

PhD Research Proposal | Exposé zum Promotionsvorhaben

**Going public -
Initial coin offerings (ICOs) vs. initial public offerings (IPOs)**

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1. Introduction

Start-ups used to depend solely on venture capital or business angels to raise capital, since most banks shy away from the risk of funding start-ups at seed stage. However, blockchain entrepreneurs created a new form to finance their projects, called *Initial coin offering* (ICO). Investors can fund projects, currently mostly blockchain-based business ideas, by purchasing cryptographic tokens with cryptocurrencies such as Bitcoin or Ethereum. The purchased tokens can be used for the presented blockchain-platform but also as assets to trade on secondary markets. The start-ups using an ICO gain early liquidity and can thereby jumpstart their project and incentivise developers (Lundy *et al.*, 2016; Conley, 2017; Minto *et al.*, 2017). Since founders, employees, and investors all hold the tokens of an ICO project, everyone is interested in growing the network, because it leads to an increasing value of the token (Economist, 2017a).

At first glance, ICOs are similar to crowdfunding projects, which also proceed at an early stage and raise funds over the internet from many (small) investors without standard financial intermediaries. However, crowdfunding projects are generally bound to a specific platform such as Kickstarter whereas ICOs usually function without any third party. Also, funders of crowdfunding projects have a genuine interest in the venture and prevalently receive a certain reward, e.g. being credited in a movie or having early access to a product (Mollick, 2013; Danmayr, 2014). In contrast, the investors of an ICO are not necessarily interested in the venture itself¹, but more in profitable returns on their investment once the tokens are tradable on secondary markets (Minto *et al.*, 2017).

This makes ICOs very similar to initial public offerings (IPOs), which refer to the public sale of shares of a private company for the first time (Copeland *et al.*, 2008; Mousa *et al.*, 2014). In both cases, the investors have certain goals and expectations, e.g.: return on investments, repayments, the value of their shares (or tokens), or the ability to control and influence corporate decisions (Franke and Hax, 2004). Similarities can also be assumed in the pricing of ICOs and of IPOs, because on average both offer high short-run returns (Lowrey and Schwert, 2002; Williams-Grut, 2017). High initial returns for investors are known as ‘underpricing’ (see 2.2). However, there are also key differences between IPOs and ICOs. In a traditional IPO, investors can buy shares of a company/start-up, which already has an existing product or service. Whereas in an ICO the funding begins in the very early stages of a new project and is open to anyone, a stage which was typically restricted to venture capitalists and business angels. Also, unlike shares, tokens do not represent ownership, they act as ‘admission ticket’ to the underlying blockchain. Hence, they do not grant voting rights or pay dividends² (Minto *et al.*, 2017). Nevertheless, this new form of funding bears

¹ Some investors are not (only) motivated in profits, but rather believe in a decentralised economy or a specific blockchain idea. In this perspective ICOs are indeed very much alike crowdfunding projects.

² A few ICOs also offer/promise dividends to investors.

enormous potential for start-ups and investors, while creating high risk to investors because of lack of regulation and transparency (BaFin, 2017).

Despite these risks, for companies within the blockchain sphere, ICOs are the biggest source of funding and have far outstripped venture capital. Indeed, in 2017 alone, start-ups raised more than \$5.8bn in 342 ICOs to fund their projects (*ICO Tracker - CoinDesk*, 2018). While those numbers sound impressive, they are still comparable low to IPOs, which raised over \$188bn in over 1624 IPOs in 2017 (EY, 2017). As of March 2018 already over \$3bn has been raised suggesting a continuing growth in 2018 (*ICO Tracker - CoinDesk*, 2018). Additionally, the largest ICO named EOS, which is currently still running with an unusual long duration of one year, has already raised over \$8bn³ in 257 days (*EOSscan - EOS token sale tracker by scanning ethereum blockchain*, 2018). Likewise, the upcoming ICO of the messenger App Telegram is likely to raise over \$1bn (Dale, 2018). These numbers not only underline the economic relevance of ICOs but suggest the anticipated disruptive potential of cryptocurrencies and their underlying blockchain technology.

