INSEAD

The Business School for the World®

Fight against Crypto-lemons: Evolution of Signals of Reliability

Ekin Ilseven

Term paper submitted for the class Organizational Foundation of Financial Markets, P4 2018

May 17, 2018

"But if the markets are not regulated and buyers cannot observe product quality, unscrupulous sellers of low-quality products would choose to trade on the market for high quality."

Lofgren et al. (2002), Advanced Information on Economics Nobel Prize 2001

1 Introduction

The past year has been an exciting one for crypto-enthusiasts: The cryptocurrency, Bitcoin, currently with highest market capital rose in half a year from 1,900$ to 19,000$[1]. The development of smart contracts as well as ERC20 protocol lead to the surge of Initial Coin Offerings (ICO). While Businessinsider placed the amount of money raised in 2017 at $5.6b[2], Cointelegraph reported that it was $4b[3]. Coindesk, another accepted well-known digital platform informing on crypto-assets, reported that $6.3b was raised in the first three months of 2018[4]. Whatever the exact numbers are, we see that money is still flowing into the block-chain based start-ups, either offering new cryptocurrencies or tokens, and it is not going to disappear any time soon.

While the news of ICOs raising surprising amounts of money sounds all good, there is a flip side to it that has been there as long as cryptocurrencies existed: Criminality and fraud. A recent article by an IG analyst reminds us of the dark past of Bitcoin. "Silk Road first opened in 2011, just two years after the birth of bitcoin. A 'clandestine eBay' hidden on the darknet, it was used by almost one million customers to buy drugs online. And it was dependent on the anonymity of bitcoin to function. [...] [In 2014], Mt. Gox, by then [Bitcoin's] biggest exchange, collapsed after 850,000 coins were stolen by hackers."[5] In late 2017, J. Stiglitz, 2001 Nobel Prize winner, clearly called for the cryptocurrency to be outlawed[6]. What makes this call interesting is that it came from a scholar who won the Nobel Prize for his works in information asymmetry and adverse selection (Lofgren et al. 2002).

While we see in these discussions that cryptocurrencies are used as tools for criminality in real world (such as drug trade), we have to also pay attention to what happens when fraud is brought on the block-chain platform itself. As ICOs became popular and token production standardized through ERC20 protocol, many people took the opportunity to create fake start-ups that run ICOs with "dreamy" projects. In summer of 2017, Eros.vision ICO raised $19m and disappeared with vague reasons, while not returning the money[7]. Fast-forward to early 2018, we see that Pincoin ICO raised $660m and "then the team disappeared"[8]. These news clearly show that there are still some investors investing money in fraudulent ICOs and are not able to distinguish reliable ICOs from those that are not. Similarly, they also show that there are still ways to deceive people into thinking that the focal ICO is reliable. In short, the information asymmetry is sustained and, furthermore, open to manipulation.

In this work, I investigate how the actors of the ICO market deal with such information asymmetries. Existence of such information asymmetries can be detrimental to both the ICO organizers and investors. If ICOs are not distinguishable in terms of their reliability, the investors will commit both type I and type II errors in their investments: Former describes investments in fraudulent ICOs and latter not investing in reliable ICOs. Investors constantly want to minimize type I errors because they are very costly for them; they lose all of their money. On the other hand, reliable ICOs (hereafter used interchangeably with

[1]https://coinmarketcap.com/currencies/bitcoin/historical-data/
[2]http://www.businessinsider.fr/uk/how-much-raised-icos-2017-tokendata-2017-2018-1
[3]https://cointelegraph.com/news/icos-raised-4-bln-in-2017-what-2018-has-in-store
[4]https://www.coindesk.com/6-3-billion-2018-ico-funding-already-outpaced-2017/
[5]https://www.ig.com/se/nyheter-och-analys/trading-opportunities/the-silk-road-to-bitcoin–has-the-crypto-escaped-its-dark-past–41990-180205
[6]http://uk.businessinsider.com/stiglitz-calls-for-regulating-bitcoin-which-he-says-would-kill-demand-2018-1
[7]https://medium.com/@mattdlockyer/ico-scams-damaging-the-blockchain-a57f40b9cbb0
[8]https://techcrunch.com/2018/04/13/exit-scammers-run-off-with-660-million-in-ico-earnings/

blockchain-based start-ups engaged in ICOs as start-ups are one-to-one with ICOs) want to avoid type II errors committed by investors, because type II errors lead to lack of support for genuine projects. Finally, the fraudulent ICOs want to increase type I errors, as what is lost by the investors in type I errors goes directly into their pocket. Overall, we observe competition between fraudulent ICOs, reliable ICOs and vulnerable investors.

