Crypto Tokens and Token Offerings: An Introduction

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Abstract This chapter provides an overview of crypto tokens and token offerings. Based on both utility tokens and security tokens, this chapter reviews the economics of tokens and token offerings. Specifically, it discusses the economic value of tokens for the financing, operations, and corporate governance of the issuing companies. It also discusses economic values for token investors. This chapter also discusses various token valuation models, as well as the underpricing and returns of the token markets.

1 Introduction

In this chapter, we provide an introduction to crypto tokens and token offerings. There are two main types of tokens: utility tokens and security tokens. Utility tokens give their holders access to product or service and that generally require the use of a blockchain-type infrastructure (Mougayar 2017; Fisch 2019; Yermack 2017). Security tokens are tradable tokens whose primary purpose is to give holders voting or financial rights and therefore mimic traditional financial assets such as debt and equity (Koffman 2018). Tokens represent assets and utilities of issuing companies and are issued to their investors in token offering events.

In the blockchain industry, initial coin offerings (ICOs) refer to the initial offering of utility tokens and security token offerings (STOs) are the initial offerings of security tokens (Blockgeeks 2018). In this chapter, for simplicity, we use ICOs to refer to both initial offerings of utility tokens and security tokens.

The chapter is organized as follows. It first provides an overview of tokens and token offerings, with discussions of various types of tokens, and a comparison between initial token offerings (ICOs) and initial public offerings (IPOs). It then

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S. Goutte et al. (eds.), *Cryptofinance and Mechanisms of Exchange*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-30738-7_8

discusses the token economics, usually referred to as "tokenomics", which specifies the economics behind token offerings, the economic value of tokens for token issuers and investors, and corporate governance with tokens. The next section discusses valuation of crypto tokens, based on monetary theories and traditional valuation methods for equity and assets. The section afterwards discusses ICO underpricing and returns. The last section concludes the chapter.

2 Tokens and Token Offerings

2.1 What Are Crypto Tokens?

The first cryptocurrency, bitcoin, was created in 2009 from an anonymous white paper as a method of payments (Nakamoto 2008). Ethereum is an alternative currency to Bitcoin, developed in 2014, which enables automatically executable smart contracts (Buterin 2013). Tokens thereafter are created as smart contracts on top of blockchain, often based on the Ethereum network .

There are three main types of tokens: utility tokens, security tokens, and crypto-currency tokens.

Utility Tokens Tokens that confirm rights to access to product or service and that generally require the use of a blockchain-type infrastructure (Catalini and Gans 2017).

Security Tokens Tradable tokens whose primary purpose is to give holders voting rights and/or financial rights. Specifically, security tokens, also called tokenized securities or investment tokens (Koffman 2018), are financial securities compliant with security regulations and can provide financial rights to investors such as equity, dividends, profit sharing rights, and voting rights. Security tokens usually represent rights to underlying assets such as cash flow, real estate, and collectibles such as arts.

Compared to traditional debt and equity, advantages of security tokens include (1) fractionalization of larger assets, (2) increased liquidity as it is easier to get tokens listed on crypto exchanges compared to equity, (3) lower issuance fees compared to traditional equity and debt underwriting, (4) access to a global pool of capital and more market exposure as deals are so visible to everyone with internet connection (Koffman 2018; Malinova and Park 2018; Marks 2018).

Marks (2018) considers equity security tokens, security tokens that possess characteristics similar to equities, as one of the most promising crypto-asset classes. He argues that these tokens have some characteristics that make them better than traditional equities in certain ways. First, in theory, equity security tokens can be traded all year long on crypto exchanges or OTCs without any geographic or time limitations, contrary to traditional stocks. Second, specific terms such as vesting periods and investor restrictions of tokens can be easily designed and formulated in

the smart contracts, which makes governance and management of these tokens less subject to manipulation (Yermack 2017).

Crypto-currency Tokens Tokens accepted as a means of payment for the purchase of goods and/or services, or to be used for the money or value transfer. Bitcoin, Bitcoin Cash, and Litecoin are examples of crypto-currency tokens. Crypto-currency tokens are independent of a particular platform and can be used as a form of currency outside their native environment, whereas utility tokens and security tokens in general exist on a particular platform that the token issuers create (Blockgeeks 2018).

For the purpose of this chapter in studying token offerings and tokenomics, we focus on the utility tokens and security tokens, as the issuance of these tokens are related to the real operation and/or finance of the token issuers (Gan et al. 2019; Momtaz 2019a).