Critics have pointed to fundamental tenets of many ICOs that require "...little more than a few enterprising souls and an ambitious-sounding plan" (Economist, 2017a). In fact, many ICOs already failed and it is likely that many others will fail in the future. Therefore, it is arguably, that the current hype around ICOs causes a bubble effect, however, it could be a healthy bubble comparable with the dotcom bubble, which generates a lot of innovation (Economist, 2017b). Moreover, the technology and mechanisms behind ICOs could fundamentally change the way companies raise capital. Yet, in order for ICOs to become a truly accepted and reliable vehicle for companies and investors, further development is needed, in particular in the area of regulation and investor protection.

The forthcoming PhD thesis will analyse ICOs relative to IPOs. These two funding methods are suitable, because they intersect in specific areas but also contain disparities, thus facilitating an informative comparison⁴. Contrasting to ICOs, IPOs are established, regulated, and well-researched whereas ICOs represent a novel, emerging and economical relevant phenomenon with enormous potential. It is precisely due to its potential and the importance of the economic implications regarding the way companies raise funds, that this research study will examine ICOs, and thereby fill an important research gap. Specifically, this study will describe the technical foundations of ICOs and cluster ICOs to gain a comprehensive overview. On that basis, it compares the phenomenon of underpricing in ICOs and IPOs considering

³ Taking the current price of Ethereum, the second largest cryptocurrency which is the only accepted payment method. It is debatable whether the EOS token sale can be labelled as ICO considering the long duration (there is no explicit definition of the term ICO so far).

⁴ Unlike crowdfunding projects, ICOs and IPOs enable potential investors to acquire shares respectively tokens of a company, which are tradeable on a secondary market shortly after.

various influencing factors such as the short-run performance, the ICO type but also the provided information for investors and ICO success factors.

2. State of research

2.1 Research object ICO

In essence, there are two types of ICOs, (1) the sale of primitive tokens for a new and independent blockchain such as Bitcoin and (2) the sale of secondary tokens which function atop of an existing blockchain (BaFin, 2017; Sehra *et al.*, 2017; Antonopoulos, 2018). Currently, there are over 900 primitive tokens ('coins') and over 500 secondary tokens (*All Tokens | CoinMarketCap*, 2018; *All Coins | CoinMarketCap*, 2018). All primitive and secondary tokens combined, of which many launched through an ICO, have a market capitalisation of over \$380bn⁵ (*CryptoCurrency Market Capitalizations | CoinMarketCap*, 2018).

Tokens (of an ICO) can have various use cases and can represent almost any value, e.g. a currency, a representation of an asset, a virtual share, a proof of membership, etc. (Lundy *et al.*, 2016). To name just a few examples, 'Ripple' facilitates bank settlements, 'Golem' and 'MaidSafe' create markets for unused computer resources, and 'Augur' and 'Gnosis' offer prediction and wagering platforms (Augur and Gnosis). Due to these various use cases, many regulatory bodies divided ICOs into different categories to provide a better overview but more importantly to clarify the legal status⁶ of different ICOs. A useful categorisation encompassing anti-money laundering and securities laws for each category was done by the Swiss financial authority FINMA (2018). The authority categorised ICOs into Payment ICOs, Utility ICOs, and Asset ICOs. Payment ICOs offer means of payment, e.g. tokens with similar properties like Bitcoin; Utility ICOs provide access to a future service or product, and Asset ICOs sell equities to investors which will ensure future returns as dividends or regular income.

The multiple use cases of ICOs are based on blockchain technology, which also facilitates a completely different approach in raising capital. In fact, ICOs remove an entire layer out of the transaction chain between start-up and investor(s), since the start-up engages directly with the investor by issuing tokens.

⁵ It needs to be considered that the market capitalisation and the interrelated prices of the different tokens fluctuate greatly due to the significant volatility within the cryptocurrency market. Also, ca. 44% of the market capitalisation belongs to Bitcoin.

⁶ In most countries ICOs are still subject to future regulation, yet, first regulatory steps and political statements indicate four general approaches, namely (1) favourable regulation; (2) neutral regulation; (3) heavy regulation; and (4) ban of ICOs.