Many scholars of economics and socio-economics have studied in different contexts such systems with information asymmetries and corresponding competition to decrease/increase the asymmetry. One of the most important outcomes of this line of research is the signalling theory, mostly cited to Spence (1974,1978). In signalling theory, a signal is a costly behavior or asset of the signaller that can or will be attained only if the signaller has incentives to differentiate herself from the others. Hence, reliable ICOs will look for costly signals that cannot be imitated by fraudulent ones. In such a case, investors will look for these particular signals and adjust their investments accordingly. However, simultaneously fraudulent ones might come up with fake signals, which could create enough noise to mislead investors into investing, or they could stage fake outcomes to valid signals to weaken the validity of the corresponding signal (Johnstone and Grafen 1993). As such, we would observe the outcomes of a competition of discovering and confirming valid signals versus creation of fake signals and weakening the validated ones.

In this work, I primarily aim at answering three questions relevant to signalling theory which are pointed out by Connelly et al. (2011): 1) How are signals created? 2) What are the consequences of negative feedbacks, respectively penalties? 3) How does the signalling environment influence creation of signals as well as feedbacks? Creation of signals are strongly connected to the penalties, as in the absence of penalties incentives to create new signals are low. The negative feedback will be expected after the discovery of fraudulent ICOs despite the existing signals. For example, a well-established finding, summarized and further supported by Yenkey (2018), is that "trust [is] a precondition for market exchange (Arrow, 1974; Granovetter 1985; Beckert, 2006) [...]Despite the central role of trust in facilitating market participation, fraud and other forms of misconduct that violate trust are regular features of markets and organizations (Kramer, 1999; Greve, Palmer, and Pozner, 2010; Palmer, 2012) [...] The central theme in this literature is that misconduct signifies weak regulatory institutions, which lowers generalized trust and indirectly lowers market participation (Knack and Keefer, 1997; Guiso, Sapienza, and Zingales, 2008; Georgarakos and Pasini, 2011)." In these works, the main factor studied is trust. However, before trust comes the establishment of signalling behaviors, and this is even more pronounced in emerging markets. Hence, a temporary lower market participation might be a penalty applied to all ICOs that use the same signal that failed to transmit reliability.

When a signal receives a negative feedback, what happens next? The reliable ICOs look for ways to create new signals, possibly better ones. At this point, we have to investigate how the signal is created. Discussion of creation of signals leads to a perspective on signal innovation: Are the signals the outcomes of innovative practices, which depend on local network properties and their emergence will diffuse to nearest-neighbors of the innovators, eventually to the whole community? Or is it simply adopted almost simultaneously by the members of the community which are not necessarily connected to each other? From this point of view, I investigate whether the signals of reliability diffuse over networks or they emerge as logical next step to the negative feedback received. A network diffusion approach might also give insight into the intentions of the actors and would contribute to the literature of networks of misconduct.

Finally, the influence of signalling environment is an important question regarding signal creation and associated feedbacks. There is a lack of consensus between governments about regulating ICO markets. While some do not regulate, some have already banned them. Especially, SEC's recent announcement[9] and other change the institutional environment of ICO markets. For example, the reliable ICOs aiming for long term success will not have any trouble with complying ahead of time with the expected legal

[9] https://www.sec.gov/news/public-statement/enforcement-tm-statement-potentially-unlawful-online-platforms-trading

requirements that could be instated in the future. Hence, the signal creation is then expected to happen community wide in short time and is also expected to increase positive feedback from the investors upon their adoption. So, the governmental indications would serve as a guideline for those who would like to adopt signals of reliability, even if they are not necessarily legally executable yet. At this point, Stiglitz's assertion that "when you regulate it so that you couldn't engage in money laundering and all these other things, there would be no demand for bitcoin [...]so, regulating the abuses, you are going to regulate it out of existence" could be partially tested, if the increased signals of reliability attracts more investors (as a positive feedback) or whether it actually leads to the market collapse.

In the following sections, I first summarize the fundamentals of signalling theory and then describe the ICO markets. Next, I refer to the existing works in ICO related literature. Having given the state of art, I move on to formulate hypotheses that could be tested according to the previous literature as well as the theory developed in this work. Afterwards, I suggest an empirical setting and model to test the hypotheses. Finally, I conclude with summarizing the contributions to the literature, limitations of the theory and an outlook.

2 Fundamentals

2.1 Information Asymmetry and Signalling Theory

The consequences of information asymmetries are studied well by economists and socio-economists and it is almost inevitable not to refer to the seminal works of G. Akerlof, M. Spence and J. Stiglitz. In this work here, I refer to fraudulent ICOs as "crypto-lemons" referring to Akerlof (1978). In the original model of Akerlof, bad quality used cars are named as "lemons" (as they are called in U.S.A.) and, due to information asymmetries, they are traded in the same automobiles market as good cars. While the sellers of the cars know the real quality of the car, the buyers do not until they purchase and use the car. Akerlof states that such information asymmetries will lead to collapse of the market as buyers will demand cars for lower price due to potential lemons and those who have good cars will not sell them for that price. When more good car owners leave the market, buyers expect even more lemons and further lower their price. When all the good car owners leave, there will be no trade anymore. While Akerlof finalizes with mentioning institutions that counteract such information asymmetries: Guarantees, brand-name, licensing practices.

