusted data, i.e. the initial return was significantly positive with a medium effect size. Moreover, to ensure a valid result, given non-normality, the bootstrapped t-test (appendix C.3) for 10,000 samples against the mean of 0 also reported significant underpricing for both values. Similarly, the non-parametric Wilcoxon's signed-rank test (appendix C.4) demonstrated that the median of

both underpricing was substantially greater than 0 and the effect size was large. It is thus possible to reject H_0 and assume the existence of underpricing (H_1).

When comparing with the level of underpricing in US IPOs occurred during the period from 1980 to 2021, the same procedures were undertaken. Subsequently, all three tests (appendix C.5-C.7) provided evidence of significantly greater values and medium to large effect size, for mean and median respectively. Supporting H_2 that IEO underpricing in this sample is severely higher than the average of 18.9% and the median of 7.1% for IPOS in the US, as reported by Ritter (2022a). When contrasting with ICOs, the means are comparable with the findings of Adhami, Giudici and Martinazzi (2018) for ICO underpricing, and yet the recorded median in their study is much lower (24.7%). Regarding other results of underpricing in ICO empirical analyses, it appears that IEOs in this sample are more under-priced.

3.3.2. Multiple Regression Analysis

The results of the robust standard errors regression model, computed with SPSS, can be found in appendix D.3. It provides information on the independent variables and their coefficients of correlations, as well as its statistical significance and the coefficient of determination R-squared (R^2) at 95% of confidence interval. Furthermore, the R^2 , which directly interprets the proportion of variance in the dependent variable, indicates that the predictors of the equation can explain 25.5% of the variance and 15.7% when adjusted for the number of predictors. Note that the resulting R^2 is higher than that of some ICO underpricing studies. The developed model according to unstandardized parameter estimates is, therefore:

$$\begin{aligned} Adj_UP_i = & 14.220 - 0.666 \times OfferPrice_i - 1.682 \times Presale_i \\ & - 0.109 \times Issuesize_i + 1.003 \times Rating_i \\ & - 4.189 \times ExchangeReputation_i - 15.066 \times RetentionRate_i \\ & + 1.555 \times MarketSentiment_i - 0.398 \times HotMarket_i \\ & - 0.665 \times Duration_i + 0.033 \times TradingVolume_i \\ & - 0.630 \times ERC20_i + 8.421 \times BonusProgram_i + \varepsilon_i \end{aligned} \quad (6)$$

First and foremost, the set of variables in relation to information asymmetry, signalling, and market sentiment/ cycles aiming at explaining underpricing shall be examined. Starting from the offer price, which has a negative coefficient of -0.666. Such a sign indicates that a lower offer price is negatively correlated with underpricing. However, although this coefficient is robust, given that it was not found to be significant, the result fails to confirm the third hypothesis.

Other factors with insignificant coefficients are presale, rating and market sentiment. Although H_4 , H_6 , and H_9 assumed an accurate sign of the correlation between the explanatory variables and underpricing, these hypotheses failed to reject their null

hypotheses when judging their significance. With presale ($\beta = -1.682$) is a scenario where underpricing is expected to decrease since it enables the IEO project team to gauge market demand beforehand. The rating is estimated at 1.033, implying that each additional increase in rating scale by external website such as Cryptototem, is associated with an increase of 1.033 of underpricing level. Whereas market sentiment ($\beta = 1.555$) highlights an increasing optimism among investors, which could accentuate market demand and under-price.

A significant coefficient was discovered for issue size, at over 95% of significance. With a negative parameter of -0.109, it is in accordance with hypothesis H_5 . Hence, the null hypothesis of H_5 should be rejected. Furthermore, the result estimates that an additional million dollars in the issue size would decrease the level of underpricing by 10.9% for this sample. Similarly, the seventh hypothesis concerning the exchange reputation is unveiled to align with the prior assumption on a negative correlation ($\beta = -4.189$). With its p-value being significant in the normal regression at 99%, but to ensure consistency, the robust standard errors suggest that it is borderline significant at 94.7%. As a consequence, H_7 remains inconclusive from a conservative approach.

On the other hand, H_8 and H_{10} have unexpected signs compared to previous hypotheses. The retention rate is another variable belonging to the signalling explanations. Contradicting the assumption of H_8 , it displays a large negative parameter of -15.066, indicating each additional percentage kept by project management and the team could decrease the return by 15.07% among IEOs in this sample. Though, the coefficient is also insignificant. Likewise, hot market (H_{10}) has an unexpected negative coefficient ($\beta = -0.398$) but the p-value is higher than 0.05. Thus, both H_8 and H_{10} cannot be rejected or confirmed.