One crucial step in a token offering is the Howey Test that lays down criteria according to which a token might be considered a security from a regulatory standpoint (Momtaz 2019a). The four main criteria of the Howey Test are (1) there is investment of money, (2) profits are expected, (3) money investment is a common enterprise, and (4) any profits come from the efforts of a promoted or third party. Most of the tokens, therefore, according to the Howey Test, would fall under the category of security tokens (Blockgeeks 2018).

Compared to issuance of utility tokens, it is more costly to issue security tokens as they are subject to greater security regulations and therefore a higher legal and disclosure costs. In the U.S., security tokens need to follow Regulation D, Regulation S, or Regulation A+ (Blockgeeks 2018). Nevertheless, security tokens act like a bridge between real assets and cash flows and the blockchain world.

Overall, the emergence of tokens and token offerings enables entrepreneurs to respond to two fundamental needs of the blockchain ecosystem. First, it creates incentive mechanisms to participate to this ecosystem and to innovate. Second, it provides the financial ability to fund the project, which allow entrepreneurs to fund their digital platform, software or other projects at an early stage of their development (Iansiti and Lakhani 2017).

2.2 A Comparison of Token Offerings and IPOs

Token offerings are essentially crowdfunding enabled by smart contracts for the purpose of funding blockchain-based companies or projects (Momtaz 2019a). As a financing strategy, ICOs are also frequently compared to IPOs of stocks (Liu 2019; Ofir and Sadeh 2019). In this subsection, we discuss the key differences between ICOs and IPOs.

The first difference lies in the type of securities issued. In an IPO, companies issue equity shares where investors realize returns through dividends and/or capital gains.

While security token offerings are similar to IPOs, utility tokens give their holders access to future product or service without directly sharing issuers' profits.

The second difference is the stage of the company. An IPO typically occurs at a later stage in a company's life cycle, where the company has viable product and/or service and earned revenue and is close to being profitable. An ICO in comparison is typically for a new, usually unproven concept that is seeking to raise capital (Liu 2019). Therefore, IPOs are usually for well-settled companies as exit strategies, whereas an ICO is more for young and risky companies to raise their initial financing (Liu 2019).

Third, IPOs are highly regulated, whereas ICOs are way less-regulated, or almost self-regulated, although some countries have tightened ICO regulation (Rhue 2018). Companies that issue their stock for the first time go through a complex IPO process, filing a lengthy IPO prospectus in order to get approved by security commission, while in early days ICOs companies often just disclose a whitepaper. Another major difference is the listing requirements—in order for an IPO to sell shares and thus provide liquidity to existing shareholders, it must be listed on an exchange. ICOs in comparison are not obligated to list on any cryptocurrency exchange, and in fact many ICO issuers fail to list on crypto exchanges (Momtaz 2019a).

The fourth main distinction is the investor type. In order to subscribe for an IPO, an investor must be deemed as sophisticated with basic requirements to be met. In fact, IPOs are often allocated only to institutional investors such as investment banks, mutual funds and endowments (Liu 2019). In an ICO of utility tokens, the investors are not known and there are in general no requirements on the investors' sophistication. For security tokens though, investors still need to be accredited investors, at least in the U.S. (Blockgeeks 2018).

3 The Emergence of Tokenization and Tokenomics

3.1 Tokenomics

ICO first started as entrepreneurs could not raise enough capital through traditional fundraising methods, therefore innovative ways of fundraising were necessary (Chen 2018). ICOs were then invented to create a more direct relationship between blockchain entrepreneurs and investors.

The importance of the ICO and tokens is to be understood through the economic functions of tokens, what is frequently coined as "tokenomics" (Malinova and Park 2018). Ennis et al. (2018) propose three definitions of tokenomics: "(1) a means of self-funding within the crypto economy, (2) the deployment of a token within the ecosystem of an ICO project and (3) the set of all economic activity generated through the creation of tokens". The first definition suggests the funding role of tokens, and the second and third definitions consider tokens as important incentives to use the technology provided by the token issuer, and in a broader sense, focus on the economic activity and value generated through the token creation.

The Network Effects and the Token Price

A strand of literature examines the network effects in blockchain-empowered token projects (Bakos and Halaburda 2018; Li and Mann 2018; Sockin and Xiong 2018). Sockin and Xiong (2018) model a platform token as the only currency accepted in a network. Li and Mann (2018) and Bakos and Halaburda (2018) highlight that most ICO projects are designed to create positive network effects that the token holders can monetize later. This is consistent with the second and third definitions of tokenomics of Ennis et al. (2018). Specifically, blockchain projects aim to create a network of users, often referred to as a "community", and tokens are used as an incentive mechanism to reward network contributors. A contributor can be an engineer who writes code for blockchain development, a financier who contributes fiat or cryptocurrency investments, or a community member who helps advertise and market the projects and token sales (Cong et al. 2018). Contributors are paid in tokens, and their inputs drive the quality of the blockchain platform. As the quality of the network improves, it is more attractive for users to buy tokens to gain access to the network, which further makes it even more attractive to contribute to the network (Klöhn et al. 2018). This relationship is intended to create positive network effects to make the network more attractive for all users.

