To ICO or not to ICO – Empirical analysis of Initial Coin Offerings and Token Sales

Work in progress

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Abstract

The current paper is the first holistic study on ICOs and token sales and presents key results that trace the evolution of the industry from 2013 to date. We argue that while the full potential of blockchain technology is yet to be realized, with major infrastructure challenges in place, the technology (particularly with the advent of the Ethereum blockchain, which is the first successful programmable blockchain), blockchain technology has created a new viable vehicle for early stage capital raising. Along with creating a new asset class, the development is transforming the financial services sector (which other industries like supply chain, healthcare, etc. closely following suit). We trace the evolution of ICOs and token sales using a hand-constructed complete ICO database from small contribution campaigns from project's backers and the community in 2013, to the multibillion dollar industry as it is at the beginning of 2018. We show that successful ICOs tend to be more self-compliant with the forthcoming potential regulation and spend more effort on signalling their quality and reducing asymmetric information problem. Finally, our research highlights the incomplete nature and poor quality of the data provided by the ICO aggregation websites and calls for creation of a complete database to study the phenomenon in a scientifically sound manner.

Keywords: Financial industry, crowdfunding, venture capital, ICOs, token sales, blockchain, distributed ledger technology, , tokenomics, blockchain economics, token models, crypto assets, cryptocurrencies, token offering, Ethereum, , bitcoin, fintech, financial technology

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Introduction

With the global recession that followed the 2007-08 crash, due to the sub-prime lending crisis, the issues with systemic risk became (and continues to be) a key matter of scientific query for finance professionals. One of the outcomes of the financial crisis was a new crypto currency called bitcoin, that provides a trusted peer-to-peer payments network bypassing the global financial structure(s) to move value around. A decade later, it has taken the world of finance by storm (along with other industries), creating an entirely new asset class that promises to be the future of global commerce.

Back in 2008, blockchain (the technology underlining bitcoin) seemed to be an IT-confined short-lived phenomenon. Ten years later, it has radically changed the financial industry landscape and its future outlook. The most significant and disruptive of all so far, has been the way start-ups and SMEs attract financial resources with Initial Coin Offerings (ICOs) or token sales. The amount of capital raised by ICOs and token sales bypassed the traditional Venture Capital in 2017 (Catalini et al., 2018) becoming a direct threat to the VC and angel model.

Financial technology or fintech in short has always been a distributed global effort, with developer teams being scattered around the world, communicating and collaborating through web-based resources and depositaries. As the name suggests, financial technology refers to technological innovations that have and continue to transform the financial services sector. This includes digital money, credit cards, ATMs, electronic trading and more recently, micro finance, mobile banking, online lending, crowdfunding, etc.

Arguably, the most promising of all, blockchain technology promises to push it even higher, with all aspects of the business process – financing, sales, investing and others being completely freed from national boundaries. The promise is as big as the internet itself, with many referring to blockchain technology as internet 2.0 and/or terming it as an 'infrastructure technology'. With the state of the art in blockchain, not only it has revolutionized and truly internationalized the funding process for SMEs, but, for the first time, it also allowed for considerable disintermediation of the post-issue market trading of new distributed financial instruments called tokens[3]. Any investor from any part of the world is able now to buy and sell the tokens various online exchanges that have no national boundaries, thus freeing the

[3] Tokens or coins are a medium of exchange granting rights to use future services of realized project and as such represent claims whose value is connected to the ultimate success of the issuing start-up.

investor from the so-called “home bias”. The focus of this paper is on the origin, similarities and differences with traditional financing and evolution of “blockchain crowdfunding", as a new step from equity and reward-based crowdfunding

For entrepreneurial ventures (EVs) and small and medium enterprises (SMEs), it is rarely the case that internal funds (or bootstrapping) are sufficient to finance their investment projects and scalability requirements. Since the business profits are highly procyclical, this is especially true during economic downturns. Indeed, up until recently, the finance-hungry entities had only two possibilities – to borrow from local banks or to sell part of their companies to outside investors. The later are usually venture capitalists (VCs) or angel investors for start-up firms and institutional investors or general public in case of SMEs[4].

Looking at the various funding mechanisms preceding blockchain financing, be it IPOs, bonds, VC or bank loans, we observe that they are localized to a particular geographical area, be it national or some union boundaries, defined by common legislation, cultural linguistic similarities or common past[5]. These limits are less binding for large corporations who can tap into foreign capital markets by issuing ADRs in US or Eurobonds in foreign jurisdiction[6]. As a result, high net worth Individuals were always able to invest abroad using private banking facilities whereas small investors were left to deal with local banks, or buy national debt or invest in local stock market.

Initial Coin Offerings or token sales have abruptly shaken the whole system of borrowing and investing, by allowing anybody anywhere in the world to invest in a start-up formed by the team members residing in several countries, with an office rented, say, in Singapore, with legal entity being registered in Switzerland, and ICOs process run under the Virgin Islands jurisdiction. Using social media, blogs, web-based communications and internet channels in general, companies have suddenly realized the possibility to attract financing from abroad, free from the limitations of the local financial system, without the need to sell a larger part of its business to a venture capitalist. Nor they need to spend substantial resources on marketing and promotion of the capital issuance and on extortionate fees to intermediaries without whom the process would be doomed. Not anymore. Internet, blockchain and

[4] There are of course alternative non-financial funding methods like trade credit, leasing and some others (for a recent overview see Ferrando and Mavrakis, 2017).
[5] See, for example French and Poterba (1991) for equity home bias puzzle.
[6] O’Malley (2015) provides an excellent overview of the Eurobond markets history.

distributed ledgers have removed the need for a financial middleman, leading to a genuine revolution in the way SMEs obtain early stage financing.