ICO structure

As illustrated in *figure 1*, the usual structure of an ICO, involves founders, which start a company and manage the issuance of tokens. An appointed amount of these tokens is allocated to the founders and developers, whereas the major proportion is available for public sale. Therefore, ICOs are also labelled 'token sale', yet the more marketable term ICO is predominantly used. Private investors can purchase the issued tokens in exchange for Bitcoin and/or Ethereum and can either use the token for the presented platform or trade it on secondary markets. The founders use the raised funds to implement the envisioned project. Thus, an ICO is basically a vehicle of using a (blockchain-based) start-up's business idea to fund itself.

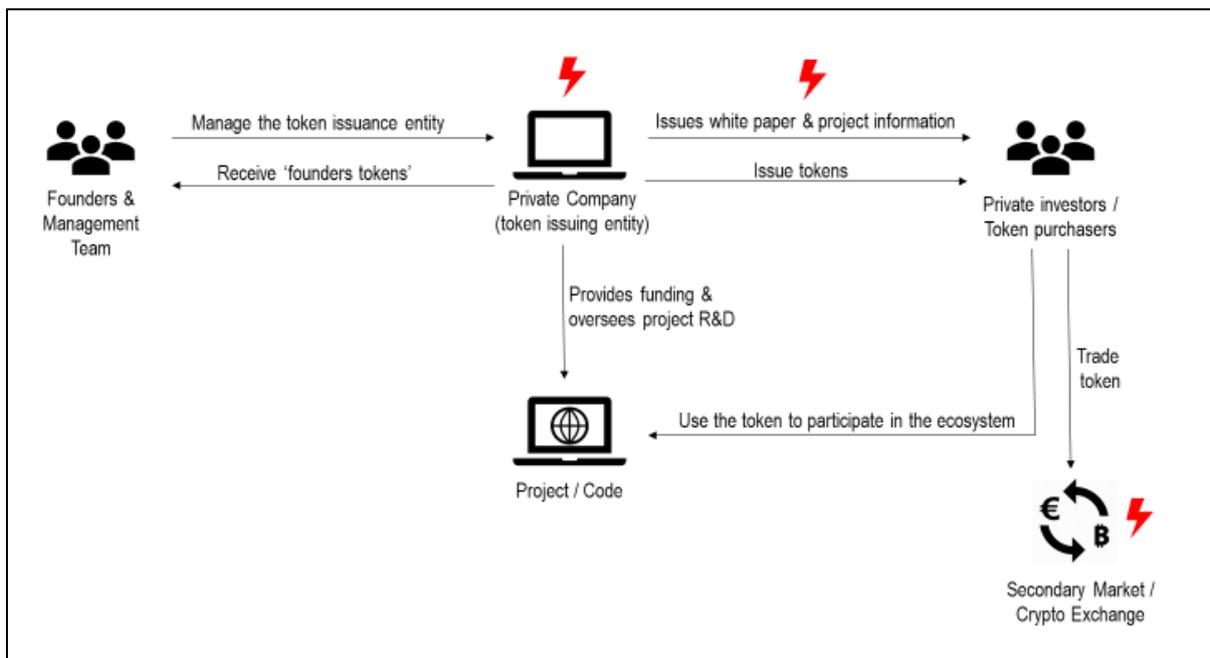


Figure 1: ICO structure. Own representation based on PwC (2018a)

ICO process

The process of an ICO can be divided into five phases, namely Business Strategy, Token Utility and Economy Design, Detailed Planning, Sales Execution, and Business Execution. The first phase, *Business Strategy*, includes inter alia the concrete business model and the project strategy. On that basis, the *Token Utility and Economy Design* is conducted comprising the sales mechanics, the token valuation, and the 'whitepaper'. Such a whitepaper provides usually details regarding how the tokens will be produced and used, how the collection of funds will happen, how the tokens will be distributed, the escrow used, and the rate of the native token compared to Bitcoin or other cryptocurrencies (Lundy *et al.*, 2016; Conley, 2017). This phase is by *Detailed Planning* covering tax, accounting, and legal issues as well as

the selection of advisors followed⁷, which act as quality seal for an ICO. *Sales Execution* defines the timeline including presale⁸ and public sale (the actual ICO) along with a related marketing plan and the launch of a website. Finally, *Business Execution* comprises relevant steps right before the ICO such as operational framework design and strategic alliances. Typically, the entire process of an ICO takes only two to five months (PwC, 2018a). In contrast, the process of an IPO is far more time-consuming and complex, indeed, it usually takes at least a year of planning and six months for the IPO execution (PwC, 2018b). Similar to an ICO whitepaper, IPOs provide certain information in form of a prospectus including exact number of shares/certificates issued, the precise offering price but also further details such as firm products and resources, risks pertaining to past financial performance, ownership details, competitors, and risks associated with the investment (Mousa *et al.*, 2014).