Lastly, three out of four control variables were found to have a significant influential relationship with IEO underpricing. Including, duration of the offer ($\beta = -0.665$), trading volume ($\beta = 0.033$) and bonus program ($\beta = 8.421$). In fact, among all the parameters of the equation, the unstandardized betas indicate that trading volume has the greatest relationship with underpricing level, followed by exchange reputation and the existence of bonus program⁶⁰. While ERC20 has a negative and insignificant influence on underpricing.

⁶⁰ The unstandardized betas are sequentially at 0.380, -0.282 and 0.230 for trading volume, exchange reputation and bonus program.

4. Discussion

4.1. Discussion of Results

The carried investigation suggests a strong and large presence of underpricing in initial exchange offerings. The result indicates an average level of initial returns at 847.6% for raw underpricing and 757.6% for adjusted underpricing, which is within the range of previous mean in ICOs⁶¹, in particular, with the findings of Adhami, Giudici and Martzinazzi (2018) for ICOs where they find 919.9%. However, while their study found a median of only 24.7%, the median from this IEOs sample is at 229%. It seems therefore that although ICOs can contain extremely under-priced tokens with great returns, they also involve more risk compared to IEOs. Arguably, the aim to mitigate information asymmetry through the re-introduction of intermediary - the exchange, has allowed for lowering risks in token offerings. Notwithstanding, this funding mechanism is still subject of significant asymmetric information, likely because it remains an unregulated market with barely any reputable legal actors. Therefore, underpricing tokens enables to attract both informed and uninformed investors. However, some IEOs were not listed after its announcement, perhaps only projects which could afford this loss from underpricing would proceed in the offering. Additionally, as more than 90% of these IEOs led to positive returns and their average was 949.89%, it further suggests that if an investment was to be profitable, it would tend to return ten times the initial investment.

The regression results highlight a relatively great degree of variance explanation compared to previous underpricing models in ICOs. Implying that perhaps information asymmetry, signalling and market-related variables have a stronger influence on underpricing in IEOs than ICOs. To name a few, Momtaz (2020) found only 6.7% of R^2 in his linear regression, whereby, he argues that past regressions conducted to explain underpricing in IPO also pointed to a comparatively low R^2 . Chanson *et al.* (2018) from their model also uncovered an adjusted R^2 of 14.9% and Lee, Li and Shin (2019)'s R^2 was at 17%, while the model of Felix and von Eije (2019) could explain the phenomenon of underpricing in ICO to 33%.

The findings underline primarily that information asymmetry theories could likely explain underpricing in IEOs. Indeed, the coefficient of offer price is consistent with information asymmetry and the winner's curse (Kothari, Warner and Eckbo, 2007; Rock, 1986). Herewith, by setting offer price to be relatively low, it enables issuers to generally attract more investors, translated therefore to a greater demand for token as well as higher underpricing. Furthermore, it may strategically be used to signal quality of the project as

⁶¹ As discussed in chapter 2.5.2. The Existence of Underpricing

previously assessed, which would ultimately increase its value in the secondary market. To reduce asymmetric information and underpricing, presale could also allow issuers to gain relevant information for their pricing. Though not significant, in presence of a presale, it could reduce underpricing by roughly 168% according to this sample. Similarly, as explained in IPOs, larger issue size does seem to negatively correlate with underpricing as they are more thoroughly investigated. However, the effect of issue size on underpricing seems to be minor compared to presale in IEOs.

Since IEOs reintroduce the role of an underwriter in the token scene - the exchange platform, its influence on underpricing is intriguing. In fact, the coefficient of exchange reputation shows that exchanges with higher reputation decrease underpricing by a large extent. Although the data display significance at only 94.7% when adjusting for standard errors. A plausible explication for this correlation would be that projects, which passed the vetting and were introduced on a more reputable large exchanges, are better regarded with more demands, while facing fewer concurrences from other IEOs on the same exchange. Supposing, that popular exchange launches less frequently projects, thus, when there is less fierce competition, issuers would not have to employ strategies such as low offer price to attract investors. Additionally, popular exchanges provide accessibility to a larger network of potential investors and users, given that it has a redundant secondary market for tokens. All of which implies that launching on such an exchange could reliably signal quality to many investors, consequently, project teams would attempt to capitalize on it with a higher offer price and decrease underpricing.