We use the data from a proprietary hand-constructed database on all known token sales that took place from 2013 to September 2017 to study various new mechanisms and features that characterise and differentiate blockchain financing from other funding methods. We provide detailed statistics on all aspects of blockchain financing and study its evolution from the early stages when the annual number of ICOs were below a dozen (2013-2015) up to the recent times when the total funds attracted internationally have reached USD 10bln[7] We propose a taxonomy of all ICOs, looking not only at the successful and most well-knows fundraises so far, but also at fraudulent, cancelled, failed and underfunded ones. From a legal and regulatory perspective, it is clear that blockchain financing is the advanced stage of equity and reward-based crowdfunding with the JOBS Act enabling entrepreneurs to raise capital from non-accredited investors in the United States. We, hence, provide a comparative study of token sales vs. crowdfunding and conventional financing methods such as IPOs and Venture Capital (VC).

The first section looks at the history of the innovative financing methods for SMEs following the 2007-08 global financial crisis. In the next section we introduce the concept of blockchain-based capital raising methods and compare various aspects of ICO financing with conventional methods and crowdfunding. Section three provides a detailed empirical account of the evolution of token sales and their various characteristics related to the most important problems with conventional funding methods. The next section focuses on issues around security breaches, fraudulent ICOs and their relative incidence and losses to investors. The penultimate section looks at the most successful ICOs and compares the strengths and the quality of the measures taken to overcome the signalling and asymmetric information problems present in ICOs campaigns. The last section summarizes the findings and lays down the possible future research agenda.

1. Novel financing methods for start-ups and SMEs

In a market economy, each business entity strives for continuous growth which is only possible when the firm expands and invests in new projects. This in turn, creates a need for

[7] Fundraising information is from hand-collected data for 2013 – 2017 and from coinmarketcap.com for a later period.

capital. The most conservative method to obtain capital is internal financing, i.e. accumulate the needed resources through retained earnings. This represents a powerful strategy to avoid selling part of the firm to outside investors or gearing up , though not feasible for the start-ups and majority of SMEs.

During the recent financial crisis, the international financial system (banks and other lending institutions who takes deposits from lenders and make loans to borrowers) was badly damaged from taking excessive risks originating in subprime-mortgages, leading to frictions that have prevented banks from supplying a sufficient volume of loans to the market participants, thus aggravating the crisis and leading to a much higher fall in output. Conveniently termed as credit crunch, the reduction of the supply of loans coming not from reduced demand but from inability or unwillingness of financial institutions to issue loans to enterprises, especially to SMEs, is currently of highest importance to policy makers, economic agents and the general public alike. Indeed, several studies demonstrated that small firms have more difficulties in accessing credit compared to large firms (Berger and Udell 2006) with ECB surveys (European Central Bank 2015) providing evidence that bank-related financing conditions deteriorated most for euro area SMEs compared to larger firms. Following the 2007-08 financial crisis, the cost of additional regulatory and compliance requirements with the Dogg-Frank Act in the US, particularly from big banks is to the tune of $32 Billion. Higher compliance costs have resulted in lower funds available for SME and start-up financing in the form of bank loans.

Apart from ensuring stability and smooth functioning of the financial system, to provide a timely and fast response to start-ups' needs, many international institutions, national governments, regions and even municipalities have established or participated partially in establishing technological hubs, incubators, or accelerators (Hallen et al. 2016) or even set up the dedicated financial funds to provide financial resources (usually microloans) to entrepreneurs and to some extent to SMEs. Be it supranational, national, or regional initiatives, these provided only limited amount of funds and in no way were destined to solve SMEs' financing problems.

In a bank-based financial system, firms obtain external financing mostly through bank loans and not in the capital markets. However, severe financial crises lead to credit tightening (Davis and Stone, 2004) and it is documented that the firms increase their borrowing by issuing more bonds (Mietzner et al, 2017), although this opportunity is opened almost exclusively to

larger corporations. Public debt financing for smaller firms is either unsuitable at early-stage financing (Stiglitz and Weiss, 1981), or too expensive and overregulated for SMEs.

To attract listings from SMEs several exchanges have established special segments tailored to smaller, usually first-timeissuers of corporate bonds allowing them to obtain debt financing in an easier or cheaper fashion through issues of debt termed in the literature mini-bonds. Several European countries have experimented in this area (ORB market in UK, MARF initiative in Spain, Euro Private Placement framework in France, Nordic ABM market are tailored more to the financial industry borrowers), however the most developed mini-bonds markets are currently in Germany and Italy.

Venture capital represents the main, and sometimes the only source of financial capital for potentially high-growth small and medium ventures. It is a form of equity financing where the outside investor provides external financing, expertise, guidance and support in exchange for a stake ownership. Given more widespread use of equity funding by young high-growth-potential companies from 1980s, Venture Capital has grown into established and truly international source of financing, with venture fundraised capital in 2016 totalling $41.6 billion in US and $77 billion worldwide (National Venture Capital Association, 2017). Still, VC funds are estimated to finance less than 0.25% of all new ventures (Kaplan and Lerner, 2017).

Although VC-backed firms have traditionally been quite active in the Initial public offerings (IPOs) market, this option of capital raising was either available to rather large or successful firms or used as an exit option at the last stages of VC-financing. Offering shares to the general public entails more regulation from the regulators, more requirements for public disclosure of internal information, and, at the end, is very costly. Those high costs may to some extent explain the decline in the number of IPOs around the globe in recent years, the gap that was predominantly filled by private VC (Ewens and Farre-Mensa, 2017).

Many European stock exchanges have been experimenting with creating special segments, or second-tier markets dedicated to firms that were unable or unwilling to fulfil the requirements to be admitted to the main markets. As noticed by Vismara et al. (2012) there were eleven second-tier markets launched in Germany, France, Italy and UK with only five existing by 2012. Most of the time these markets were designed to meet the needs of younger and smaller companies that would tap into the public market during IPOs and follow-up issues for needed finance. Still, this way to obtain financing is costly and virtually closed for smaller SMEs and start-ups.