These institutions mentioned by Akerlof are studied by his contemporary Spence (1974, 1978), under the name signals and in the context of job markets. Spence (1974) argues that "in most job markets the employer is not sure of the productive capabilities of an individual at the he hires him. Nor will this information necessarily become available to the employer immediately after hiring. [...] to hire someone, then, is frequently to purchase a lottery." As a solution to this problem, Spence suggests that incentivizing the potential high-quality employees to obtain some costly signals would allow them to separate themselves from those who are low-quality. This state can be furthermore reached as an equilibrium of all participants. As such, in a market with information asymmetries, the investors will set a threshold for signal costs, such that the reliable ICOs will still be able to afford it, while crypto-lemons cannot. The corresponding dynamics that arise from this will be studied here.

2.2 Why ICO markets?

The recent emergence of ICO market, especially driven by the entry of high amounts of non-expert investors, offers a unique setting to study the evolution of signalling behaviors aimed at dealing with information asymmetries. ICOs constitute an unregulated market and most of the governmental institutions are reluctant to regulate it. While we observed bans from China and South Korea, SEC in U.S.A. only implied potential or partial regulation. Meanwhile, other countries such as Switzerland and Singapore are looking for ways to ride the wave by regulating and motivating ICOs at the same time[10]. This multi-vocal perspective on ICOs by government leaves the responsibility of regulation to the actors in the market, ICO organizers and investors. Hence, we can see the system as self-regulatory and decentralized. "Much of the criminal activity is now being mitigated by self-organized, crowdsourced due diligence in the community, as well as by external parties such as Smith and Crown, a research group focused on cryptofinance, and ICO Rating, a ratings agency that issues independent analytical research on blockchain-based companies" (Kastelein, 2017). It is not possible to talk about a well-established institution that has authority over ICO organizers, which leaves investors without an insurance. Akerlof's licensing practices, for example, would require such an authority or legitimacy. This particular nature of the ICO market leads to observable actions that reveal the evolution of signals. Reliable start-ups engaged in ICOs have to use several signals to distinguish themselves from crypto-lemons. However, as ICO market is only emergent, the signals are not well-established and each signal has to stand the test of sustainable success to become valid.

Before the discussion of signals of reliability, the difference from quality signals should be pointed out. ICOs are one-time events (including the pre-sales), where start-ups raise money for a future project. In some sources, they are considered equivalent to seed stage funding by crowds, meaning the timely distance to final product is remarkable. Hence, the amount of money that is raised is mainly dependent on a future project and nothing tangible in these settings; it is almost as good as gambling on a future success. A similar setting has been also recorded for angel investors by Huang and Pearce (2015). "[Angel investors] participate at the earliest stages of new ventures, just after entrepreneurs' use of personal savings and money from family and friends, when they face decisions with such extreme uncertainty that the risk qualifies as unknowable. Angel investors often make decisions before prototype products have been developed (will it even work?) and for products or services that have no established markets (will anyone use this?)." How can we define quality in such a situation where even the prototype does not exist? I argue that we can not determine the quality of a product (hence the net present value), but we can rely on a group of people that they will eventually work hard and succeed in one way or another. Momtaz (2018) similarly argues that "the quality of the management[11] should have a strong positive effect on the success of ICO projects. [...]theoretical predictions of the effect of a project's vision are ambiguous." Then what is the meaning of the amount of money raised in the ICOs? Are they representative of perceived (future) product quality?

To answer this question, we have to look into the literature concerning ICOs; however as the ICO markets are emerging, there are also limited amount of (pre-)published works and it seems like consensus is not established yet. Conley (2017) says that "the tokens should be worth the present value of the expected fees less the cost of providing services to the platform." On the other hand, Sockin and Xiong (2018) state that "the shareholders who participate in the ICO are also the customers that use the currency to trade goods and services, there is an intimate link between the success of the ICO and the viability of the currency as a medium of exchange." Interestingly, Catalini and Gans (2018) state that "the ICO mechanism allows entrepreneurs to generate buyer competition for the token, which, in turn, reveals consumer value without the entrepreneurs having to know, ex ante, consumer willingness to pay. Interestingly, conditional on successfully raising enough funds to cover development costs, the value of an ICO is independent of the anticipated growth of the platform, and offers higher returns to the entrepreneur than traditional equity financing." We can see that scholars also have diverging opinions

[10]https://www.bitcoinmarketjournal.com/ico-regulations/

[11]Reliability is a more accurate word for the construct of this measurement of quality used in the paper, as it consists of scores on 1) teams with strong and trustworthy members that can show time-commitment and past projects, 2) codebase on various platforms and the commits, 3) community and the consistent information flow, keeping updated with project progress. It is open to debate whether this is management quality or simply signals of it that might be accurate.

about the meaning of the money raised in ICO.