Interestingly, the result of retention rate and hot market contradict to the prior assumption. The outcome of the retention rate could indicate a higher setting of the token's offer price, due to the issuer's confidence in the project, thus, countering the underpricing level. Furthermore, one could attempt to reason this from an investor perspective by reflecting upon the ethos of cryptocurrency and tokens, where decentralization is at the centre. When a large portion of tokens is retained by an individual or group of people, from an investor perspective, it implies more concentration of power in the market and pricing control. Perhaps in a market where there is relatively no framework to punish such behaviour, the higher retention rate stipulates more of a negative signal and excessive power concentration. While hot periods mean more IEOs and were expected to imply higher under-price of the token as means to attract investors according to IPOs research (Ritter, 1984). Nevertheless, the coefficient suggests the opposite and such sign is actually consistent with the result of Felix and von Eije ICO studies (Felix and von Eije, 2019). In fact, issuers would tend to profit and capitalize on optimism in the tokens market.

Furthermore, a shorter duration of the offer is associated with more underpricing at a significant level. Various explanations aligning with underpricing theories could be given for this. As previously assessed, it could suggest confidence in fundraising in a shorter amount of time, i.e. quality signal. It could also arguably generate more irrational attitudes such as fear of missing out since longer duration allow investors to have more time to perform due diligence and evaluate an offer. While implementing a bonus program strongly increase underpricing. The most prominent reason is likely because of higher market demand for such tokens and issuers did not capitalize it⁶². Findings regarding the ERC20 standard support a decrease in asymmetric information and underpricing but are not significantly evident. Trading volume though is significant, could not explain much variance in underpricing, with an additional million dollars of trading volume on the first listing day related to an increase in underpricing level of only 3.3%.

4.2. Limitations and Implications

Many limitations were encountered during this research. Predominantly from the lack of data and its reliability as the concept of IEOs is relatively recent. Given that the token market is unregulated in many aspects, information about different projects varies greatly even within the same exchange platform⁶³. Many projects needed therefore to be excluded or complemented information based on other sources. Such manual collection across various sources impedes the reliability and consistency of data as the non-probability sampling method became the only option. Furthermore, the exclusion of projects with missing data points was usually because a token was delisted along with all of its information, making this sample prone to survivorship bias. In other words, IEOs which could be captured in this sample consist of tokens that were not delisted, probably implying that they performed better, thus, their launch could experience stronger underpricing compared to that of failed and delisted projects.

Moreover, during the examination of past studies, it was discovered that token websites like ICO Rating, ICOBench and Coinschedule, i.e. sources that were widely used by a vast number of ICOs studies, were publicizing paid promotion without disclosure (Abbassi, 2018; Munster, 2019; SEC, 2021). This denotes that websites dealing with tokens, including those used in this research, are to be cautiously regarded for their credibility. The study of Boreiko and Vidusso (2019) which focus solely on the credibility of external ratings in ICOs also mentioned that these websites are often of low quality.

⁶² It could however be either intentionally or unintentionally. The former case could be conjectured that issuers prioritize network user mass over leaving money on the table, whereas the latter could be due to lack of experience and difficulties to handle such a volatile market.

⁶³ Recently in IEOs, there is a type of offerings through “launchpools”, whereby, investors who wish to participate need to stake a certain number of tokens for a period of time. Such IEOs were not accounted in this research due to the lack of precise price point for the determination of token offering price.

All of which emphasizes the urgent need for a regulatory framework not only to minimize risks but also to increase data adequacy, enabling more accurate analysis of this novel mechanism and its potential for both investors and researchers.

In addition to possible deviation from reality because of inadequate sources, the implementation of real data commonly leads to rejections of many model assumptions. Notably, are the violation of normality distribution and homoscedasticity, as previously demonstrated. Besides remedies for outliers as a possible solution, a larger sample could have allowed to converge towards these assumptions and better postulation outside of the sample. While the implementation of robust standard errors allowed to improve consistency, meaning when the sample size increases, the sampling error would decrease, further enhancement of the model could indeed take place. In fact, as this is an exploratory research, not only that outliers were untouched because of insufficiency in reasonings for their rejection, but also, many variables were incorporated to grasp their possible influences on underpricing. Based on this, a new model incorporating only predictors with high significance and large influence on the level underpricing could be inspired and perhaps explain more variance in underpricing.

The results of this paper show nonetheless that IEOs issuers could price tokens more efficiently by conveying information to investors through various quality signals to reduce information asymmetry. It also enables a better understanding of market sentiment and cycles to strategically plan IEOs. Investors on the other hand, are presented with a set of variables that would facilitate the identification of an under-priced token offer. Additionally, the findings also mean that investors are relatively susceptible to signals emitted by issuers and exchanges. Such behaviour might be of concern for manipulation, considering the lack of regulation, protection for investors and validity of the information.

