Governance 2.0: a Hayekian approach to (r)evolutionary self-governance by cryptocurrencies

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I. Introduction

Speaking about governance means speaking about an increasingly used term without a consistent definition. In broad terms, governance is a main concept regarding different forms of political order, either pertaining to government, markets or networks (Heritier 2002). A concept related to governance is self-governance. Until now, self-governance was seen as limited due to the challenge of social diversity. While theory and history prove that self-governance is able to overcome this particular challenge, it is still restricted by the limits of both ex post and ex ante mechanisms. Research shows that self-governance is indeed possible using both ex post and ex ante mechanisms, but is restricted by several severe limits. While ex post mechanisms grounded in the discipline of continuous dealings are already theoretical valid examples, new research about ex ante social-distance reducing signaling creates another valid mechanism as well as new challenges. Social distance-reducing signaling in this old form may just not be a concept which can be applied to the modern world. Yet technology is rapidly developing and makes us re-examine this belief. With the internet as a driving force of change, new applications evolve and disrupt more and more areas of our life, even services traditionally reserved for governments. The idea of Governance 2.0 is born and could provide a solution.

Since 2009, crypto-currencies have been disrupting the current monetary regime of governments. Decentralised, peer-to-peer crypto-currencies like Bitcoin are virtually impossible to regulate or manipulate, yet their capacity as currency is only one, more prominent, part of a greater development. With crypto-currencies comes blockchain technology, a public ledger that records and stores every transaction in the network. For the first time in history it is due to crypto-currencies now possible to determine decentralised, transparent and in a virtually impossible way to manipulate, which one of two transactions passes first. This creates huge opportunities in reinventing many kinds of already centralised systems. It also makes us re-examine the limits of self-governance, particularly those connected to social distance-reducing signaling. Can the blockchain claim to be a solution to overcome the challenge of social diversity by applying social-distance-reducing signaling in a way that is suitable to our century?

My research shows that it is indeed possible to do so. Acting as a decentralised, transparent and non-manipulable intermediary, using competing blockchains already signals credibility and thus reduces social distance. Alongside the possibility of technical self-enforcement of the blockchain and ex post reputation mechanisms, signaling over the blockchain is, consequentially, another mechanism to take into consideration. Concretely, ex ante social-distance-reducing signaling of varying degrees of transparency by different modifications of blockchains connected to different competing crypto-currencies is the additional mechanism that can ensure effective self-governance. So far, discussion about the blockchain has been overwhelmingly technical. My thesis opens up complementary possibilities from a social science perspective without being involved heavily in technical discussions.

Thus, writing about something new like crypto-currencies and their revolutionary implications is politically, socially and academically relevant. Politically it is relevant because possible decentralisation, which is virtually impossible to regulate or ban, may radically change many fields centralised until now, possibly democratising finance and replacing government services. Socially it is relevant because new applications based on crypto-currencies might be a key technology towards more freedom and transparency for those who want it. Finally, academically it is relevant because it is a new and scarcely researched area, especially from a non-technical social science angle. While this causes some limitations in providing compelling academic research papers concerning the blockchain, this thesis is addressing the most recent developments by involving internet sources of both people involved in crypto-currency business and development. It has a unique explorative approach, combining theoretical insights, historical evidence and the description of a new technology while trying to shed new light on a belief which is as yet hardly examined- that is the applicability of ex ante self-governance mechanisms in our 21st century – the evolution of "Governance 2.0".

The methods of my thesis will be theoretical on a threefold base: normative, descriptive and explanatory. It begins with a normative discussion about the applied definition of

self-governance, here understood as “emergent order” rather than something like “self-government” (Part II.1). It is followed by an explanatory discussion about two mechanisms of self-governance, the important distinction between ex ante and ex post self-governance, to prepare explaining the challenge of social diversity. Social diversity has been identified in the literature as the main obstacle to self-governance, but has been disproved by more recent research (Part II.2). A descriptive approach to this research on a historical basis proves how self-governance has already effectively worked out, providing details on the mechanism of social-distance-reducing signaling in practice (Part II.3). After explaining the implications of ex ante self-governance by social-distance reducing signaling, it will discuss its applicability in our modern times, discussing the role of the internet in reducing social distance and some of its problems: centralisation, anonymity and manipulation. It turns out that the new technology of a decentralised, transparent and virtually impossible to manipulate blockchain may be a solution as an effective signaling mechanism (Part II.4).