An empirical study by Amsden and Schweizer (2018) defines the ICO success empirically in two ways: 1) Whether the token is traded in an established crypto exchange market (such as coinmarketcap.com) 2) Total amount of money raised at the ICO. Following the work by Ahlers et al. (2015) on crowdfunding, they hypothesize that increasing the venture uncertainty, venture quality, and investor opportunity set leads to decreasing, increasing and increasing ICO success. Some of the constructs that stand out in their significance are communication through Telegram, Number of Tokens Available at ICO, CEO having 500+ LinkedIn connections, Team Size. Similarly, Fisch (2018) measures ICO success as total amount of money raised and confirms positive influence of the number of tokens available. However, he does not find support for number of founders and finds support for number of whitepaper words. An important remark about these works is that Amsden and Schweizer look at a dataset collected from 2015 till 2018, whereas Fisch uses 2016-2017 dataset; both datasets are collected from different sources (with some overlap) and the data sizes are considerably different (1009 vs. 238 respectively).

What these works demonstrate is that the current state of empirical works on ICOs require identification of signals of reliability, their operationalization (as investors would do) and looking for success factors. Based on this observation, I take the opportunity to study the evolution (creation, feedback, adoption/diffusion) of signals of reliability rather than estimating how much influence they have on ICO success. As such, reliability is seen as more fundamental than quality (necessary for quality differentiation), and the reliability differentiation power of signals are under study, not how much the already reliable ICOs will succeed, especially compared to other ICOs. Parallel to this, if we are looking to distinguish crypto-lemons, we have to start from the bottom and see whether the ICOs are worthy to analyze for success after all.

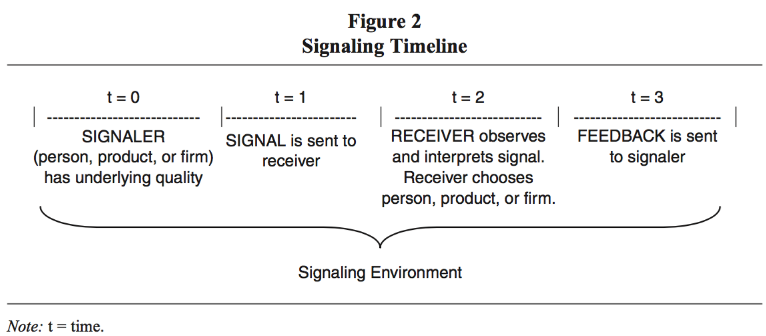

Figure 1: Taken from Connelly (2011)

3 Theory and Hypotheses

A sketch of signalling timeline presented in Connelly et al. (2011) can be found in Figure 1. The usual timeline of signalling starts with the establishment of signaller at t=0. Signaller sends a signal to the receiver at t=1, and receiver processes this signal at t=2. Finally, a feedback (response signal) is sent back to the signaller at t=3. In this work, we can identify the actors on this sketch. First of all, crypto-lemons and reliable ICOs both belong to signallers. The signal (or more accurately the signal set) is sent to the receivers, which are investors. The feedback is the result of the sense-making process found in the investor pool. Hence, any discussion on online forums, news articles and social media decides the type of the feedback. Meanwhile, these all happen in a signalling environment determined by governments. In this work, governments can mainly influence signals and feedbacks. Having assumed that the reactions in (social) media belongs to the sense making process of the crowds, the feedback is measured through the average amount of money raised through ICOs. The statistics on CoinSchedule.com shows that since April 2017 the minimum average frequency of ICOs per day has been 1/3 [ICO/day] and the maximum 3 [ICO/day]. Hence, we can fairly assume that money raised in ICOs measures the investors' opinions almost daily[12]. This work focuses on three temporally longitudinal periods shown in Figure 2, which present the hypothesized signal evolution cycle: 1) Penalty (Feedback), 2) Signal Creation, 3) Signal Adoption/Diffusion.