The last five years have witnessed the proliferation of the actors that to some extent took the role of a financial intermediary between borrowers and financial markets. From the crowdfunding and peer-to-peer (P2P) platforms that connect lenders with borrowers through online platforms to the initial coin offerings that completely bypass financial intermediaries, these new advances have led to the creation and explosive growth of what is called an Alternative Finance (AF) financial sector. Measured in size to be over €5b in Europe in 2016 (though with Continental Europe having only one fifth of the total) and seven times as large in the US, it represents a viable alternative to traditional sources of financing.

With the advent of the internet, the geographical boundaries limiting the distance between the financing counterparties have been removed and many financial institutions established purely online subsidiaries for private and corporate customers. Burned in the recent financial crisis, mired in the red tape of supervisory regulation, apprehensive of excessive risk-taking, and overloaded with high running costs they were no longer ready to provide finance to riskier borrowers. As a result, in the last decade this role was, to some extent, overtaken by private actors who organized online platforms matching borrowers and lenders and administering provision of credit at a lower cost. Be it private lenders or small businesses, this activity has become, by far, the biggest AF sector by volume in Europe, following the new EU regulation on e-money institutions (EU Directive 2009/110/EC).

The P2P online lending platforms have implicitly taken the functions of the financial lending institutions, from matching assets to liabilities to performing credit checks and monitoring of the borrowers. A much more radical step forward was introduced with the development of so called crowdfunding – an online (most often) platform that allows entrepreneurs and firms to attract funds from individual investors by publishing and advertising their projects. Having started from the donation-based and reward-based crowdfunding (Hemer, 2011), it turned out to be an alternative venue to attract the needed seed capital for entrepreneurs or small firms that have limited access to more traditional financing sources described above (Ordanini et al, 2011). As a result, at an earlier development stage, the role of the financial intermediary was overtaken by the online platform, reducing costs and vastly expanding the investor base at the expense of lower monitoring effort and greater need for stronger signaling to overcome the potential underinvestment due to the asymmetric information (Rossi and Vismara, 2018).

Several unrelated factors contributed to the explosive growth of investment-based crowdfunding that is rapidly becoming a viable alternative to more traditional ways of external equity financing[8]. As outlined by Block et al. (2017), both supply-side factors such as rapid growth of the Fintech sector, internet and social media usage along with the persisting impact of the 2007-08 financial crisis, manifested in reduced bank lending and a low interest rate environment, increased government attention to entrepreneurial financing as well as demand-factors (higher importance of market externalities and knowledge economy, disruptive effects on incumbents from start-ups) played an important role in ongoing development of crowdfunding and AF in general. In other words, a technology-enabled market for new financial services is rapidly emerging around the world.

2. Blockchain financing vs. its earlier alternatives

The great and fastening stride of "the Fintech revolution" is promising to continuously transform the once-static traditional financial industry, in particular, the provision of credit. Born about a decade ago, crowdfunding was first regarded as unsuited and illegal for business lending, with subsequent post-factum acknowledgement by the regulating authorities worldwide who had to tailor existing regulation or develop completely new regulation for the already burgeoning market. A similar story is enfolding with the innovative way of obtaining crowd-financing. Similar to crowdfunding and conventional public offerings (IPOs) in some respect, but fundamentally different in many others, unregulated by any jurisdiction, the initial coin or token offerings (ICOs / ITOs) currently face a detailed scrutiny from regulators worldwide with some of them having completely banned the activity (China and South Korea in September 2017), some issuing warning statements and still investigating the matter (US in July 2017) and some taking no particular stance.

The development of a new asset class of digital assets (bitcoin, altcoins, cryptocurrencies, crypto assets, tokens, etc.) and associated blockchainsallows easy, secure transfer and trade over the Internet without a centralized intermediary like a bank or an exchange. With the ability to virtually record everything of value, "the blockchain revolution" will challenge and disrupt the current *centralized* business models and the financial services sector – a fact that is already being acknowledged by global financial players who are tacitly

[8] See Bottiglia and Pichler, 2016 for a review of the European experience.

or openly studying blockchain adaption[9]. The Ethereum blockchain protocol allows for easy creation of other cryptocurrencies (as ERC20 tokens) that can be offered for sale to interested investors, who can keep them or resell in the secondary market through a crypto exchange.

Most innovative start-ups in the Fintech sector, often at the stage of early project development and frequently working on the open-source based projects were facing difficulties securing funds not from banks, but also from usual early-stage financiers like VCs and angel investors and even from innovative crowdfunding platforms. The idea to attract the financing for growth in the form of existing cryptocurrency to be converted into fiat money to invest in a project and in exchange to offer a new, this-project-specific, currency that can be resold or used as a payment for services rendered by the issuer, was regarded first as a nonsense or as an elaborate scam.

ICOs in a nut shell can be considered as an alternative form of crowdfunding financing that has emerged outside of the traditional financial system for the first time completely removing national boundaries. Since the essence of any ICO is to obtain the external funds for the company or project development, this can be considered a peculiar channel of new AF market. The traditional financial industry representatives regard it as new version of the Ponzi scheme, the opponents of the fiat money treat ICOs as a new legitimate way of raising capital based on new digital-era "gold coin" equivalent - a cryptocurrency "minted" and supported by the users for the users without the need for a financial intermediary. Notwithstanding the critique and being currently unregulated the market is growing rapidly reaching large amounts of capital attracted (USD 5bln in 2017 and over USD 1bln in January 2018 already).