5. Conclusion

Despite the lunacy in the crypto world both in general and in the thriving amount of investment money involved in token offerings, there is little to no research in IEOs. This study attempts therefore to explore and provide also empirical insights for this field in terms of underpricing. To understand the IEOs concept, it was essential to initiate by evoking its development and other similar mechanisms like crowdfunding and ICOs. In fact, they all share many similitudes which had revolutionized digital finance in the past and perhaps would also in the future. However, characteristics specific to IEOs such as their purposes, tokens, structure and market were also assessed. Followed by an analysis of economic rationales. In fact, IEOs could highly benefit young ventures, especially those dealing with blockchain, in their growth, while allowing high-risk appetite

investors to participate in a much simpler manner than ever before. Yet, the main outstanding problem of IEOs and tokens topics originates from the lack of regulation and authorities' control. Note that however, it appears that such an issue is currently working on by most regulators and exchanges, collaboratively, as previously shown in their approaches.

Considering the possible returns that tokens can generate, it is thus crucial to understand and explain the surge in token price post offering. Constructed upon underpricing literature of the well-established predecessor funding method IPOs and empirical ICOs findings, a set of hypotheses were tested through various statistical tools. Subsequently, 105 different IEOs were observed and showed evidence of the underpricing phenomenon at a considerable extent. Such a conclusion was drawn from the mean, median as well as in comparison of the respective parameters to IPOs of the US market. The result corresponds to those of underpricing in ICOs. The main difference between the two lies in the reintroduction of intermediary, i.e. the exchange platform, aiming to enhance transparency and suppress frauds. After testing for assumptions, the robust regression model was chosen and further highlighted that issue size, duration and bonus program could significantly affect underpricing but failed to find a significant impact of the offer price, presale, rating, exchange reputation, retention rate, market sentiment, hot market and ERC20 implementation. With offer price, presale, issue size, exchange reputation, retention rate, hot market, duration and ERC20 having a negative relationship with underpricing level and the remaining predictors having positive effects.

Through the empirical examination of proxies arising from important underpricing theories including information asymmetry, its extensions, signalling theories and behavioural market movement, an equivocal picture of IEOs and the phenomenon of underpricing could be drawn. There is, however, much room for further research beyond the sample enlargement and statistical improvements of the current model. As the concept and literature of IEOs remain quite immature, despite the growing number of launches every day as well as returns, depicting an expanding market and interest. It would be intriguing to analyse the topic in the future at different time periods, as current results could be impacted by its novelty. Alternatively, the return on investment for a longer timeframe to evaluate whether tokens' value sustain. Furthermore, the role of exchange in IEOs should be more profoundly investigated, in terms of fees, negotiating power, incentives regarding the principle-agent theory and opportunity costs for issuers as well as investors. The role and extent of involvement that should be taken by an authority to regulate IEO without obstructing its growth should also be discussed. Another interesting point is to search for the involvements of bigger venture capitalists and consequences in this scene, whether prior to or during IEOs. Assuming that

underpricing is as present as suggested by this sample, it most likely has sparked interest beyond that of average retail investors. Moreover, given that there is such an important amount of money left on the table, there could be ulterior motives in token offerings that were not introduced in IPOs and require further studies.

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Annexes

Appendix A: Information on Variables

Appendix A.1: Exchange Reputation by Coincodex

How do we determine which exchanges are Trusted Exchanges?

There are a number of different criteria an exchange can meet in order to be included in our Trusted Exchanges list. This either includes membership in certain organizations, holding certain licenses, or receiving good scores in reports produced by cryptocurrency research firms. If a cryptocurrency exchange meets any of the following criteria, we will include it in the Trusted Exchanges list:

- The exchange holds a [BitLicense](#) with the NYDFS (New York State Department of Financial Services)
- The exchange is a member of Japan's [JVCEA](#) self-regulatory organization
- The exchange is listed as "BTI Verified" by the [Blockchain Transparency Institute](#) (BTI)
- The exchange is one of the exchanges identified as having "real volume" by Bitwise Investments in their presentation to the Securities and Exchange Commission (SEC) from March 2019
- The exchange was included in Group 1 AND achieved a score of 4 or higher in Alameda Research's