Tokens, if well designed, will provide novel ways of incentivizing the network and monetizing network effects. Because tokens provide access to the network, their value correlates positively with the appeal of the network. The more attractive the network, the higher the demand for tokens, the higher the value of tokens. As long as tokens are kept scarce, a higher demand for tokens leads to a higher price of the tokens (Li and Mann 2018; Klöhn et al. 2018). Cong et al. (2018) formally model token valuation with the network effect. They argue that token transactions give token holders a flow utility that depends on tokenholder-specific needs, the size of the platform user base, and the platform quality.

Token holders can then sell their tokens on a secondary market, in exchange for cryptocurrencies such as Bitcoin or Ether or fiat money. This is the innovation of ICOs with a liquid secondary market for the tokens and thereby enabling token holders to monetize the network effect (Amsden and Schweizer 2018; Lee and Parlour 2019; Momtaz 2019a). This is particularly valuable for earlier contributors/investors, who are able to purchase the tokens at lower price (Catalini and Gans 2017). In addition, any increase in network value will immediately be reflected in the token price because tokens are scarce and are necessary to gain access to the network (Klöhn et al. 2018).

3.2 The Economic Value of Tokens for Entrepreneurs

3.2.1 Benefits of ICOs to Entrepreneurs

ICOs are an important innovation in entrepreneurial finance that have several advantages over traditional financing channels, particularly in mitigating moral hazards and asymmetric information (Momtaz 2019a; Howell et al. 2018).

First, significant information asymmetries exist in the traditional entrepreneurial finance that impedes entrepreneurs' access to capital. Specifically, traditionally, investors who wish to invest in high risk and high reward projects have little access to the projects' information, and entrepreneurs have few connections to such investors. A first improvement is through crowdfunding platform such as Kickstarter and Indiegogo, which presents startup projects on the Internet and thereby increasing the capital-raising opportunities for small business (Mollick 2014) and democratizing access to capital (Mollick and Robb 2016). Making information readily available on the Internet significantly reduces information asymmetries. A further improvement is made by ICOs: raising capital on the internet via blockchain technology connects entrepreneurs with a wide range of investors including future customers, thus reducing information frictions substantially (Adhami et al. 2018; Catalini and Gans 2017, 2019; Momtaz 2019a; Li and Mann 2018; Lipusch 2018). Importantly, after the tokens are listed on crypto exchanges, they provide liquidity for tokenholders, which is key advantage over private equity investment and crowdfunding (Lee and Parlour 2019).

A second significant benefit of ICOs is that since token sales are based on blockchain technology, issuers usually have to establish immutable and non-negotiable governance terms through smart contract (Howell et al. 2018). These terms are available to investors ex ante and are theoretically impossible to change ex post, signaling strong commitment of the founding team on governance (Yermack 2017).

Third, ICOs use decentralized networks, in which values generated in the network would accrue to its token holders. This is consistent with the network effect discussed above. Chen (2018) therefore argues that blockchain tokens give entrepreneurs new ways to engage key stakeholders and to develop, deploy, and diffuse decentralized applications. While an ICO can compensate initial investors and developers, it does not give them more control of the network than any other token holders (Garratt and van Oordt 2019; Howell et al. 2018). This helps alleviate the concern of moral hazard in traditional networks, where investors or customers worry the first-comers and developers extract rents from the network (Lee and Parlour 2019).

ICOs and token issuing are important features that facilitate the blockchain open source projects. A computer program is open source when its underlying source code is freely available, which means developers will not be rewarded from the project itself (Klöhn et al. 2018). Token sales solve this problem by creating an opportunity for developers to participate in the economic success of the project. If tokens are necessary to use the platform or services offered within the network, any increase in the value of the network is reflected in an increased demand and consequently a higher value of the tokens, which the developers can monetize via the sale of tokens on the secondary market. In addition, tokens give users an incentive to become an early contributor in the development of software, as they can directly profit from their contribution of value (Klöhn et al. 2018). Thus, the interests of the developers and other statekholders are aligned right from the start (Catalini and Gans 2017).