[Insert Table 1 about here]

Table 1 outlines briefly the main features of the blockchain financing versus other methods, with the main advantages of the former being openness to international investors, speed, cost and ease of investing, no dilution of ownership of the founders and high liquidity of the bought coins/tokens in the aftermarket. These come at a cost of extreme information asymmetry, absence of quality certification and regulation and as a result, of investor protection. The true international nature of the industry, absence of any prior regulation or

[9] Taking for example Enterprise Ethereum Alliance that includes not only the Fintech start-ups but giants like J.P. Morgan, Mastercard and other global financial players.

standards and decentralized nature of blockchain have led to the rich set of techniques developed and tried by various start-ups in order to reduce information asymmetry, raise sufficient funds for development and keep the investors content in the process. In the next section we closely examine various stages and methods of the blockchain-based funding as it originated in 2013 and continued to grow and mutate up to present.

3. Database construction and empirical review of ICO activity

The first task was to give an objective definition to the ICO funding process. Since we treat the phenomenon as a start-up funding mechanism, it was decided to adopt an operational definition that defines an ICO as a crowdfunding fundraising campaign that sells the new proprietary cryptocurrencies to investors in exchange for existing cryptocurrencies or fiat money[10]. Given the absence of any coherent reliable database the task of constructing a complete list of true ICOs represents a hard task. We proceeded in the following way. The lists from 7 largest ICO tracking websites were taken and merged together eliminating the double entries with ICO end dates before 07 Sep 2017[11]. Even from the start the mediocre quality of data from them was obvious because even on the start and end dates of the ICO token sales these 7 were usually conflicting. The initial list was manually checked and filled in with missing data on various aspects of ICOs process using various sources such as:

- Websites of the ICO companies - looking for statistics and terms of ICOs. Quite often these were not operational anymore, so we looked through their archived versions.
- Companies' blogs – private ones or hosted on majour blogging servers as Medium.com, Steemit or Dusil.
- Blockchain forums - Bitcointalk, Bitcoingarden, Reddit, Thewiring and Forebits.
- Social media communication channels - Twitter, Facebook, Linkedin, Tumblr.
- Github - as a source of information for open projects that placed their depositories there.
- Chats channels as the places where developers provided information to the interested parties in relatively safe and confidential manner– Telegram, Slack.
- Press releases, news and wire articles about a particular ICO.

[10] We exclude the cases were only fiat money are accepted as most of these are usually variations of elaborate frauds or Ponzi schemes not leading to creation of the new cryptocurrency that is traded widely afterwards. In the section on security breaches and frauds in the ICO industry we provide a more detailed analysis.
[11] Smith & Crown, Tokenmarket, Icobazaar, Coinschedule, Hubcoin, Icodata, and Icoprojectrank.

The original sample was merged with the later deals up to 31 March 2018 taken from Icobench database through API calls, though the later database being much poorer in available details that are planned to be filled in the future work.

We excluded an ICO candidate if there was no information about the offer and final results in analysed communication channels, or if not validated by at least three external sources. We included and checked also all references to potential ICOs found during the data-cleaning phase in the sources listed above. As a result, the constructed database is a unique source about ICO activity from 2013 that is almost 100% correct and clear. Apart from general numbers our sample is much more complete as we manage to obtain information on investors, tokens and ICO details in more than 90% of the cases where Adahmi et al. (2018) collected basic information for less than 40% of all the sample ICOs and Fenu et al. (2018) used the Icobench database and based their conclusions on the sample of 712 observations although the Icobench data reports raised funds only for 360 ICOs in that period[12].

As at the end of March 2018 there were 51 online sources that provided the lists and reports on the past, active and forthcoming ICOs, with majority of them focusing on active token sales and in most cases providing very limited data on the past ICOs. Moreover, all of them contained unconfirmed deals that were not ICOs, or were cancelled or postponed. Table 2 provides an overview of the data quality from the main 6 sources of information on ICOs.

[Insert Table 2 around here]

Table 2 illustrates that even the most popular ICO listing websites cover rather poorly the early ICOs up to 2017, including maximum 70% of all ICOs run in that period and frequently listing unconfirmed ICOs that turned out to be other activity, or simple announcement not resulting in the token sale in the studied period. In fact, frequently the listing website focus on the most successful ICOs and prefer to focus on active or forthcoming ICOs as these often pay to be included and reviewed, with earlier ones lacking virtually all relevant information. This calls for more effort to create a database available to researchers for future analysis, similar to what has been done with VC deals (National VC associations' statistics) or IPOs data worldwide (John Ritter online IPO database[13]).

[12] Missing data for raised funds is reported as zero and not as n/a in the Icobench database.
[13] https://site.warrington.ufl.edu/ritter/ipo-data/

With considerable degree of subjectivity the ICO activity may be split into several stages that we list in Table 3 and provide selected summary statistics in Table 4. Below we briefly outline the main distinct features of each stage.

[Insert Table 3 about here]

Prototype phase.

The first documented and confirmed attempt to use blockchain for funding a start-up venture is traced back to 2013 when J.R. Willet, a bitcoin enthusiast during San Jose Bitcoin conference suggested to the listeners an idea of joint financing of building a new more versatile protocol layer on top of bitcoin[14]. In exchange of bitcoins the contributors would receive new coins which represented de facto an ownership stake of the new technology. With a simple bitcointalk.org forum thread announcement, no advertisement, legal or financial intermediation, or social media campaigns the developer managed to attract 4,740 BTC from 551 anonymous contributors from crypto community, to whom he later distributed the new Mastercoins, later rebranded as Omni coins. The funds were used to develop the original idea into a viable software and issued tokens could be instantly traded first on the dedicated exchange organized by the developers (buymastercoin.com) and later on other exchanges providing liquidity, exit strategy or speculation chances to investors. Such lightning speed, anonymity, low transaction costs and after-issue liquidity were not reachable in conventional crowdfunding and therefore, the Mastercoin ICO paved the way to many more to come.