The costs of executing an ICO or IPO also differ greatly, while an ICO requires around 100.000 €, an IPO can easily exceed € 1 million. A majority of IPO costs relates to the underwriter's discount⁹, legal fees and external auditor fees (PwC, 2012; Förste, 2018). The comparable low barriers for ICOs regarding planning time and costs, enable small businesses, which would have been ineligible for traditional funding methods, to raise significant funds for their projects. So far, most start-ups using an ICO emerged from the blockchain community, however, it is likely that ICOs could become disruptive to the venture capital market by conquering other market segments (Minto *et al.*, 2017).

2.2 Underpricing of ICOs

Underpricing is a typical phenomenon for IPOs, meaning that the stock price for an IPO rises above the initial offer price after one trading day, hence, investors who purchase 'underpriced' IPO shares earn significant short-run returns (Lowrey and Schwert, 2002). IPO literature counts underpricing as indirect costs of financing, since in consequence firms give up a part of their revenue to the benefit of the investor (Ritter, 1987). High quality firms use underpricing to demonstrate that they are high quality by 'leaving money on the table' in the IPO. These firms seek to regain their upfront sacrifice post-IPO, e.g. in future issuing activity¹⁰ (Ritter and Welch, 2002). It has been established that IPOs earn positive first day returns on average across the world. Indeed, a sample of 29 countries showed an IPO underpricing, on average and by country, from 3.5 to 56 percent (Boulton *et al.*, 2009). Explanatory models¹¹ of IPO underpricing

⁷ The exact function and remuneration is often not disclosed for ICO advisors.

⁸ A presale is a token sale event that runs before the official ICO. Typically, a presale is done to accrue funds to cater for the expenses incurred on the way to launching the main ICO ('public sale').

⁹ An underwriter is usually an investment bank (or a syndicate of banks), which ensures that the IPO firm satisfies all regulatory requirements, contacts large prospective buyers of stock, and negotiates the pricing with the issuer.

¹⁰ This theory based on asymmetric information where the issuer is more informed than investors.

¹¹ There are also specific non-rational explanations and agency explanations affecting IPO underpricing.

assume distribution of asymmetric information¹² with information advantages for the investors¹³, for issuers, or for investment bankers taking the firms public. Overall, these theories are not mutually exclusive and specific reasons can be more important for some IPOs than for others (Ibbotson and Sindelar, 1994).

Just as IPOs, ICOs are averagely underpriced, even though, a great deal of last year's ICOs have already failed (Sedgwick, 2018). According to a report from Mangrove Capital, a blind investment in every ICO¹⁴ in 2017, including those that have failed, would have generated an average return of 1,320 percent for investors (Jackson, 2017). However, it is arguably that those numbers are just a current snapshot impacted by the general hype and growth of the entire cryptomarket in 2017. Therefore, it will be particularly interesting to observe whether ICOs will show similar high (short-run) returns in 2018. IPO and (potentially) ICO underpricing is affected by uncertainties for private investors and founders. In case of ICOs, specific uncertainties apply due to missing regulation and lack of consumer protection. As illustrated in *figure 1*, the uncertainties for ICO investors (red flash) are connected to the provided information, the ICO firm, and secondary markets.