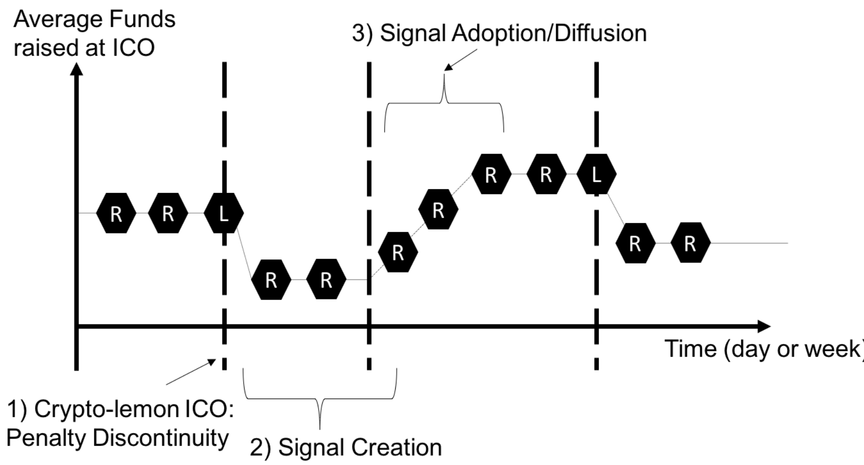

Figure 2: The signal evolution cycle. "R"s present reliable ICOs and "L" present crypto-lemons. The cycle begins with revelation of a crypto-lemon (1). Then the remaining actors create new signals (2). Achieving success, they either diffuse it around or it is simultaneously adopted by the community (3) The success is reinforced by the investors' positive feedback. At a later stage, another crypto-lemon is discovered (1').

3.1 Penalty

If we consider a marginally differentiated emerging ICO market, where the signals are stabilized but not optimal, we would expect that the crypto-lemons are indistinguishable to investors. The crypto-lemons can have enough time to develop work-arounds of the signal costs and appear to be just a normal start-up organizing an ICO. This is the attempt of increasing type I errors committed by investors. Over time the crypto-lemon will be revealed as the fraudulent ICOs cannot be kept hidden (the team disappears, website shuts down and such). This sudden revelation can lead to weakening of the established signals: Every ICO looks the same, yet some of them are fraudulent. To understand the reaction to the revelation of information asymmetries, we can look at the counterpart of risk of being exploited through asymmetry: Trust that the exchange partner will not exploit. Trust underlies all transactions whether economic or not. Granovetter (1985) points out that even when there are hierarchies that can regulate market transactions internally as Williamson (1975) suggests, it is still trust that enables the transactions. The penalty to lack of trust is clearly stated by Guiso et al. (2008) as the following: "In deciding whether to buy stocks, investors factor in the risk of being cheated. The perception of this risk is a function of the objective characteristics of the stocks and the subjective characteristics of the investor. Less trusting individuals are less likely to buy stock and, conditional on buying stock, they will buy less." What is detrimental is that the behavior will persist, which is supported by Guiso et al. (2008). "When mistrust

[12] 2018 statistics show an average frequency of ICOs of 1.86 [ICO/day].

is deeply rooted, people may be doubtful about any information they obtain and disregard it in revising their priors." Hence, we see that the more the individuals are affected, the deeper the mistrust will be and the behavior will be more impactful and persistent. The mistrust is spread to all participants who organize an ICO as everybody shares similar signals. Following this, I hypothesize:

H1a: *After the revelation of a fraudulent ICO (a crypto-lemon), the average total amount raised by ICOs will decrease.*

H1b: *The decrease in the average total amount raised by ICOs will increase as the impact of the fraudulent ICO increases.*

3.2 Signal Creation

The drop in investments is an expected scenario from Akerlof's (1978) model, although through a different mechanism. We can reconcile both view by asserting that when the crypto-lemon is discovered the priors and correspondingly the expectation value are adjusted. The next step following the drop in prices would be that the reliable ICOs do not take place and the start-ups look for an alternative source of funding. However, there are two reasons why this will not happen. First, the start-ups commit to an ICO and get prepared way ahead before the actual ICO date. This requires announcements, technical preparations and intense social media communications. Moreover, it might be that by self-selection the majority of the blockchain based start-ups are those who actually aimed at raising money through ICOs and did not invest in alternatives, which would require networking and such. Given that the reliable ICOs are locked-in to their ICO dates, the revelation of a crypto-lemon is also exogeneous to the corresponding decision process. Hence, the ICOs that are committed long ago stand under the pressure of achieving a successful ICO no matter what. This is the competitive pressure where reliable start-ups try to decrease type II errors.