The blockchain-funding activity slowly gathered pace, with relatively few ICOs taking place in years 2013-2015 (correspondingly 2 ICOs raising in total 630k USD, 11 raising 33m USD, and 14 raising 11m USD), collecting from investors variable amounts of funds from few hundreds to fifteen million US dollars equivalents. Initial fund-raising campaigns disclosed only the virtual identities of the founders (although well-known by the community long before) but the later ones emphasized the teams' compositions to lend credibility to the funded projects. The majority of the ICOs in that period focused on the infrastructure and platform projects aimed to upgrade and expand bitcoin-based ecosystem, but already in 2014 the US singer Tatiana, inspired by the first conventional crowdfunding campaign run by British rock band

[14] https://www.forbes.com/sites/laurashin/2017/09/21/heres-the-man-who-created-icos-and-this-is-the-new-token-hes-backing/.

Marillion in 1997, attempted to finance the production of her new album by fundraising bitcoins in exchange for newly issued Tatiana coins[15].

At that time virtually all fundraising campaigns called themselves all but ICOs (donations, crowdfunding, crowdsale, presale or even software sales) and half of them were conducted without providing a detailed description of the project state of art and future plans of the developers given the collected funds, a document that was subsequently called Whitepaper. Those projects relied on already established communities composed of blockchain zealots and first investors who sensed an opportunity to invest money, receive tokens and become a part of the rapidly growing ecosystems within blockchain industry. Given the anonymity of the investors and absence of regulation regarding cryptocurrencies trade and usage, little they cared about anti-money-laundering (AML) and know-your-customer (KYC) compliance rules and as a result those first ICOs were not accompanied by legal support, nor have they thought about compliance with securities regulation of developers' or investors' jurisdictions. With one notable exception – the Ethereum donation campaign, run for forty days in the summer of 2014, accompanied by well-thought strategy and development plan that was later called Roadmap, with funds collected by the foundation set-up in Switzerland, mandatory but rather formal registration of the investors, unique contribution addresses for each investors for greater security, escrow account under control of the third parties for better transparency of the process and reduction of moral hazard ex post, and carefully drafted by lawyers legal Terms of Sale document to be accepted in order to receive new Ethereum coins.

Although some prior projects have collected funds to develop layer protocols on top of bitcoin allowing for scripting and more versatile toolset[16], it was Ethereum project that aimed at and succeeding in developing a token that allowed implementation of smart contracts concept, pioneered by Szabo (ref), resulting in openly available software to create proprietary tokens in Ethereum blockchain requiring no time and sometimes only 41 lines of code. This opened a new stage in blockchain financing. Apart from Ethereum, several other projects from that time (NEO (Antshares), NXT, Bitshares) have used the blockchain financing to push forward their implementation.

[15] Following the failure of the campaign to collect the required minimum of 25,000 USD (only 40% pledged), these coins did not end up on any active exchange. What is interesting, the funds were not returned to investors as was planned in case of under-investment – a quite frequent practice in the forthcoming ICOs.
[16] Bitshares AGS or Swarm projects, for example.

Initial start-up phase.

It took the full year for the first ICO to be run on Ethereum blockchain (Augur in Sep 2015, raising over 5m USD both in Bitcoins and Ether) and by June 2016 only 3 ICOs followed suit. The majority of ICOs continued to accept funding in Bitcoins only with one quarter allowing investment with other altcoins. Unlike the first stage ICOs, majority of these required some formal registration of the users prior to be allowed to invest and many (46% of all cases) have taken legal advice and drafted the Purchase agreements outlining the risks and stressing the new nature of the tokens not similar to that of the conventional securities. All fundraising campaigns have not warned or excluded US investors from participating and one third of all ICOs originated in the USA, that either chose Anglo-Saxon jurisdiction to run token sales or even did not bother to make the event at least formally complaint with any regulation. It was USA-based gaming start-up Breakout in November 2014 that called the funding campaign "an ICO event" for the first time[17], but the rest (except 4 cases in total) of the subsequent fundraising campaigns were run as crowdfunding, crowdsales or software sales, with one calling the fundraiser an IPO.

In this phase 4 out of 27 start-ups have used some sort of VC-seed funding before the ICO and 10 ICO pioneered the pre-sale arrangements selling the tokens to earlier backers, individual private investors or business angels at large discounts. One quarter of all ICOs in this period run funding campaigns successfully raising millions of USD equivalents without publishing a whitepaper, that later would be become de facto issuing prospectus equivalent of the conventional IPOs. The majority of ICOs offered deep discounts (up to 50%) to earlier buyers to make an impression of high investor interest and maximize campaign's success chances. Various distribution model types where tried to allocate the tokens to investors – even Dutch auction in one case – but the majority of these envisage either a token or monetary cap on the accepted funds, offering the tokens either at fixed price (or at fixed price plus early investment or referral bonus) or running proportional sales with the token price to be determined at the end of the campaign given the total contribution amounts.

Four start-ups have chosen the uncapped model where the firms were ready to accept unlimited funding from investors issuing uncapped number of tokens to investors limited only the demand. One of them was the notorious The DAO ICO that was the first pure Ethereum-

[17] Interestingly, this ICO raised only half of the declared minimum needed to proceed with the project but never returned money to investors and continued the development nevertheless.

based one, with contribution process and coin issue run automatically using smart contracts and that was uncapped so that investors contributed over 150m USD to the project. Due to an error in the ICO contract's code, a hacker managed to steal all the funds shortly after the fundraising campaign and Ethereum community had to cancel blocks already appended to the blockchain, restoring the pre-DAO state of the network and effectively creating a hard fork, discrediting the new smart contract system and raising for the first time awareness of possible security breaches soon to be faced. Nevertheless, even the failure at such a big scale did not stop the ICOs activity worldwide that entered into the growth stage.

Late start-up phase.