A detailed descriptive discussion about the blockchain will follow, showing why it can serve as this signaling mechanism and the limitations it faces (Part III.1). Through concepts of social philosopher F.A. Hayek, the blockchain can be investigated from a social science perspective. A short normative discussion will explain three theoretical concepts by Hayek and why they are able to provide insights into the evolution of self-governance, concretely those of “currency competition”, the “nature of knowledge” and “spontaneous order” (Part III.2). Teaming Hayek’s insights with the technological ability of the blockchain will provide an outlook on how competing social-distance reducing signaling blockchains evolve alongside other crypto-currencies bound blockchains and how they ensure effective self-governance (Part III.3). Finally, the conclusion will provide the most significant results of my thesis and discuss its limitations (Part IV).

II. Self-Governance Revisited

II. a. Self-Governance Understood as Emergent Order

Self-governance has, like governance, a variety of meanings which cannot be discussed here in full detail. For example, Héritier (2002) distinguishes the notions of governance via order either by government, markets or networks. Self-governance in this thesis relates mostly to governance via order by markets; the term self-organisation might be more suitable in this regard. Namely, the concept of self-governance is often confused with the concept of self-government. This fails to address the essential concept I want to deal with in my thesis. Self-government as described by Bird (2000: 563) describes very roughly a political community or organisation whose "actions taken or controls imposed by its governing institutions can be thought of as originating from within that community or organisation." Bird identifies three ways in which self-government could take place, each relying on a collective interpretation that there must be someone to govern.

Like most social choice theorists, Bird is influenced by the Impossibility Theorem of Kenneth Arrow (1951 [1963]). It states that no rank-order voting system can be designed that satisfies the three "fairness" criteria of non-dictatorship, unrestricted domain and independence of irrelevant alternatives. Yet the concept of self-governance I want to deal with does not need to take into account Arrow's paradox, because it does not apply methods of voting. It likewise does not need to take into account advanced social choice theories like those of Sen (1970), Gibbard (1973) and Satterthwaite (1975) because this concept of self-governance is not one of collective democracy; it is one of emergent order. This emergent order is best described by social philosopher F.A. Hayek's term "spontaneous order" (Hayek 1973), rather the "result of human action, but not the execution of any human design" as Scottish Enlightenment philosopher Adam Ferguson (1767: 205) stated. It is essentially self-organisation, albeit I will use the term self-governance like other

scholars before me (e.g. Boettke 2003, Leeson 2008). As governance is order (Heritiér002), self-governance is emergent order - an order generated by itself.

Clarifying this, self-governance regarded as emergent order or even anarchy should not be immediately dismissed, as most scholars since Thomas Hobbes' Leviathan (1651 [1996]) did. Shortly after Hobbes, John Locke (1681 [1986]) wrote about its possibility; however he himself preferred a reliable sovereign for reasons of increased effectiveness. Much later, Peter Boettke (2005: 208) argued that research, limited to what he calls analytical anarchism, can provide meaningful insights, because unlike other forms of anarchism, it relies heavily on political and economic theory. In the tradition of Murray Rothbard (1973) and David Friedman (1973), many scholars in political economy have researched self-governance mainly seen as a non-coercive possibility for governance. These scholars argue that a free market is able to provide everything, even governance in terms of security and contract enforcement.

In regard to the overall intention of my thesis, I will limit myself in discussing self-governance seen as contract enforcement. Although still contradicting conventional wisdom, the possibility of self-enforcing contracts is much less controversial than providing security services by market processes. The self-enforcement of contracts is also much more relevant in the light of the new blockchain technology I will discuss later. Basically, enforcing contracts is necessary for efficient exchange and investment in the economy. Contracts can be enforced through different public and private mechanisms. Admittedly, in many developing and transitional countries, public institutions are either absent or ineffective in ensuring contract enforcement. Under such conditions, private enforcement mechanisms may provide a suitable replacement for public enforcement institutions, as a study by Gow et al. (2000: 253) suggests.