There are several questions open to the process of signal creation. First of all, how do the start-ups come up with new signals such that they can differentiate themselves from crypto-lemons? Here, I propose two possible mechanisms: 1) The new signal is the outcome of a local innovation process 2) the new signal is the next logical step to adopt. These two mechanisms describe the two extremes and the observations might correspond to a mixture of both. There could be many local innovations that spread out quickly, almost as if simultaneously. The differentiating factor would be the complexity of the new signal. For example, listing team members on a website could be a new signal adopted after crypto-lemons, but this does not require innovation. On the other hand, as Haenni (2017) elaborates, know-your-customer (KYC) due diligence practices are complex and costly; not so easy to adapt to blockchain systems. As such, I hypothesize that:

H2a: *Following a penalty period, the start-ups will create a new form of signal, during which the average total funds raised at ICOs will stay constant.*

H2b: *The length of the signal creation process will be shorter for less complex novel signals.*

3.3 Signal Adoption/Diffusion

Practice and value adoption/diffusion is a well-studied field in sociology and management. While there are many works devoted to these, we can look at several relevant ones here. Regarding diffusion over networks, Davis and Greve (1997) look at how board interlocks and personal networks lead to diffusion of poison pills and golden parachutes as a measure against hostile takeovers. Similarly, Shipilov et al. (2010) study the diffusion of institutional logics of board structure and practices through board interlocks in Canada. On a different note, Fiss and Zajac (2004) describe the adoption of shareholder value orientation among

German firms. Their results support a picture of adoption but they do not find significant network effects in their study. Moreover, the geographic ties that can be established between firms is acknowledged as well. Jaffe et al. (1993) study the geographic localization of knowledge spillovers in R&D data. Sorenson and Stuart (2001) argue that the geographic distance has to be compensated through personal networks, as information flows much more easily from geographically proximate partners. In the case of ICO markets, we encounter all three cases as usual. The networks can be built between ICOs just like the board interlocks: blockchain start-ups can and do have shared advisors as well as shared legal counsels. The advisors, at least, are made as public as possible and their distance from other advisors over social media such as Twitter and LinkedIn can be calculated. For geographic diffusion, there are several emerging locations known as crypto-valleys: Zug in Switzerland and Singapore can be counted as examples.

An important difference from the previous works has to be underlined: In this work, we are looking at practices that are designed by the reliable actors of the network to distinguish themselves from the crypto-lemons. Hence, while there is an extensive study of network diffusion on non-fraudulent practices, the dynamics of networks with crypto-lemon actors may not be comparable with them. First of all, there will be a difference between motivations to adopt new practices between reliable and fraudulent start-ups. The fraudulent start-ups only want to get the money and disappear; hence, in expectation, there will be more crypto-lemons that have less incentives to work harder for a new signal and its adoption. Moreover, mere cost of a new signal could make it impossible for the crypto-lemons to adopt such practices. It must be noted that it is not easy to distinguish, which adoption mechanism is the most prevalent one. For this, I theorize that direct involvement in ICOs or geographic proximity to them will facilitate the adaptation of high-specificity signalling practices as they can be translated to own "organizational language" easier. Adoption, on the other hand, will take place over start-ups that are similar to each other. Hence, I hypothesize:

H3a: The advisor network (through direct ICO participation or social media) or geographical proximity will facilitate the diffusion of signals requiring high-specificity in a start-up.

H3b: Adoption will take place when the new signalling practice is created/adopted by another ICO that has similar structure.

H3c: The fraudulent ICOs (crypto-lemons) will in expectation lag in adopting any novel signalling practice.

3.4 Signalling Environment

As Connelly et al. (2011) suggest, "the signalling environment on the whole is an under-researched aspect of signalling theory." While they refer to Sanders and Boivie (2004) to offer "the institutional environment, the task environment, and the industry competitive environment" as example of environments, I choose the political environment as an influence on signals. Sehra et al. (2017) state that "as the market matures, issuing companies will want to ask themselves upfront how an ICO can be structured to meet the existing regulatory requirements, future-proof the tokens to the extent possible and limit the liability of the issuer of the tokens. [...]Issuers will need to consider upcoming legislation and try and structure for this, which may involve a longer period liaising with regulators in a proactive way to mitigate the chances of an ICO becoming unlawful or needing a radical restructure after issue." Hence, the anticipating and future-looking ICO organizers can differentiate themselves from crypto-lemons by signalling ahead of time that they are legitimate and will not be illegal in any way. Another regulatory practice that the ICOs can and do commit to is "the Howey Test". Coinist.io titled the SEC report requiring this test as "SEC sent shockwaves through ICO world"[13]. Hence, anticipating alignment with future regulations before they

[13] https://www.coinist.io/the-howey-test-the-sec-and-ico/

become enforceable, the ICOs might opt in for some signalling restructuring accordingly. However, this clearly shows the way to restructure and makes it easy for a global adoption of the practice:

H4a: Following announcement of potential future regulation, we will see adoption of some organizational practices as signals of reliability.

H4b: The adoptions will happen slower for crypto-lemons.

H4c: Those ICOs that signal conformation to such future regulations will increase the average total amount of money raised at ICOs.

4 Potential Empirical Model

To test the above presented hypotheses, an extensive database is needed on ICOs, the organizational structures of block-chain based start-ups and media coverages.