3.2.2 Drawbacks

Regardless of the benefits discussed above, ICOs have their own drawbacks. First, most ICOs only consists of one round of financing. The one-round-only design is necessary because the initial supply of tokens typically is fixed (Klöhn et al. 2018). However, this means ICO projects do not have the opportunity of further financing rounds as in angel or venture capital (VC) investments, which may limit the amount raised through ICOs over the long term.

Second, token sales can be tax inefficient (Cook and Heath 2017). The proceeds raised through token sales are treated as revenues or deferred revenues, which are subject to tax. In contrast, funds raised through equity financing are not treated as revenues and thus are not subject to tax.

An additional disadvantage is the regulatory uncertainty with ICOs. In 2017, some countries (e.g., China and South Korea) banned ICO (Choudhury 2017; O'Leary 2017). In the U.S., ICOs are not illegal, yet the Securities and Exchange Commission (SEC) has not offered clear guidelines regarding token sales.

3.2.3 Implications for Entrepreneurs

Researchers are starting to provide guidance to start-ups looking to issue tokens through ICOs (Conley 2017), including the technical factors and business elements that influence success. Although ICOs have the potential to disrupt the VC process (Lipusch 2018), there is not much guidance for entrepreneurs or investors on how to maximize this opportunity.

As a technical matter, as most tokens are created on smart contract, which is immutable once it is deployed, start-ups must choose the parameters of their token carefully. Prior to the token launch, entrepreneurs must identify a number of technical elements of the ICO such as the total supply of tokens, the token decimals, and the initial price.

In addition to the token details, companies must decide their business practices such as strategy, marketing, and issuing jurisdiction. To attract investors and provide information, token issuers often build their corporate websites, post their white paper, and share corporate information on social media. Value of the tokens are associated with the white paper quality and social media attention (Bourveau et al. 2018; Liu and Wang 2019).

Also, because ICOs are a global phenomenon (Zetzsche et al. 2018), token issuers must decide in which jurisdiction to issue their tokens. For instance, although the U.S. security law is unclear on the status of tokens at the time of writing (Rohr and Wright 2017), the U.S. government currently views the sale of tokens in the U.S. as a form of securities, requiring that companies vet their investors and/or verify the investor status as "accredited investors". In addition, token issuers who wish to accept investment from U.S. citizens must comply with U.S. know-your-customer (KYC) and anti-money laundering (AML) regulations and gather detailed about their

customers. Companies that are KYC/AML-compliant may be more successful due to their access to U.S. investors and signaling of better quality (Lyandres et al. 2019).

3.3 The Economic Value of Tokens for Investors

Investors purchase tokens because they expect the underlying value of the tokens to increase, either through exchanging the tokens for goods and services or through its resale in a secondary market, either on a crypto exchange or over-the-counter (OTC) (Amsden and Schweizer 2018; Momtaz 2019a). Volatility of token prices in the secondary markets may attract investors looking for a high risk-return profile, with confident investors tempted by the prospect of identify the "next Bitcoin" (Masiak et al. 2018).

In addition to the financial reasons, Fisch et al. (2018) propose that investors invest in ICOs because they want to support the anonymity and decentralization of the blockchain system (the ideological reasons) and they value the technology of ICO firms (the technological reasons).

There are multiple ways to invest in ICOs (Colak and Hoogeveen 2017). In order to understand the value proposed by the cryptocurrency, the investor must read the white paper and research the company itself (Liu and Wang 2019). However, since the relationship between cryptocurrencies and traditional assets tend to be low, traditional analyses for security valuations may not be applicable (Bheemaiah and Collomb 2018). The next section will discuss more details on token price and valuation.

Rapid liquidity after ICO exchange listing is another benefit of ICOs (Momtaz 2019a; Howell et al. 2018). It permits a broader range of individuals, who may be excluded in traditional financing instruments, to invest in high-risk, high-return venture projects. In addition, crypto tokens, whether utility or security tokens, are a new asset class that allows investors to diversify their investment portfolios (Feng et al. 2018).

3.4 Corporate Governance with Tokens

Corporate governance is the way in which a corporation is directed, administered, and controlled (Baker and Anderson 2010). There are two ways tokens can impact corporate governance. First, token holders, as a new group of stakeholders, can affect the balance of power within companies. Second, tokens make possible a completely new governance structure, such as the decentralized autonomous organization (DAO).