A decisive criterion for investors is available information on the proposed projects. IPOs are legally required to provide certain information in form of a prospectus, since they are subject to the Transparency and Publicity Act (Franke and Hax, 2004, p. 32). Whereas, ICOs mostly have no legal obligation¹⁵ to do provide information and the related whitepapers are usually not verified by any third (independent) party. However, a lack of information for investors' concerns both, ICOs and IPOs. This problem of asymmetric information is correlated with the (under) pricing of IPO shares or ICO tokens and thus with prospects of success (Rock, 1986; Ritter, 2003; Copeland *et al.*, 2008, p. 491; Takahashi and Yamada, 2015). In order to reduce asymmetric information and convince potential investors, companies deploy voluntary corporate disclosure (Knauer and Wöhrmann, 2010). Though, it is a fine line for selecting appropriate information, because while favourable information increases the market price, it is also available to direct competitors. For instance, if a firm reveals high profits, other firms might enter their market causing proprietary costs, in this case a loss of profit due to increased competition (Wagenhofer, 1990). Therefore, voluntary

¹² In general, asymmetric information means that founders are better informed than buyers (Franke and Hax, 2004, p. 547).

¹³ One significant rationale assuming information advantages for the investors is Rock's (1986) 'winner's curse' model. In this model, issuing firms are assumed to be incapable of forecasting the market price with certainty. Investors are divided into two categories regarding the knowledge of the future market price: completely informed and completely uninformed. While informed investors will attempt to buy shares only when an issue is underpriced, uninformed investors do not know which issues will be underpriced or overpriced. As a consequence, uninformed investors face a winner's curse: when they get all of the shares they demand, then only because the informed investors don't want the shares. Therefore, uninformed investors face this 'adverse selection' problem, and will only purchase stocks of IPOs, which are sufficiently underpriced on average. Thereby, they can compensate the bias in the allocation of new issues.

¹⁴ Across 204 ICOs until October 2017

¹⁵ Depending on the country where the ICO is registered.

corporate disclosure arises when company-specific benefits outweigh the disadvantages (Mohamed and Schwienbacher, 2016). It is likely that voluntary disclosed information of ICOs and IPOs differs, because the companies are in different phases of development. Indeed, most start-ups of an ICO are in a pre-alpha stage of development and not ready for consumer adoption, whereas companies executing an IPO already have an existing product or service. Therefore, ICO start-ups are less concerned about revealing profits, but rather interested in protecting/maintaining a technological edge. Essentially, founders and investors of ICOs, both make a bet on the future and the blockchain technology, hoping that their project will thrive. In fact, at the time of the ICO, neither the product exists nor a business operation suggesting that investments in ICOs are in particular speculative and uncertain.

Due to the uncertainty of ICO projects and their development, it may be expected that ICOs constitute for higher-risk investments than IPOs. This is compounded by insufficient regulation of ICOs, which bears the risk for regulatory arbitrage. Unsurprisingly, ICO start-ups exploit regulatory loopholes to put themselves in legally advantageous and protected positions. Justifiably, many financial market regulators such as the German BaFin (2017), the Austrian FMA (2018) or the French AMF (2017), published articles aiming to alert investors of the ICO related risks.

Further risk emerges from unsecure secondary markets on which issued tokens can be traded. Clearly, there are some established and regulated secondary markets ('exchanges') such as the US company Coinbase, which complies with applicable laws and regulations (*Coinbase - Legal*, 2018). However, most tokens issued through an ICO are not tradeable on Coinbase or other established exchanges. Instead, private investors of ICOs often need to rely on unregulated and unsecure exchanges to trade their tokens, exposing them to further risks such as trade-based manipulation¹⁶ through 'pumping and dumping'¹⁷ schemes. The listing of a token does not only depend on demand, shareholder interest, or market capitalisation of the token, but also on specific listing requirements of the exchanges (Bovaird, 2018). It might be reasonably assumed that (ICO) tokens, which are tradeable on secondary markets with comparatively strong listing requirements have improved prospects. Such correlations exist for IPOs, where listing requirements for different IPO markets make a significant difference to the long-run

¹⁶ Trade-based manipulation occurs when a group of traders or a large trader attempt to manipulate the price of an asset, e.g. a stock, by buying and then selling. In general, this kind of manipulation is done without taking any publicly observable actions or releasing false information to change the price.

¹⁷ 'Pumping-and-dumping' is such a trade-based manipulation technique, meaning that manipulators collude and trade amongst themselves to artificially raise the price of a stock or token to attract unsuspecting investors. The manipulators leave the market, once prices have risen, and trigger a drastic decline in the stock price (Aggarwal and Wu, 2006; Cumming, 2008; Neupane et al., 2017). These 'pump-and-dump' schemes are a significant issue for (ICO) tokens and due to missing regulation, such schemes are simple to implement and on unregulated markets not even illegal. In fact, often manipulators spend little effort to disguise their activities and use social media channels to coordinate and promote ('pump') the elected token (Williams-Grut, 2017).

performance of IPOs. Indeed, studies discovered that IPOs listed under lower listing requirements have a lower survival rate¹⁸ (Johan, 2010; Vismara *et al.*, 2012).