Dependent variable: Each main hypothesis (H1, H2, H3, H4) requires the average total amount of money raised at ICOs as a dependent variable, which can be obtained from coinmarketcap.com. For H3 and H4, we require furthermore the dependent variable of novel signal. As we lack longitudinal data on which signals were new at the time and which were not, we have to rely on a proxy measure, identified on media outlets. Articles on ICOs can be traced back to early 2017 and even earlier. The websites that inform investors of what to pay attention for can be used to identify which practices turned out to be successful after a revelation of crypto-lemon. Similarly, the dates of other signals (such as GitHub or Telegram membership identified by Amsden and Schweizer, 2018 and Fisch, 2017) can be traced to the date of the account creation. These two dependent variables will be used to test the hypotheses.

Independent variable: For H1, the independent variable is revelation of fraudulent ICO (crypto-lemon). This can be obtained through news on ICOs, where especially the significant ones are reported along with how much they raised in time. A further source could be elliptic.co[14], a cryptocurrency fraud detection company. For H2, we need the dependent variables of H3 and H4, namely the novel signal. The complexity of such a signal can be measured through its potential cost and specificity. For example, CEO LinkedIn connection number is a high-specific signal that is difficult to attain; hence that would be coded as a high specificity signal. The coding only needs to be ordinal and can be done along the identification of novel signals by separate individuals.

The independent variable for H3 would be geographic proximity calculated through location of start-ups which are disclosed and the advisor networks, which can be built by collecting all advisors of all ICOs. The list of participants in ICOs are presented in ICObench.com[15]. The adoption in previous (or second previous) time step through a tie could be used to assess network diffusion. Similarly, geographic co-location can be either a categorical variable to emphasize location density, or real geographic distance as calculated by Sorenson and Stuart (2001). H3c requires comparison with future events of fraudulent ICOs: When a node in the network adopts a signal late, this node can be flagged as a potential crypto-lemon. Then a collection of revealed future fraudulent ICOs can be checked if this flagged node is in there or not. Finally, for H4, we require media coverage on governmental regulations and their times. Control variables will be chosen as in Amsden and Schweizer (2018) as well as Fisch (2017). As an empirical model, the most suitable methods would be regression discontinuity and event history analysis. The penalty period and beginning of adoption processes require such models.

[14]https://www.elliptic.co

[15]https://icobench.com/people

5 Conclusion and Outlook

In this work, I aimed to investigate a self-regulating decentralized community, which struggles to establish stable signals such that the market is sustained. Akerlof's (1978) lemons may lead to market collapse, and as he suggested a form of insurance or trust is required to sustain markets. In the case of ICO markets, the existence of crypto-lemons necessitate the same conditions, but they are not established by third parties. This necessity leads to coordination of both sides due to lack of centralization and the coordination process is investigated in terms of signalling theory in this work. As such, I aimed at contributing to the literature of signalling theory by offering a theory of signal evolution and an empirical context to test the theory. Moreover, using the signals as diffusive over networks, the work contributes to understanding the unique characteristics of fraudulent networks. Finally, as the ICOs are steadily attracting attention, I contribute to the literature growing on ICOs. So far, a work combining ICO practices and networks have been missing, as well as an approach studying the diffusion of ICO practices, more specifically signals.

Signalling is one of the fundamental mechanisms by which we coordinate, get along, build communities and a society. While signalling can be taken in its purest meaning, for example language would be a set of signals that have well-established meanings after many trials through the history, in an organizational context it plays a crucial role in conveying a message about the unobservables of the focal organization. As the complexity of the world increases, the more we rely on stable meaningful signals. However, in the history we observe not only the struggles to make sense against complexity, but also against misconduct and fraud. In such circumstances, understanding the dynamics of communication and coordination in the presence of fraudulent actors becomes more important. An ironic anecdote from the history can be given: John Law was a British economist in 18th century who proposed a novel banking scheme as well as a study of the role of money scarcity to explain the on-going crisis at the time. He argued that "the notes of the land bank would have other advantages over metallic money in that they would be easier to transport, store, and count, while being equally divisible without loss of value and equally capable of receiving a stamp as metallic money."[16] Fast-forward to what we know today: He was known for creating the Mississippi bubble and was deemed as a fraud, but also as a great economist, who is still influential today. The world has been through a great sense-making process as well as establishing the correct signals to follow and transmit. What would John Law think about the crypto-currencies today?