3.4.1 Token Holders as a New Type of Corporate Stakeholders

Security Tokens and Corporate Governance
At the corporate governance level, the main issue for security token holders is to know whether they legally have and could exercise the ownership, cash flow or control rights granted to them. For example, Blemus and Guégan (2019) find that tokens could avoid granting voting rights or rights to liquidation surplus. In addition, it is still not clear whether the purchase of security tokens (during ICOs, on crypto-exchange platforms, by OTC transactions, or else) could have similar qualifications as the purchase of 'traditional' securities such as equity or debt instruments (Blemus and Guégan 2019; Marks 2018). There is also concern for market abuse, where token prices can be manipulated by not-yet-regulated crypto exchanges or investors with significant holdings, that could negatively affect the issuing companies (Keidar and Blemus 2018).

Utility Tokens and Corporate Governance
Blockchain entrepreneurs create utility tokens to raise funds without granting investors economic rights nor having any substantial fiduciary duty to the investors (Bheemaiah and Collomb 2018; Catalini and Gans 2017). While utility token holders have no control rights, the market value and trading volumes of these tokens would represent an important role in exerting pressure for the token holders to have an indirect impact on the company's decisions (Blemus and Guégan 2019; Yermack 2017). It is therefore important for the token holders to develop a direct dialogue with the corporation and to send requests to the company management. In the long term, companies will have to rethink the role of utility token holders and ways to develop interactions and communications with these new group of corporate stakeholders (Yermack 2017).

3.4.2 The Emergence of Distributed Governance

The DAO (Decentralized Autonomous Organizations)
The DAO (decentralized autonomous organizations) represents a new kind of organizations (Yermack 2017). Specifically, the DAO governance is based on a structure where the corporate decisions are decided by token holders' online voting processes (Buterin 2014; Chohan 2017; Jentzsch 2016). While the DAO fund later collapsed, it highlighted investors' willingness to support a new type of funding mechanism that is inherently built on anonymous trust and voting. It started a new decentralized/distributed form of corporate governance based on peer-to-peer cooperation and on consensus automated decision-making processes (Yermack 2017).

Distributed Organization Models
The use of blockchain technology, smart contracts, tokens and token offering has allowed many innovators to think about new models of corporate governance (Yermack 2017). Developing consensus mechanisms for corporate decisions could

alter the fundamentals of corporate governance, such as the firm theory, the agency theory and the relationship between agents and principals (Jensen and Meckling 1976), beyond the traditional centralized and hierarchical governance structure of firms.

Some recent studies (such as De Filippi 2018; Feng et al. 2018; Fenwick and Vermeulen 2018; Johnson and Yi 2018; Wright and De Filippi 2015; Yermack 2017) have considered the distributed and consensus mechanisms of blockchain tokens as an instrument to solve corporate governance issues. ICOs can alleviate asymmetric information and incentive problems through self-imposed governance mechanism despite the limited regulation in the crypto market (Johnson and Yi 2018). The tokens and smart contracts could potentially provide a full and constant transparency and verifiability of the data available to key stakeholders for corporate management (Davidson et al. 2016). In this way of thinking, the replacement of trust in a disruptive technology management instead of trust in a human management team would be a strong incentive to minimize agency costs (De Filippi 2018; Yermack 2017).

4 Valuation of Crypto Tokens

The book of Burniske and Tatar (2017) is one of the first studies on crypto token valuation by underlying the similarities between stock and token valuation and applying the traditional valuation methods to crypto assets. They discuss traditional valuation methods such as the discounted cash flow (DCF) method, P/E ratio and the velocity of circulation. They therefore suggest that when examining a crypto asset, the fundamental analysis ought to include: (1) whitepaper, (2) technical aspects (e.g., hash rate, number of miners), (3) community and developers, (4) relation to other crypto assets, and (5) issuance model.

Since the book, there has been a growing interest in examining the valuation methods for tokens, including studies based on the traditional monetary theory (Buterin 2017; Weber 2018) and new terms such as Crypto J-Curve (Burniske 2017). The rest of this section discusses each valuation method. Studies mentioned here are mostly from practitioners' side and the academic studies (e.g. Cong et al. 2018; Pazos 2018, 2019) are catching up lately.

4.1 Token Velocity Methodology

The token velocity methodology applies the Quantity Theory of Money (QTM) to a token-based economy (Buterin 2017; Weber 2018). It has therefore gained a lot of ground in the discussion of utility tokens valuation.