2.3 Research Questions

The following research questions seek the acquisition of new knowledge, insights and understanding of ICOs. By building up an ICO database and applying Ritter's (2012) established method of performance measurement as well as existing theories of IPO underpricing. These theories will inter alia be based on asymmetric Information where the issuer is more informed than investors and vice versa.

How does underpricing of IPOs and ICOs differ? An evaluation of the short-run performance.

Whether ICOs offer similar, lower, or higher short-run performances respectively underpricing as IPO firms will be evaluated and analysed. A particular focus will be placed on Asset ICOs, which are most alike IPOs, and hence best suitable for a comparison of the two funding methods. On the IPO side, a focus will be placed on high-tech firms undergoing an IPO. Like ICOs, at the time of an IPO these firms are considered risky and difficult to evaluate, because they have limited histories, high information asymmetry problems, an uncertain future, significant intangible assets, and compete in complex and emerging markets (Carpenter *et al.*, 2003; Certo, 2003; Reuer and Shen, 2003; Hasan *et al.*, 2011; Mousa *et al.*, 2014).

What factors influence success and underpricing of ICOs?

Many studies demonstrated that correlations between company-specific characteristics and underpricing exist for IPOs (Jog and Wang, 2002; Loughran and Ritter, 2002; Jog and McConomy, 2003; Loughran and Ritter, 2004). Whether such correlations exist for ICOs will be explored and thereby it will be examined what factors do have an impact on the success and the pricing of ICO tokens.

¹⁸ Policymakers hope that relaxing listing requirements help smaller firms, which would not be eligible to list on the main markets, to raise capital and grow through an IPO. Thereby, policymakers expect revenues from listing fees and trading commissions as well as contribution to economic development through job creation and innovation (Takahashi and Yamada, 2015).

How does asymmetric information differentiate in ICOs and IPOs? How does asymmetric information impact ICO underpricing?

The level of asymmetric information is significant factor for the pricing of IPO shares and ICO tokens. Whether IPO firms, which are legally obliged to disclose certain information or ICO firms provide more relevant information for investors will be researched by evaluating the disclosed information in ICOs whitepaper in contrast to IPOs prospectus of a high-tech firm. In this respect, it will be assessed to what degree the asymmetric information correlates with underpricing of IPOs and ICOs.

3. Research Methodology

The forthcoming thesis will analyse ICO underpricing considering three areas, namely the short and long-run performance of ICOs, specific ICO characteristics and success factors for ICOs (explanatory variables), and the distinctions of disclosed information in ICOs and IPOs.

The performance of ICOs¹⁹ and high-tech IPOs will be compared and analysed in an equal timeframe, starting in 2016, and is not bound to a specific country or stock exchange/ crypto exchange. The short-run performance of ICOs will be measured in accordance with Ritter's (2002; 2003; 2017) method of IPO performance measurement. Accordingly, the event study will use the average first-day returns ($t=1$) from the offer price to the closing market price (event window) and weigh all IPOs respectively ICOs equally. The performance will be measured with regard to the market performance, which is in particular important for ICOs, since the cryptomarket is very volatile. Here, the market performance/return will be defined as equal weighted return in a cross-section of all cryptocurrencies on day t , excluding the ICOs in the last 30 days before the day t . In addition to the determination of initial returns, the abnormal rate of return will be evaluated. In this respect, an ICO can be considered as one event that may lead to an abnormal (positive or negative) return in relation to the expected return. The abnormal return, meaning the difference between the expected return and the actual return of a stock/token, will be measured by applying the CAR

¹⁹ In order to analyse and compare performance data of IPOs and ICOs, assumptions about the market including the distribution of information and rationality of market participants must be made. The author will assume a perfect market with economical rational market participants. A capital market is perfect, when the following conditions are fulfilled:

1. There are neither transaction costs nor taxes.
2. The same interest rate counts for every investor and every company to invest money and obtain credits.
3. There is no asymmetric information. Investors and companies have homogeneous expectations on project and financial effects of the provided data (Franke and Hax, 2004, p. 153).