	Bitwise report	BTI Verified	BitLicense	Alameda report	JVCEA
Binance	✓	✓		✓	
OKEx				✓	
BitMEX				✓	
Huobi Global				✓	
Bybit				✓	
BitMax				✓	
Coinbase Pro	✓	✓	✓	✓	
UPBit		✓		✓	
Kraken	✓	✓		✓	
Liquid		✓		✓	✓
Bitstamp	✓	✓	✓	✓	
Bitfinex	✓			✓	
Coinone				✓	
Bittrex	✓	✓		✓	
Gate.io		✓		✓	
BitFlyer	✓	✓	✓	✓	✓
Gemini	✓	✓	✓	✓	
Coincheck				✓	✓
Poloniex	✓	✓		✓	
Binance.US				✓	
OKCoin				✓	
Bitbank				✓	✓
Bitso		✓			
Indodax		✓			
itBit	✓	✓	✓		
Zaif				✓	✓
CEX.io	✓				

Source: Coincodex.com

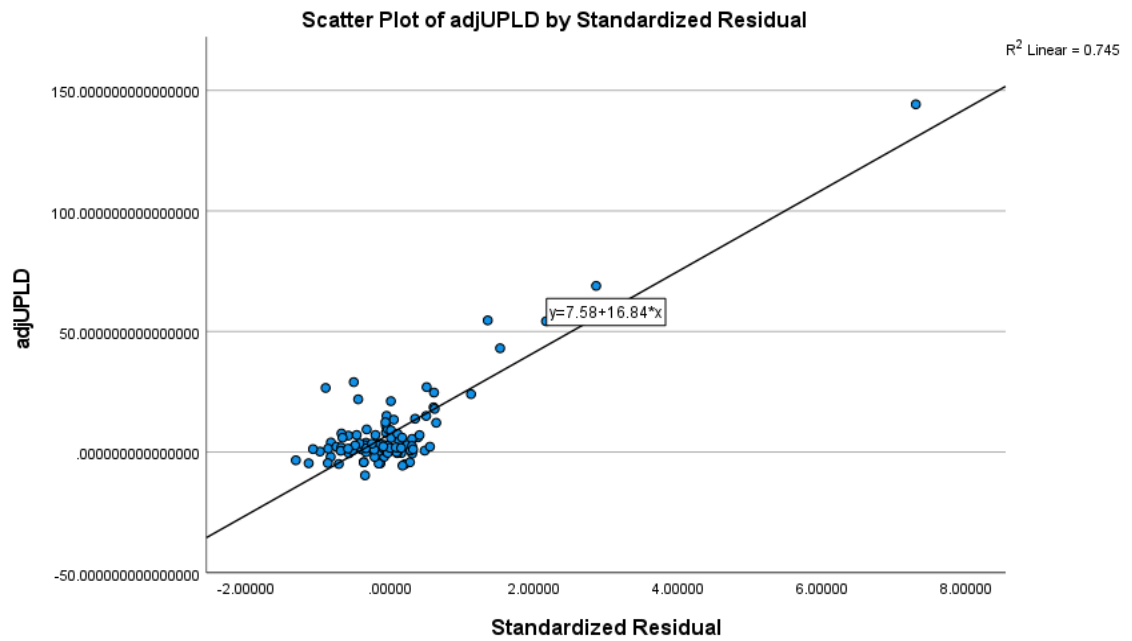
Appendix A.2: Summary of Variables

Variable	Description	Source	Predicted Sign
Offer price	The price of a token set during the IEO process, in \$	Respective exchange	-
Presale	Dummy variable, 1 is given when there exists prior to the launch of IEO a presale of tokens, 0 to otherwise.	Respective exchange/ Whitepaper	-
IssueSize	The number of tokens offered multiply with the offer price, in million \$	Respective exchange	-
Rating	The rating of the IEO by an external party, ranging from low, medium to high and rescale to 1-3. When no rating is available, 0 is assigned	Cryptototem	+
ExchangeReputation	Dummy variable, 1 is given to exchanges rated reliable, 0 to otherwise.	Coincodex	-
RetentionRate	The percentage of tokens that is retained by the team, management and/or advisors.	Respective exchange/ Whitepaper	+
MarketSentiment	15-day return of the CCI30 index on the listing date, in \$	CCI30	+
HotMarket	The number of IEOs happening within the range of 15 days of the issue date	Cryptototem, Coincodex, CoinMarketCap, Exchanges	+
Duration	The number of days that holds an IEO.	Respective exchange	-
TradingVolume	Trading volume on listing day, in million \$	Respective exchange	+
ERC20	Dummy variable, 1 is given to implementation of ERC20, 0 to otherwise.	Respective exchange/ Whitepaper	+
BonusProgram	Dummy variable, 1 is given to existence of bonus program prior to IEO, 0 to otherwise.	Respective exchange/ Whitepaper	+