Specifically, the QTM states that the general price level of goods and services is directly proportional to the amount of money in circulation, or money supply

(Friedman 1956). The QTM is based on the definitional relationship: MV = PQ, whereas M indicates the money supply in the economy, V is the velocity of circulation, P is the price level, and Q is the output produced by the economy. Applying it to tokens, we have the following equation:

$$MV = PQ$$

$$Token\ Price = \frac{1}{P} = \frac{Q}{MV}$$

whereas

- M is the total number of tokens
- V is token velocity, that is, the number of times that an average token changes hands
- P is the price of goods and services in terms of the token, and therefore it is the inverse of the token price
- Q is the economic value of token transaction per day

The method hence states that velocity is one of the more important drivers and indicators of valuation (Evans 2018; Lannquist 2018; Weber 2018). The implication is that tokens with low velocity, i.e., those that held (owning to speculation, asset backed, and etc.), will see prices rise (Bheemaiah and Collomb 2018).

This valuation methods can be applied to both the general purpose cryptocurrencies such as the Bitcoin and the utility tokens used in a smart contract platforms (Bheemaiah and Collomb 2018). The reasoning behind this approach is that as the token of a smart contract platform becomes widespread and sufficiently useful, it will emerge as an independent store of value (Samani 2018).

4.2 Crypto J-Curve Methodology

Burniske (2017) proposes the Crypto J-Curve. While J-Curve in economics is used to describe the effects of currency devaluation on the national deficit, and in private equity refers to a portfolio's cash flow, Burniske (2017) uses the J-Curve to capture the market values of crypto assets over time. Specifically, a token's price is composed of two forms of value: (1) "current utility value" (CUV), which represents value driven by utility and usage today, and (2) "discounted expected utility value" (DEUV), which represents value driven by investment speculation for the future (Burniske 2017).

According to Burniske (2017), CUV and DEUV take turns driving token prices as a blockchain project develops and its market perceptions change accordingly. Specifically, when a project and its token are first launched, CUV is low and DEUV dominates as holders are excited about the technology and expect future price appreciation. When enthusiasm wanes and DEUV drops with inevitable

technical roadblocks, token price drops and is driven more by CUV from the project's early adopters. As the team overcomes challenges, CUV grows as the token becomes more widely adopted, driving up the token price. DEUV then catches up as speculation and excitement start to grow again. Ultimately in the steady state of the blockchain project, CUV should drive token price.

Linking back to stock valuation, the notion of DEUV can be considered as a modified version of the DCF valuation method. Instead of measuring expected future cash flow, this model is a first step in estimating CUV and DEUV and their respective dynamic influences on token price (Bheemaiah and Collomb 2018).

Some adopters of the Crypto J-curve have begun to use it as a proxy for measuring the different life stages of a cryptoasset. For example, a New York based VC investment fund, Placeholder uses the curve to determine which stage a token sale is at: a whitepaper stage is where the team works to define and implement a "minimum viable protocol" and to validates the network's functionality, a release stage is when a token is first made available to the public, and a public stage when the token begins trading on exchanges (Monegro and Burniske 2017).

4.3 Network Value-to-Transaction Ratio (NVT)

In traditional stock markets, price-earnings ratio (P/E ratio) has been a long standing tool for equity valuation. A high P/E ratio indicates either over valuation or a company in high growth. Applying the P/E ratio to the crypto world, Woo (2017) suggests using money flowing through a token's network as a proxy to "earnings", leading to the NVT (network value to transaction ratio) method of token valuation:

$$\text{NVT}\,(\text{network value to transaction ratio}) = \text{network value}/\text{daily transaction volume}.$$

This valuation ratio compares the network's value (the market cap) to the network's daily on-chain transaction volume. Similar to the P/E ratio, the NVT may indicate whether a network token is under or overvalued by showing the market cap relative to the network's transaction volume, which represents the utility that users derive from the network. When the ratio becomes very high, it indicates potential token over-valuation.

The NVT methodology is consistent with the network theory of the tokens discussed above, as it emphasizes the overall utility of the network. Moving forward, using NVT will require some formal definition on what constitutes a valid transaction in certain networks.

4.4 Security Token Valuation

The methods discussed above are primarily related to the evaluation of utility tokens. When it comes to security tokens, the valuation models are more traditional as they are financial securities, providing an array of financial rights to investors such as equity, dividends, profit share rights, voting rights, etc. (Koffman 2018). While moving securities onto a Blockchain can have advantages in comparison to a legacy system in terms of settlement times, lower fees, automated service functions and custodianship, this does not change anything about the nature of the security itself (Bheemaiah and Collomb 2018). Hence, evaluation models of traditional securities, such as the DCF valuation, relative methods (e.g., P/E), or option pricing model, can be applied to valuation of security tokens.

4.5 Traditional Valuation Methods in Crypto Valuation

In this subsection, we further discuss whether and how traditional valuation methods can be used in token valuation in general.