6 References

- Ahlers, G.K., Cumming, D., Gnther, C. and Schweizer, D., 2015. Signaling in equity crowdfunding.Entrepreneurship Theory and Practice,39(4), pp.955-980.
- Akerlof, G.A., 1978. The market for "lemons": Quality uncertainty and the market mechanism. InUncertainty in Economics(pp. 235-251).
- Amsden, R. and Schweizer, D., 2018. Are Blockchain Crowdsales the New'Gold Rush'? Success Determinants of Initial Coin Offerings.
- Arrow, K.J., 1974.The limits of organization. WW Norton & Company.
- Beckert, J., 2006. 18 Trust and markets.Handbook of trust research, p.318.
- Catalini, C. and Gans, J.S., 2018.Initial coin offerings and the value of crypto tokens(No. w24418). National Bureau of Economic Research.
- Conley, J.P., 2017.Blockchain and the Economics of Crypto-tokens and Initial Coin Offerings(No. 17-00008). Vanderbilt University Department of Economics.
- Connelly, B.L., Certo, S.T., Ireland, R.D. and Reutzel, C.R., 2011. Signaling theory: A review and assessment.Journal of management,37(1), pp.39-67.

[16] https://www.encyclopedia.com/people/history/french-history-biographies/john-law

- Davis, G.F. and Greve, H.R., 1997. Corporate elite networks and governance changes in the 1980s.American journal of sociology,103(1), pp.1-37.
- Fisch, C., 2018. Initial coin offerings (ICOs) to finance new ventures: An exploratory study.
- Fiss, P.C. and Zajac, E.J., 2004. The diffusion of ideas over contested terrain: The (non) adoption of a shareholder value orientation among German firms.Administrative Science Quarterly,49(4), pp.501-534.
- Georgarakos, D. and Pasini, G., 2011. Trust, sociability, and stock market participation.Review of Finance,15(4), pp.693-725.
- Granovetter, M., 1985. Economic action and social structure: The problem of embeddedness.American journal of sociology,91(3), pp.481-510.
- Greve, H.R., Palmer, D. and Pozner, J.E., 2010. Organizations gone wild: The causes, processes, and consequences of organizational misconduct.Academy of Management Annals,4(1), pp.53-107.
- Guiso, L., Sapienza, P. and Zingales, L., 2008. Trusting the stock market.the Journal of Finance,63(6), pp.2557-2600.
- Haenni, R. 2017. Understanding Identity Verification (KYC) for ICO Token Sale, Nov 26. Available at https://blog.datum.org/w datum-requires-identity-verification-for-our-token-sale-159dcfb139d0
- Huang, L. and Pearce, J.L., 2015. Managing the unknowable: The effectiveness of early-stage investor gut feel in entrepreneurial investment decisions.Administrative Science Quarterly,60(4), pp.634-670.
- Jaffe, A.B., Trajtenberg, M. and Henderson, R., 1993. Geographic localization of knowledge spillovers as evidenced by patent citations.the Quarterly journal of Economics,108(3), pp.577-598.
- Johnstone, R.A. and Grafen, A., 1993. Dishonesty and the handicap principle.Animal Behaviour,46(4), pp.759-764.
- Kastelein, R., 2017. What Initial Coin Offerings Are, and Why VC Firms care. Harvard Business Review, March 24. Available at https://hbr.org/2017/03/what-initial-coin-offerings-are-and-why-vc-firms-care
- Knack, S. and Keefer, P., 1997. Does social capital have an economic payoff? A cross-country investigation.The Quarterly journal of economics,112(4), pp.1251-1288.
- Kramer, R.M., 1999. Trust and distrust in organizations: Emerging perspectives, enduring questions.Annual review of psychology,50(1), pp.569-598.
- Lofgren, K.G., Persson, T. and Weibull, J.W., 2002. Markets with asymmetric information: the contributions of George Akerlof, Michael Spence and Joseph Stiglitz.The Scandinavian Journal of Economics,104(2), pp.195-211.
- Momtaz, P.P., 2018. Initial Coin Offerings.
- Palmer, D., 2012.Normal organizational wrongdoing: A critical analysis of theories of misconduct in and by organizations. Oxford University Press on Demand.
- Sanders, W.M. and Boivie, S., 2004. Sorting things out: Valuation of new firms in uncertain markets.Strategic Management Journal,25(2), pp.167-186.
- Sehra, A., Smith, P. and Gomes, P., 2017. Economics of initial coin offerings.Allen & Overy.
- Shipilov, A.V., Greve, H.R. and Rowley, T.J., 2010. When do interlocks matter? Institutional logics and the diffusion of multiple corporate governance practices.Academy of Management Journal,53(4), pp.846-864.
- Sorenson, O. and Stuart, T.E., 2001. Syndication networks and the spatial distribution of venture capital investments.American journal of sociology,106(6), pp.1546-1588.
- Spence, A.M., 1974.Market signaling: Informational transfer in hiring and related screening processes(Vol. 143). Harvard Univ Pr.
- Spence, M., 1978. Job market signaling. InUncertainty in Economics(pp. 281-306).
- Williamson, O.E., 1975. Markets and hierarchies.New York,2630.
- Yenkey, C.B., 2018. Fraud and market participation: social relations as a moderator of organizational misconduct.Administrative Science Quarterly,63(1), pp.43-84.