Source: Own illustration

Appendix B: Assumption Testing

Appendix B.1: Scatterplot

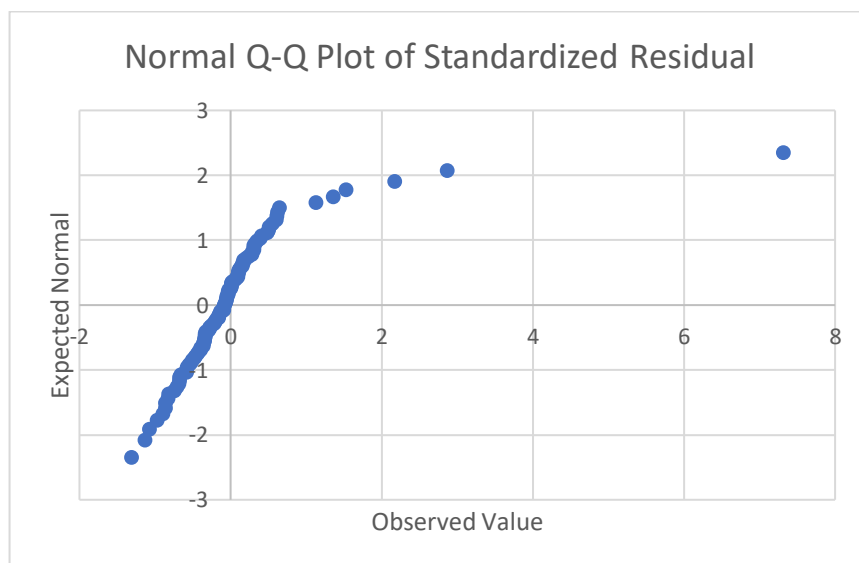


Appendix B.2: Shapiro-Wilk Test

	W	p
UP	0.476	< .001
UP _A	0.533	< .001

Note. Significant results suggest a deviation from normality.

Appendix B.3: Q-Q plot



Appendix B.4: Homoscedasticity Tests

Modified Breusch-Pagan Test for Heteroskedasticity^{a,b,c}

Chi-Square	df	Sig.
4.597	1	0.032

a. Dependent variable: UP_A

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

c. Predicted values from design: Intercept + Offerpricein\$ + Rating + ExchangeReputation + Retainedrate + Presale + Hotmarket + MarketSentiment15dayreturn + IssueSizeinM\$ + Duration + TradingvolumeinM\$ + ERC20 + Bonusprogram

Breusch-Pagan Test for Heteroskedasticity^{a,b,c}

Chi-Square	df	Sig.
82.234	1	< .001

a. Dependent variable: UP_A

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

c. Predicted values from design: Intercept + Offerpricein\$ + Rating + ExchangeReputation + Retainedrate + Presale + Hotmarket + MarketSentiment15dayreturn + IssueSizeinM\$ + Duration + TradingvolumeinM\$ + ERC20 + Bonusprogram

Appendix B.5: Correlation Table

Pearson's Correlations												
Variable	UP _A	OfferPrice	Presale	IssueSize	Rating	ExchangeReputation	RetentionRate	MarketSentiment	HotMarket	Duration	TradingVolume	BonusProgram
1. UP _A	Pearson's p-value	— —										
2. OfferPrice	Pearson's p-value	-0.116 0.239	— —									
3. Presale	Pearson's p-value	-0.196 0.011	— 0.011	— —								
4. IssueSize	Pearson's p-value	0.045 -0.123	0.91 -0.028	— -0.089	— —							
5. Rating	Pearson's p-value	0.213 0.114	0.777 -0.216	0.369 -0.11	— 8.38E-04	— —						
6. ExchangeReputation	Pearson's p-value	0.247 -0.083	0.027 0.098	0.265 0.105	0.993 -0.07	— 0.111	— —					
7. RetentionRate	Pearson's p-value	0.403 -0.014	0.317 -0.403	0.289 0.075	0.478 -0.023	0.26 0.174	— 0.062	— —				
8. MarketSentiment	Pearson's p-value	0.886 -4.07E-04	<.001 0.046	0.45 -0.102	0.814 -0.253	0.076 -0.062	0.527 0.148	— 0.575	— —			
9. HotMarket	Pearson's p-value	0.997 -0.055	0.641 0.071	0.3 0.131	0.009 -0.03	0.53 -0.107	0.132 -0.083	0.125 0.203	— 0.004	— —		
10. Duration	Pearson's p-value	0.576 -0.06	0.469 0.002	0.182 0.094	0.762 -0.012	0.279 -0.175	0.398 -0.261	0.128 0.194	-0.105 0.285	— —		
11. TradingVolume	Pearson's p-value	0.543 0.312	0.98 0.022	0.339 -0.028	0.902 -0.057	0.075 0.053	0.007 0.314	-0.038 0.001	-0.054 0.584	0.099 0.316	— —	
12. ERC20	Pearson's p-value	0.001 0.036	0.82 -0.104	0.775 -0.102	0.562 -0.01	0.594 0.157	0.001 0.052	0.704 0.007	0.919 0.148	0.316 -0.103	— -2.82E-04	—
13. BonusProgram	Pearson's p-value	0.719 0.246	0.293 0.035	0.301 -0.366	0.921 -0.086	0.11 0.073	0.596 0.128	0.941 -3.31E-04	0.132 -0.08	0.296 0.088	0.998 0.117	— 0.052
	Pearson's p-value	0.011 0.725	<.001 0.011	0.38 0.46	0.38 0.46	0.46 0.46	0.194 0.194	0.997 0.997	0.419 0.923	0.372 0.372	0.235 0.235	0.601 0.601