The subsequent year was characterized by internationalization of the phenomenon – 112 ICOs from 23 countries have raised close to 300m USD. The increased regulators' attention and legal uncertainties surrounding blockchain financing called for more thoughts on the right procedures and possible consequences after funding. More than one third of the ICOs have explicitly chosen the governing jurisdiction for token sales, with twenty percent choosing Swiss law, other twenty percent Anglo-Saxon jurisdiction and the rest predominantly the countries of teams' origin. Moreover, starting from August 2016 some ICOs either warned and discouraged USA residents from investing (Lykke and Cosmos under Swiss jurisdiction), allowed only accredited USA investors to participate (QTUM and Blockchain capital from USA), excluded particular US districts (Storj and BAT excluding NY-based investors) or prohibited participation of all residents of the US (7 token sales in total).

In this phase half of the ICOs have chosen to accept only bitcoins, eighteen percent opted for bitcoins or ether contributions and more than one fifth accepting only ether. Companies have started to target potential investors through PR articles and press-releases, participating in hackathlons or other blockchain events, increased communicating activities through social media and online channels and have started to allocate tokens to active private promoters through what was called bounty campaigns. Although around ten percent of all fundraisers later on turned out to be frauds, the term "ICO" didn't sound that negative at that time and majority of the start-ups run the campaigns under the ICO caption.

Early growth phase.

Spectacular appreciation of bitcoin and other cryptocurrencies during 2017 brought increased media attention and raising investment interest from outside of the cryptocommunity. Having sensed an opportunity to raise funds quickly and cheaply many start-ups rushed in to announce and run their token sales. Almost 2.5 billion USD were raised from 169 ICOs in that period. Fifteen percent of these were oversubscribed and have reached their funding hard caps but one third of all ICOs raised less than requested minimum and refunded investors, re-run the campaigns or continued development at a slower pace. A median ICO size has grown sevenfolds to above 4m USD with several ICOs raising more than 100m USD.

In this period the ICO phenomenon started to take the form as we know it today. First small-scale advertisement and bounty campaigns in social media to bring the attention of the crowd, small-scale fundraising campaign called pre-sale targeted to big investors (whales) or business angels or venture capitalists who obtained the tokens at very large discounts, followed by more intensive advertisement using collected funds from pre-sale and then the main event, offering deep discount for early participants. It has become a standard to provide investors with start-ups' pitch manifested in white paper, establish active communication channels with community through Slack, Telegram or blockchain forums, release detailed information about the fundraising and business development through blogs or dedicated blockchain news websites. The sold tokens are distributed automatically by the smart contracts during the crowdsale or immediately after in majority of the cases, with the issuers arranging for listing of the tokens on various online cryptoexchanges as is usually promised during the fundraising. In fact in all the first 4 phases of ICOs evolution, three quarters of issued tokens ended up being freely traded on cryptomarkets[18].

Faced by regulators scrutiny worldwide, SEC decision to treat The DAO's token as securities with all the consequences[19], Chinese ban on all national ICO activity and several cases of large security breaches of funding processes, many ICOs allocated considerable funds to legal compliance, have choses Switzerland or Singapore as governing jurisdictions for token sales and sixty percent of all have prohibited US residents from participating. In August of 2017 the USA-based start-up for blockchain-based data storage network called Filecoin not only have managed to raise 284m USD from institutional and private investors, but also tried to be

[18] Data is taken from coinmarketcap.com
[19] https://www.sec.gov/news/press-release/2017-131

compliant with any future forthcoming regulation on ICOs – running KYC checks on all investors, allowing only accredited investors from selected jurisdictions to participate (USA and UK), warned investors from other jurisdictions (China and Canada), and sold a new product, called a Simple Agreement for Future Tokens (SAFT)[20], that is restricted to be sold and may be converted into tokens only after the network lunch.

Late growth/maturity phase.

What followed after the Filecoin ICO is the flood of new token sales from all over the world, with blockchain and industrial start-ups trying to get in before the activity would be restricted or regulated, thinking that the regulation might not be applied retroactively to already run fundraising campaigns. Over 1200 ICOs were conducted by the end of March 2018, raising close to 4b USD[21] but according to anecdotal evidence with half of them failing to raise the required announced minimum to proceed. The ICO activity show no sign of slowing, already surpassed the VC funding of fintech industry, and whether we are witnessing the maturity or decline phase depends entirely on the regulatory decisions to be coming in the nearest future.

4. To fraud or not to fraud: how serious is phenomenon?

Incomplete – data on funds stolen with scam, security breaches and total losses.
Activity is much smaller than feared: reports about 25% total ICO funds stolen grossly inaccurate are misleading because majority of losses come from exchanges losses and have nothing to do with ICOs funding.

5. What determines ICO success

The tokens sold in an ICO represent a means to access the future services of the fundraising project once it is implemented and as such resemble very much the reward-based crowdfunding fundraising. At the same time, quite often the tokens allow participation in the governing of the future ecosystem and grant the investors cash-flow claims on the future revenues thus making the tokens more similar to equity crowdfunding instruments. With two notable differences – the tokens do not give ownership rights but can be traded after the ICOs. So to study what determines the success of the token sales, it is instructive to see the accumulated evidence from reward and equity crowdfunding.

[20] Modelled from the similar instruments for equity investment, SAFE, pioneered in the late 2013 (http://www.ycombinator.com/documents/).
[21] In reality the figures are much larger as the data is taken from icobench database that has fundraising data only for 25 percent of the deals.

Several papers studies various crowdfunding campaign characteristics , signals from the entrepreneurs and various means of reducing asymmetric information problem as the key factors to the campaign success (Ahlers et al., 2015, Vismara, 2016a,2016b, 2018 and others). Similar analysis may be applied to blockchain crowdfunding. In fact, only two studies up to date looked at the issue. Adhami et al. (2018) collected very basic data on the sample of ICOs run mostly in 2017 up to end of August and Fenu et al. (2018) studied a sample of ICOs from Icobench database up to the end of 2017 that is of very low quality with few available parameters and many missing data points.