Rational market participants act rational in accordance with the image of man as 'Homo Economicus'. This neo-classical theory defines a human as rational benefit-maximizer (Franke and Hax, 2004, p. 329).

(cumulative average return) and CAAR (cumulative average abnormal return) formula with different event windows ($t=1, t=2, t=3, \dots, t=30$) (Campbell *et al.*, 1997).

While IPOs are generally underpriced in the short-run, they have a poor long-run price performance on average²⁰. Whether and how the long-run performance of ICOs differs to IPOs, will be evaluated and compared in a three-year period. Commonly, the long-run performance is reported in cross-sectional average of compounded (holding period) returns, also referred to as buy-and-hold-return (BHR). Accordingly, the BHR as well as the BHAR (buy-and-hold-abnormal-return) formula will be applied to analyse ICOs long-run performance (Ritter and Welch, 2002).

Besides the performance data, a database will be build comprising (but not limited to) the following information on ICOs:

- General information (ICO type, registered place of the ICO, number of advisors, number of team members, number of sale rounds, capped or uncapped²¹, relative token price²², percentage of pre-mined tokens/ founder's tokens, minimum/maximum investment, accepted payment methods, KYC²³ requirements)
- Whitepaper (scope, technical depth, roadmap)
- Technical details (code availability, primitive or secondary token, token supply algorithm, consensus mechanism²⁴, specific token type - e.g. ERC20 token²⁵)
- Statistics (rate of return, ICO rating²⁶, total amount raised, presale amount, public sale amount, trading volume)
- Secondary markets (listing requirements, number of secondary markets)

Building an own ICO database is necessary, since such data has not been collected and assessed in the required depth and range. The data will be validated, edited, coded, entered and cleaned. On that basis, descriptive statistics will be provided giving an overview of the different areas, functions, and activities of ICO projects. The different variables are subjectively chosen, yet, also relate to certain IPO

²⁰ One explanation for this poor long-run performance is that most optimistic investors about an IPO will be the buyers. If there is a great deal of uncertainty about the value of an IPO, optimistic investors are likely to value an IPO stock higher than pessimistic investors. With time and more available information about future performance, the different views of optimistic and pessimistic investors will narrow, and therefore, the market price will decrease (Ibbotson and Sindelar, 1994).

²¹ 'Uncapped' ICOs do not specify the required capital amount in advance. Whereas 'capped' ICOs define a minimum and maximum amount before the token sale starts.

²² The token price will be defined in relation to the total number of issued tokens.

²³ KYC (Know your customer) refers to the process of a business identifying and verifying the identity of its investors.

²⁴ There are different mechanisms to secure a decentralised blockchain and reach consensus on 'who owns what', e.g. Bitcoin uses a 'proof-of-work' mechanism.

²⁵ 'ERC20 tokens' follow a certain protocol standard that defines a set of commands that a token should implement on the Ethereum blockchain. This protocol includes basic functions that any useful token should implement such as "...transferring tokens, inquiring the balance of tokens at a certain address, and the total supply of tokens" (Seibel, 2017).

²⁶ Ratings are provided on specific websites for ICOs, e.g.: www.icorating.com, www.icobench.com

characteristics, which are acknowledged for influencing IPO underpricing. For instance, IPO underpricing is related to the size of an IPO, evaluated through the gross proceeds (Ritter, 2017). Whether ICOs show similar size effects will be assessed with the CAAR formula (using the total amount raised in an ICO instead of the gross proceeds of an IPO). Also, missing liquidity can be a reason for IPO underpricing (Ellul und Pagano, 2006), accordingly, it will be evaluated whether the level of liquidity (taking the number of exchanges/ secondary markets) is related to ICO underpricing. The database also enables a regression analysis to investigate whether and to what degree specific ICO characteristics (unrelated to acknowledged IPO characteristics affecting underpricing, e.g. ICO or token type) influence the success and the underpricing of an ICO.