Appendix C: Statistical Results

Appendix C.1: Descriptive Statistics

Variables	Mean	Median	Std. Deviation	Minimum	Maximum	No of Observations
UP	8.476	2.29	17.99	-0.76	144.47	105
UP _A	7.576	2.24	18.35	-9.65	144.24	105
OfferPrice (\$)	0.884	0.09	3.199	0.00	26.76	105
Presale	0.40	0.00	0.492	0.00	1.00	105
IssueSize (M\$)	6.905	1.78	18.305	0.00	135	105
Rating	2.105	2.00	0.96	0.00	3.00	105
ExchangeReputation	1.486	2.00	1.233	0.00	3.00	105
RetentionRate	0.159	0.17	0.066	0.00	0.26	105
MarketSentiment	0.02	0.01	0.196	-0.49	0.95	105
HotMarket	3.552	3.00	2.353	1.00	10.00	105
Duration	4.581	2.00	5.302	1.00	28.00	105
TradingVolume (M\$)	78.753	5.67	213.784	0.00	1220	105
ERC20	0.562	1.00	0.499	0.00	1.00	105
BonusProgram	0.486	0.00	0.502	0.00	1.00	105

Appendix C.2: T-test for Existence of Underpricing

Variables	t	df	p	Mean Difference	95% CI for Mean Difference	
					Lower	Upper
UP	4.828	104	< .001	8.476	5.562	∞
UP _A	4.23	104	< .001	7.576	4.604	∞

Note. For the Student t-test, location difference estimate is given by the sample mean difference d.

Note. For the Student t-test, the alternative hypothesis specifies that the mean is greater than 0.

Note. Student's t-test.

Appendix C.3: Bootstrapped T-test for Existence of Underpricing

	Bootstrap ^a				BCa 95% Confidence Interval	
	Mean Difference	Bias	Std. Error	Sig. (1-tailed)	Lower	Upper
UP	8.4758	0.0149	1.7430	0.0025	6.0620	∞
UP _A	7.5759	0.0175	1.7813	0.0036	5.1080	∞

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

Appendix C.4: Wilcoxon-test for Existence of Underpricing

Variables	V	p	Hodges-Lehmann Estimate	95% CI for Hodges-Lehmann Estimate	
				Lower	Upper
UP	5434.5	< .001	4.16	3.05	∞
UP _A	4593.5	< .001	3.605	2.305	∞

Note. For the Wilcoxon test, location difference estimate is given by the Hodges-Lehmann estimate.

Note. For the Wilcoxon test, the alternative hypothesis specifies that the median is greater than 0.

Note. Wilcoxon signed-rank test.

Appendix C.5: T-test for Underpricing Compared to IPOs

	t	df	p	Mean Difference	95% CI for Mean Difference	
					Lower	Upper
UP	4.72	104	< .001	8.287	5.373	∞
UP _A	4.125	104	< .001	7.387	4.415	∞

Note. For the Student t-test, location difference estimate is given by the sample mean difference d .

Note. For the Student t-test, the alternative hypothesis specifies that the mean is greater than 0.189.

Note. Student's t-test.