Crypto CAPM
It would be interesting to explore how a multi-factor CAPM model could be applied to crypto asset valuation. Lannquist (2018) suggests using the following factors in a crypto multi-factor CAPM model:

- Momentum factor
- Liquidity factor (potentially measured by trading volume, bid/ask spreads, or small-cap minus large-cap returns as in CAPM)
- Token exchange and storage frictions (prevalence on centralized exchanges and decentralized exchange protocols, convenience to purchase, wallet quality, etc.)
- Community size/strength factor
- Value: low NVT vs. high NVT factor
- "FOMO" factor (beware of multicollinearity w/momentum and other factors)
- Global political or economic uncertainty

Since historic return periods are short, the model will be more effective in the future when the crypto asset markets mature and we have more data to study the relationship of token price and its various drivers.

Discounted Cash Flow Analysis (DCF)
Generally speaking, DCF is not suitable for utility tokens because they do not generate cash flows or represent equity claims on cash flows. However, a DCF valuation would be a great tool to value security tokens that provide equity features such as expected dividends or distributions.

Comparables Valuation Approach
In traditional equity valuation, the financial ratios and multiples of comparable companies can be used to imply share prices for a target company. Multiples such as P/E, EV/EBITDA, EV/Sales are applicable for security tokens and methods with token-relevant metrics such as NVT can be applied to utility tokens.

In summary, crypto markets are very new with limited data history pertaining to crypto asset behavior, returns, and correlations (Lannquist 2018). Many of today's models are simplistic or limited. In the future, when the markets mature and asset relationships and behaviors are more discoverable, valuation models should be more predictive and informative. As crypto assets are an emerging alternative asset class, much work is yet to be done studying valuation frameworks that can help investors estimate token prices. This calls for serious future research in the crypto area.

5 ICO Underpricing and Token Returns

5.1 Underpricing and First-Day Returns

Underpricing is the phenomenon whereby the price of an asset is set too low on issuance. As a result, the price adjusts to its market value on the listing day and underpricing is indicated by a large first day return (Loughran and Ritter 2002). Empirical studies find a significant evidence for underpricing in ICOs. For instance, Adhami et al. (2018) find that the mean (median) value of first-day return is 929.9% (24.7%). Benedetti and Kostovetsky (2018) find that the average first-day returns to be 179%. Bourveau et al. (2018) document the mean (median) first-day return to be 39% (40%). Overall, these results are evidence of significant underpricing in ICOs, although the degree of underpricing differs depending on the ICO sample and sample period.

Some studies offer a theoretical explanation for ICO underpricing, mostly in line with IPO underpricing. Momtaz (2019b), for example, argues that ICOs have an incentive to underprice their token to attract a large user base, which is an important signal for investors in particular with large degree of information asymmetry in ICOs. Benedetti and Kostovetsky (2018) argue that the information asymmetry associated with the market, coupled with the projects' early stages of development during the offering, are the main reasons for this underpricing. Similarly, Howell et al. (2018) suggest that in the absence of measures of commercial success, liquidity is a major signal of ICO quality from early investors' perspective. Cong et al. (2018)'s network model argues that when a platform has a token investors (users) join the platform, they not only enjoy its token utility, but also benefit from the rising token price as a result of the growing network size.

Momtaz (2019a), Benedetti and Kostovetsky (2018), Lyandres et al. (2019) and Felix and von Eije (2019) analyze the determinants of ICO underpricing. Benedetti and Kostovetsky (2018) and Felix and von Eije (2019) find that presales have a significant negative influence on underpricing. This result is consistent with Howell

et al. (2018) and Lee et al. (2018)'s argument that early investment rounds provide an indication of the demand for the token, thus helping determine an appropriate price for the launch of the ICO. Felix and von Eije (2019) and Lyandres et al. (2019) find that the issue size of an ICO is negatively associated with underpricing, indicating that larger ICOs are associated with a lower degree of information asymmetry. They suggest that successful presales generate an information cascade during the launch of the ICO, encouraging subsequent investors to invest regardless of their own information

Conversely, Momtaz (2019a) finds that issue size is positively associated with ICO underpricing. Momtaz (2019a) also finds that country restrictions are positively associated with ICO underpricing, suggesting that higher incentives are required for the remaining potential investors. Interestingly, in contrast with IPOs, Chanson et al. (2018) and Benedetti and Kostovetsky (2018) find no significant association between firm's age and underpricing. Even though this may look surprising as older companies have had more time to reduce information asymmetry, in ICO markets, issuing companies are in general young startups, and therefore the firm age effect may not be at play here.