The database will be extended with data of an IPO prospectus, accessed via IPO Database (*IPO Database*, 2018), allowing a comparison with the information of ICOs whitepaper²⁷, accessed inter alia via TokenData (*Token Data | News, data and analytics for all ICO's and tokens*, 2018). In this respect, high-tech IPO prospectus and ICO whitepaper will be contrasted²⁸ and distinctions of available information for private investors in ICOs and IPOs will be revealed.

²⁷ The study will be limited to the whitepapers which are still available (some ICOs which failed deleted their whitepaper).

²⁸ Here, the author will assume a perfect market with economical rational market participants, yet, with the ease of existing asymmetric information. In this context, asymmetric information does not imply heterogeneous expectations, it only implies informational benefits of some market participants (Schmidt und Terberger, 2006, p. 391).

4. Thesis Outline

The introduction including research objectives and thesis outline is followed by Chapter 2, providing specific information of ICOs. An explanation of important concepts and technologies based on existing literature will be given, covering the fundamentals of Bitcoin and Ethereum including the mechanisms of blockchain technology and smart contracts (Antonopoulos, 2014; Bohme *et al.*, 2015; Fanning and Centers, 2016; *Ethereum Project*, 2018). These concepts are essential for the process of an ICO, which will be described and contrasted to traditional IPOs along with the motivation and key differences of ICOs and IPOs. Then, in Chapter 3, a classification of different ICO types will be conducted, to obtain an overview of the areas ICOs seek to innovate. The author will adapt the FINMA's (2018) general classification of Payment, Utility, and Asset ICOs to provide a comprehensive overview of the ICO landscape. Further, this classification is useful to examine whether the level of underpricing is correlated to the ICO type.

In Chapter 4, the phenomenon of underpricing will be examined including the empirical evidence and the proposed reasons for IPO underpricing. Based on existing theories, the ICO short-run and long-run performance will be measured and compared to IPOs performance. Then, potential explanatory variables for underpricing will be analysed. Additionally, the lack of information for investors when participating in an ICO or IPO will be explored. The problem of asymmetric information will be analysed and divided into two classes: the lack of information about the project (legal relationships, management competences) and about the future business development of the company (Franke and Hax, 2004, p. 547). Finally, the last chapter will conclude and summarize the findings of the thesis.

5. Thesis structure (preliminary)

1. Introduction

- 1.1 Introduction
- 1.2 Research Objectives
- 1.3 Thesis Outline

2. ICO background

- 2.1 Cryptocurrencies
 - 2.1.1 Bitcoin
 - 2.1.1.1 Bitcoin System
 - 2.1.1.2 Bitcoin Blockchain
 - 2.1.1.3 Bitcoin's effect on ICOs
 - 2.1.2 Ethereum
 - 2.1.2.1 Ethereum System
 - 2.1.2.2 Smart Contracts
 - 2.1.2.3 Ethereum's effect on ICOs
 - 2.1.2.3.1 The introduction of ERC-20 tokens
- 2.2 ICOs vs. IPOs
 - 2.2.1 Process
 - 2.2.2 Motivation
 - 2.2.3 Key Differences
 - 2.2.4 Consequences

3. ICO overview and empirical evidence

- 3.1 Methodology
- 3.2 ICO clustering
 - 3.2.1 Payment ICOs
 - 3.2.2 Utility ICOs
 - 3.2.3 Asset ICOs
- 3.3 ICO analysis
- 3.4 Results

4. The phenomenon of underpricing

4.1 IPO underpricing

4.1.1 Empirical evidence of IPO underpricing

4.1.2 Explanations for IPO underpricing

4.1.3 Underpricing and symmetric distributed information

4.1.4 Underpricing and asymmetric distributed information

4.1.4.1 Information advantage for investors

4.1.4.2 Information advantage for issuers

4.2 ICO underpricing

4.2.1 Methodology

4.2.2 ICO short-run performance

4.2.3 ICO long-run performance

4.2.4 Results

4.2.5 Comparison of IPO and ICO underpricing

5. ICO success factors

5.1 Methodology

5.2 Results

5.3 Correlations with ICO underpricing

6. Information Perspective on ICOs

6.1 Methodology

6.2 Whitepaper vs. Prospectus

6.2.1 General project information

6.2.2 Future business development

6.3 Results

7. Summary and Conclusion

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