Appendix C.6: T Bootstrapped T-test for Underpricing Compared to IPOs

	Mean Difference	Bias	Std. Error	Sig. (1-tailed)	Boots BCa 90% Confidence Interval	
					Lower	Upper
UP	8.2868	0.0260	1.7774	0.0032	5.7910	∞
UP _A	7.3869	0.0256	1.8126	0.0048	4.8349	∞

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

Appendix C.7: Wilcoxon-test for Underpricing Compared to IPOs

	V	p	Hodges-Lehmann Estimate	95% CI for Hodges-Lehmann Estimate	
				Lower	Upper
UP	5395	< .001	4.089	2.979	∞
UP _A	4573	< .001	3.534	2.234	∞

Note. For the Wilcoxon test, the location difference estimate is given by the Hodges-Lehmann estimate.

Note. For the Wilcoxon test, the alternative hypothesis specifies that the median is greater than 0.071.

Note. Wilcoxon signed-rank test.

Appendix D: Regression Results

Appendix D.1: Model Summary

R	R ²	Adjusted R ²	Std. Error of the Estimate	Durbin-Watson
0.505 ^a	0.255	0.157	16.844	2.060

Predictors: (Constant), Bonus program, Retained rate, ERC20?, Issue Size in M\$, Trading volume in M\$, Duration, Hotmarket, Rating, MarketSentiment15-dayreturn, Presale, Offer price in \$, Exchange Reputation

Dependent Variable: UP_A

Appendix D.2: Regression's Coefficients

	Unstandardized Coefficients		Standardized Coefficients		Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	Beta	Std. Error	Beta	t		Lower Bound	Upper Bound	Tolerance	VIFr
OfferPrice	-0.666	0.587	-0.116	-1.135	0.259	-1.833	0.500	0.773	1.293
Presale	-1.682	3.914	-0.045	-0.430	0.668	-9.456	6.092	0.735	1.361
IssueSize	-0.109	0.096	-0.109	-1.137	0.259	-0.300	0.082	0.883	1.132
Rating	1.003	1.853	0.052	0.541	0.590	-2.678	4.684	0.862	1.160
ExchangeReputation	-4.189	1.593	-0.282	-2.629	0.010	-7.353	-1.024	0.706	1.416
RetentionRate	-	28.397	-0.054	-0.531	0.597	-71.466	41.333	0.780	1.283
	15.066								
MarketSentiment	1.555	9.574	0.017	0.162	0.871	-17.460	20.570	0.773	1.294
HotMarket	-0.398	0.771	-0.051	-0.516	0.607	-1.928	1.133	0.829	1.206
Duration	-0.665	0.350	-0.192	-1.899	0.061	-1.361	0.030	0.791	1.265
TradingVolume	0.033	0.008	0.380	3.892	0.000	0.016	0.049	0.848	1.179
ERC20	-0.630	3.450	-0.017	-0.183	0.856	-7.482	6.222	0.922	1.084
BonusProgram	8.421	3.777	0.230	2.229	0.028	0.919	15.922	0.758	1.319

Appendix D.3: Regression's Coefficients with Robust Standard Errors

Parameter	B	Robust Std. Erro	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
OfferPrice	-0.666	0.721	-0.924	0.358	-2.099	0.767
Presale	-1.682	2.245	-0.749	0.456	-6.142	2.777
IssueSize	-0.109	0.049	-2.229	0.028	-0.206	-0.012
Rating	1.003	1.408	0.712	0.478	-1.793	3.798
ExchangeReputation	-4.189	2.140	-1.958	0.053	-8.438	0.061
RetentionRate	-15.066	25.164	-0.599	0.551	-65.043	34.911
MarketSentiment	1.555	7.262	0.214	0.831	-12.868	15.978
HotMarket	-0.398	0.469	-0.848	0.398	-1.329	0.533
Duration	-0.665	0.315	-2.109	0.038	-1.292	-0.039
TradingVolume	0.033	0.013	2.480	0.015	0.007	0.059
ERC20	-0.630	3.365	-0.187	0.852	-7.314	6.054
BonusProgram	8.421	4.249	1.982	0.050	-0.018	16.860

a. HC3 method

b. Computed using alpha = .05

Declaration of Authenticity

I, Minh Anh Tran Bui, hereby declare that the work presented herein is my own work completed without the use of any aids other than those listed. Any material from other sources or works done by others has been given due acknowledgement and listed in the reference section. Sentences or parts of sentences quoted literally are marked as quotations; identification of other references with regard to the statement and scope of the work is quoted. The work presented herein has not been published or submitted elsewhere for assessment in the same or a similar form. I will retain a copy of this assignment until after the Board of Examiners has published the results, which I will make available on request.

Düsseldorf, 9th of March 2022



Minh Anh Tran Bui