One of the complication might be to define properly the success of the ICO. Adhami et al. (2018) classified as failed ICOs those that have collected funds lower that the voluntary declared required minimum, were targets of security attacks or were perceived as fraud attempts. Fenu et al. (2018) took a more practical but very debatable approach of marking an ICO as a failure if it raised less than 200k USD in funding. We suggest an alternative classification instead.

First, we exclude all pure fraud campaigns identified by the users before or during the fundraising, postponed or cancelled ICOs, and ICOs that were run as jokes or by dilettante developers without raising any amount of money (we have counted 47 cases up to September 2017). Second, we identified as *Top ICOs* those that have had their funding limits (called hard caps) reached before the end of the campaigns. For the ICOs run as unlimited cap campaigns (19 in total in the sample) we have marked as Top ICOs those that have raised funds above the third quartile of all capped ICOs (6 ICOs in total) giving us the final count of 84 campaigns in this category. Third, we identified as *Failed ICOs* those that have raised less than self-imposed minimum caps (42 in total). Of these 19 refunded investors straight away, 4 have offered optional refunds, 8 have cut all communication channels and disappeared without refunding users, and the rest continued with limited funding. All other ICOs were grouped together as *Average ICOs* category, 189 campaigns in total. Table 5 shows summary statistics for all three groups of the token sales.

[Insert Table 5 about here]

Table 5 clearly illustrated the main features of the successful token sales. The preliminary univariate analysis shows that these are the ones that managed to attract higher

investors' interest with massive marketing campaigns in all media, signal their quality with prior VC-participation, selling a bigger proportion of tokens to the public and allocating smaller percentage to the developers vesting those for a longer period of time. Moreover, voluntary compliance seems to lead to higher chances of success, as well as offering less time- or contribution-size bonuses to ensure fairer treatment of the investors. The last but not the list is listing in the ICO aggregation websites for greater publicity and quality certification.

Conclusion

The financial crisis originated in 2007 have brought about worldwide GDP growth reduction or even recessions, shook the financial industry and in general reduced the credit availability to large firms, SMEs and start-up ventures altogether. At the same time it draw the attention of the governments and regulators to the needs of the businesses, spurred competition and innovation process and made clear the deficiencies of the traditional financial model not adapt to the demands of new era economy. Governmental and regulatory actions aimed at easing the credit-provision process in general or making it more attractive to borrow or sell equity in the public markets for SMEs seemed not to address the needs of start-ups and small businesses, with VCs often being too risk-averse or unwilling to finance the Fintech ventures. The ideas of crowdfunding and P2P lending, where individuals become angel investors and co-finance new ventures and projects, from purely socially or reward-oriented activities now represent a large share of business financing across the developed world. As a result, the regulating authorities had to react only ex-post when this sector of AF was already large and well-developed, and they adopted business-friendly laws and rules.

Blockchain financing with token sales is now a well-established practice worldwide with start-ups raising above one billion USD monthly in 2018. In this paper we have analyzed the initial phases of the industry development from 2013 to September 2017 collecting detailed information on all ICOs attempts in this period, providing a thorough descriptive analysis of the phenomenon and laying foundation for future research in this area. Among the directions to be taken are the studies of ICOs funds collection and tokens' long-run performance and effects of various signals and means to reduce asymmetric information in a multivariate context. Similar to equity crowdfunding studies on the role of the platforms, the importance of rating websites and online exchanges merits special attention. Self-compliance and effects of legal tools chosen to ensure the smooth token sales also represent a very

interesting topic to look at. The last but not the least are the analysis of token sales and alternative methods of raising capital like VC and private equity and the investing dynamics and the role of various token sales' mechanism chosen by the offering companies.

The Fintech revolution and blockchain technology seem to have potential to completely disrupt the traditional financial and banking industry in rapid and unpredicted manner, therefore viewed by many national regulators with suspicion and apprehension especially the underlying anonymity and disintermediation principles. Some countries prohibited national ICO activity (China), some are in the process to implement favourable regulation (Switzerland, Singapore, Russia), and the others are looking at the matter and prepare to take action (USA, EU countries). Whether they will take prohibitive or more liberal stance remains to be seen in the nearest future. However, it is hoped that by the time to take action, it will already be too late to prohibit it given the spread of new technologies and its grown importance for the new economy. At the end, the Italian authorities did try to shut down the crowdfunding activities in the country, later to become the first in the world to adopt the national crowdfunding regulation in 2012.

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Table 1. Blockchain funding vs. earlier alternatives

Characteristics	IPOs	Venture capital	Reward- and equity-crowdfunding	ICOs / ITOs
Marketing channels	Underwriters	private negotiations	Platforms	social media
Investor base	exclusive, local		exclusive, local	inclusive, global
Intermediation	syndicates	VCs	Platforms	no
Asymetric information	average	low	above average	highest
Funding currency	fiat	fiat	Fiat	crypto
Investor Protection	courts	automatic	Courts	no
Regulation	"standardized"	"standardized"	country-specific	no
Acquisition of	Minority ownership stake	majority ownership stake	product/ownership	future service
Monitoring ex-post	governance mechanisms	VCs	Absent	absent
Lock-ups	owners	no	Unclear	developers
Market-making	lead underwriter	N/A	No	decentralized
Liquidity	Low	N/A	No	high

Table 2. ICO listing websites data quality.

The table contains the data on the ICO inclusion in the main ICO listings websites as at 01/11/17. Only the token sales from 2013 to 07/09/17 are included. In % to true ICOs show the percentage of token sales from the constructed database in each of the ICO listing websites, In % to N of entries shows the percentage of entries that were not genuine ICOs, were cancelled or postponed.