5.2 Long-Term Returns and Performance

Regarding the long-term return, most empirical studies find that the average long-term returns are usually positive, with a median number being negative. For instance, using a sample of ICOs between 2013 and January 2018, Howell et al. (2018) analyze the return between the first day of trading and 5 months later relative to the Bitcoin benchmark. They find that the average token price increases by 149% in this period, but the median decreases by 50%. Lyandres et al. (2019) find that the mean post-ICO cumulative return ranges between 6% for the 30-day and 365-day horizons to 46% for the 180-day horizon, but the median return is negative for all horizons, ranging from −29% to −78% with 67% (77%) of 30-day (365-day) cumulative returns being negative. These results are in line with Bourveau et al. (2018) who find a positive (39%) mean return for the 30-day horizon but the median value is negative (−30%). They also find a strong and positive correlation between first-day return and extreme negative return in the following 3–12 month period.

Momtaz (2019b) find that for a holding period between 1 and 24 months, the median ICO depreciates by 30% with substantial positive skewness. His results show that although there is significant ICO underpricing, 40% of ICOs are overpriced. He argues a size effect that large ICOs are more often overpriced and underperform in the long run. Interestingly, EY (2018) analyze the returns of 2017 ICOs from January to September 2018, and find that 86% of the ICOs were below listing price, and 30% lost substantially all their value. Hu et al. (2018) study the secondary market return of 222 tokens and find them to be strongly correlated with Bitcoin returns, suggesting that the return of Bitcoin itself is a primary risk factor in the crypto market.

5.3 Behavioral Biases in ICOs

Several empirical studies analyze behavioral biases of investor' sentiments, herding behavior, and speculative bubbles in the context of ICOs. First, consistent with the IPO literature, empirical studies document significant relationship between investors' sentiment and ICO market performance. Felix and von Eije (2019) find that market sentiment is positively associated with underpricing. Lee et al. (2018) find that first-day returns, as well as 1-week, 1-month and 3-month returns, are positively associated with the parallel market returns, suggesting that a hot crypto market increases investors' sentiment. Consistently, Momtaz et al. (2019) find that market sentiments and market liquidity are strongly associated with listing, suggesting that ventures have an incentive to conduct an ICO during hot crypto markets.

Other studies examine the influence of Ether and Bitcoin prices and volatility on ICOs. Masiak et al. (2018) find that shocks to Ether and Bitcoin affect ICOs, with shocks to Ether having a stronger effect. They also find that shocks to ICOs, as well as to Bitcoin and Ether, are persistent—a bullish market in ICOs remains bullish for 4 weeks. Momtaz (2019a) finds that Bitcoin price is positively associated with the amount raised and with first-day returns. Bourveau et al. (2018) find that past returns in Bitcoin, are positively associated with extreme negative returns in the following 3, 6 and 12 months, suggesting that issuers may strategically time their fundraising to hot markets and engage in "pump and dump" strategies that could harm investors.

Empirical studies also find evidence of herding in the crypto market. Calderón (2018) finds that herding behavior exists in the ICO market when the market exhibits positive returns, but reverses when it exhibits negative returns. Bouri et al. (2018) find that uncertainty, measured by the Economic Policy Uncertainty Index, increases the probability of herding. Their findings suggest that in the presence of market uncertainty, traders become more confident about the (upward) direction of cryptocurrencies and thus tend to mimic the trading actions. Overall, there is clear evidence for herding behavior in cryptocurrencies. These results are important as the herding phenomenon suggests that the efficient market hypothesis that assumes that investors trade rationally does not apply.

Sherman (2018) discusses the speculative bubbles in the ICO market. Speculative bubbles are defined as "unsustainable increases in asset prices caused by investors trading on a pattern of price increases rather than information on fundamental values" (Gerding 2007). In a bubble, informed investors "bid up prices in anticipation of 'noise traders' entering the market. The noise traders then enter the market due to the psychological biases they encounter in making their investment decisions" (Gerding 2007). Sherman (2018) and Bianchetti et al. (2018) find evidence of bubbles in cryptocurrencies in 2017 as "investors pour large amounts of money into the ICOs and the prices of coins issued in ICOs are only rising because other investors also funnel money into them".

6 Conclusion

This chapter provides an overview of crypto tokens and token offerings. Based on both utility tokens and security tokens, this chapter reviews the economics of tokens and token offerings. Specifically, it discusses the economic value of tokens for the financing, operations, and corporate governance of the issuing companies. It also discusses economic values for token investors. This chapter then discusses various token valuation models, as well as the underpricing and returns of the token markets. Discussions of this chapter provide insights for crypto-entrepreneurs, academics and regulators worldwide to better understand tokens and their economic values to various functions in companies and to investors.

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