Source	**Description**	**Database size**	**N Included**	***% included***	**Not ICOs**	***% false ICOs***
Constructed database		315	315	*100*	0	*0*
Icoholder	Extensive list with many false entries	365	244	*77.5*	121	*33.2*
Icodata	High quality list with funds' raised data	227	209	*66.3*	18	*7.9*
Icobazaar	Basic information on ICOs Aggregated ICO rating assigned	240	200	*63.5*	40	*16.7*
Icobench	Extensive data on ICOs' details and teams Detailed rating from the site and accredited users	202	170	*54.0*	32	*15.8*
Tokenmarket	Detailed information on tokens Qualititave data only	160	135	*42.9*	25	*15.6*
Smith&Crown	Oldest website Simple list, profile, summary or full report	137	92	*29.2*	45	*32.8*

Table 3. Stages of ICO evolution in 2013-2018.

Stage	Period	N of ICOs	Leading ICO	Prominent ICOs	Stage Features
1. Prototypes	Aug 2013 – Aug 2014	10	Ethereum	Maidsafe NEM	Marketing through bitcointalk.org forum mostly. Crypto-enthusiasts and projects' community as investors. No legal entity or compliance thought except for Ethereum ICO.
2. Early start-up	Sep 2014 – May 2016	27	The DAO	Augur Antshares Lisk	More frequent usage of social media and novel marketing campaigns. Experiments with various token sales types and starting adoption of smart contracts. The term "ICO" is used for the first time. Few VC-backed start-ups conducting crowdsales.
3. Late start-up	Jun 2016 – May 2017	128	MobileGo	Aragon Iconomi Gnosis	Fast growth of ICOs number, total and average funds raised. Higher investment in marketing campaigns. Tokens issued mostly on Ethereum blockchain with funds accepted in Bitcoins or Ether. Selection of benevolent jurisdiction and attempts for self-compliance using legal advice.
4. Early growth	Jun 2017 – Aug 2017	212	Filecoin	Tezos EOS Coindash	Exclusion or limitations for investors from selected jurisdictions. Large investors (whales) participation. Many tokens sales raise unseen before funds in very short time. Pioneering of SAFT sales.
5. Late growth / maturity*	Sep 2017 – Mar 2018	1,209	Na	PolkaDot HDAC Sirin Labs	Legal uncertainty about sold token's nature. Increased regulators' attention and comments. Increased participation of private and venture capital in private sales before / instead of public small pre-sale followed by several rounds of main token sales. Stable number of new ICOs per month from January 2018.

* Estimates are taken from icobench.com database and not confirmed. Only 241 ICOs have fundraising data available.

Table 4. Main statistics on ICOs industry in 2013-2018.

The table shows the selected data for 315 ICOs run from 2013 to 31 March 2018. Legitimate ICOs are all completed ICOs that were not identified as scams during the fundraising campaign. ICOs size was calculated by converting all contributed cryptocurrencies into US dollars using the exchange rates as at the last date of the campaign. Total Funds raised are all funds contributed by the investors. Net funds raised refer to the funds that were collected by the start-ups, net of refunds, thefts or losses due to security breaches. % of overfunded ICOs/% of underfunded ICOs are the percentages of ICOs that raised the amounts equal /smaller the predefined limits (hard cap and min cap correspondingly). % of token offered is the percentage of tokens planned to be distributed to the investors. % of token sold is the actual percentage of the distributed tokens.

Stage	Period	N of legit. ICOs	N of Scam ICOs	Mean ICO size, USD	Median ICO size, USD	Total funds raised, USD m	Net funds raised, USD m	% of overfunded ICOs	% of underfunded ICOs	% of tokens offered	% of tokens sold
1	Aug 2013 – Aug 2014	10	0	3,023,323	703,605	30.4	28.7	10	30	80	81
2	Sep 2014 – May 2016	24	3	6,622,438	556,505	178.8	28.7	4	17	55	55
3	Jun 2016 – May 2017	112	14	2,239,536	622,500	286.7	283.6	13	18	66	50
4	Jun 2017 – Aug 2017	169	18	11,329,537	4,395,504	2,401.8	2,335.9	15	34	56	45
5*	Sep 2017 – Mar 2018	1,209	Na	16,340,661	7,400,000	3,938.1	Na	Na	Na	Na	Na

* Estimates are taken from icobench.com database and not confirmed. Only 241 ICOs have fundraising data available.

Table 5. ICOs statistics

	Failed ICOs (N=42)	Average ICOs (N=189)	Top ICOs (N=86)
Panel A. Fundraising statistics			
Total funds raised, USD m	6.4	664.0	2,223.7
Net funds raised, USD m	4.1	650.2	2,022.5
Funds raised per ICO, USD k	174	3,551	26,472
N of Investors per ICO	744	3,117	4,752
Average investment, USD	895	2,072	11,154
% accepting fiat contributions	4.8	13.8	11.6
% with prior VC-backing	0.0	9.5	31.4
Panel B. Compliance statistics			
% with legal contract	38.1	51.9	70.9
% with limitations	21.4	20.6	34.9
% Swiss/Singapore jurisdiction chosen	4.8	10.6	24.4
% with compulsory users' registration	45.2	48.7	43.0
Panel C. ICO details			
% with proportional distribution	23.8	23.8	8.1
% with uncapped amount	0.0	6.7	14.3
% with bonus offered	66.7	75.7	55.8
% with Whitepaper available prior to ICO	76.2	83.1	86.5
% with pre-sale	7.1	21.7	49.4
Panel D. Signalling and investors interest			
% of total tokens sold	19.2	52.1	56.4
% of tokens to developers	27.5	18.0	12.4
Average vesting period, years	0.1	0.3	0.8
N of twitter posts	741	1014	625
N of twitter followers	3,532	14,545	26,457

Days in Twitter prior to ICO	362	257	453
Days in Bitcointalk prior to ICO	22	47	50
Icobench rating (out of 5)	2.1	2.8	3.0
Icobazaar rating (out of 5)	3.2	3.3	3.3
Listing index from top 6 ICO aggregators	2.5	3.4	4.3