Basically, there are three approaches to this type of self-governance: sociological, economic and political (Frye 2000: 17-55). They all see the main challenge in social diversity, which I will discuss in the following chapter. Despite the fact that few people are arguing for effective self-governance, they are relatively prominent. From Alexis de Tocqueville's emphasis on

bottom-up self-order in his famous Democracy in America (1835) and Economic Nobel Laureate Elinor Ostrom (1990/et al.: 1992) to some other scholars (e.g. Friedman 1979, Greif 1989/2002, Ellickson 1991, Bernstein 1992/2001, Benson 1989/1990, Zerbe/Anderson 2001, Landa 1994, Clay 1997, Leeson 2014), all are fairly convinced by the potential of researching the possibilities of self-governance - emergent order able to enforce contracts.

Researching these possibilities also means defining self-governance seen as self-enforcement of contracts. An ethical approach from Peter Leeson (2003: 36) distinguishes between coercive and non-coercive enforcement mechanisms: “Coercive enforcement mechanisms are ones that entail direct punishment of the contract violating party. Direct punishment includes punishments like jail time or fines. Non-coercive enforcement mechanisms also punish the violating party but use indirect means to do so. Ostracism, injured reputation, refusal of future interaction or general boycott [...]” are non-coercive. Unlike the government having a monopoly on physical force, self-governance understood as self-enforcement of contracts does not. Without the monopoly power of physical force, self-governance is restricted to applying non-coercive enforcement mechanisms.

In doing this, self-governance has to overcome a major challenge coming up in the next chapter. Self-governance has to overcome the challenge of social diversity pointed out by social science researchers from different fields. Preparing a solution for this, self-governance must be further distinguished into ex post and ex ante self-governance. After discussing social diversity on a theoretical level, I will provide historical evidence that self-governance indeed might work, although poses new challenges.

II. b The Challenge of Social Diversity and Social-Distance-Reducing Signaling

The main challenge self-governance faces from academic literature of economics, sociology and political science, is its apparent inability to overcome problems of social diversity. Before

addressing this problem, I will briefly point out two notions of self-governance relating to this problem. Self-governance concerning the enforcement of contracts has to be distinguished in both ex ante and ex post self-governance. Academic literature apparently deals mostly with ex post self-governance. Ex post governance is grounded in the discipline of continuous dealings first described by Adam Smith (1776 [1978]). This means that self-governance is only provided after something has happened. Self-governance in this regard can mean ostracism, refusal of future interaction or a boycott, but only after a transaction has taken place. Essentially, ex post self-governance is caused by information asymmetry (Akerlof 1970). Thus, it is also related to the principal-agent model - a concept heavily applied in both political science and economics (Stiglitz 1987).

Conversely, ex ante self-governance provides an effective mechanism before something can happen. Unlike punishing afterwards, ex ante self-governance tries to avoid certain behaviors prior to that. Until recently, ex ante self-governance was almost totally neglected in the academic debate, which provides an opportunity to re-examine conventional paradigms about self-governance yet limited to ex-post self-governance. In this chapter I will extensively rely on the work of political economist Peter T. Leeson (2014) who was one of the first to re-examine the problem of social diversity by discussing the opportunity of ex ante self-governance. Leeson found that social-distance reducing signaling may be a solution to overcome the challenge of social diversity.

Admittedly, first the overall problem of social diversity needs to be explicated. Social diversity deals with the degrees of homogeneity within a society. According to Akerlof (1997), “Social distance is the extent to which individuals share beliefs, customs, practices, appearances, and other characteristics that define their identity” (Leeson 2014: 18). A large number of scholars from a multitude of disciplines (e.g. Friedman 1979, Greif 1989/2002, Ellickson 1991, Berns.tein 1992/2001, Benson 1989/1990, Zerbe/Anderson 2001, Landa 1994, Clay 1997, Leeson 2014) point out that self-governance works within small, homogenous groups where social distance is minimal. Here, ex post self-governance by reputation mechanisms can ensure cooperation.

Take into consideration the following example by Peter T. Leeson (2014: 15f). Leeson distinguishes between bilateral-punishment strategies and multilateral-punishment strategies, leading to either "one man boycotts" or "multi-person boycotts." Logically, multilateral-punishment will be more effective because it punishes uncooperative behavior much more:

> Consider [now] two societies: one populated by highly patient individuals, the other populated by highly impatient ones. Because highly patient individuals discount the earnings from interacting in the future with others minimally, the threat of losing the earnings from interacting in the future with even a single person if they cheat that person today may be enough to lead the former society's members to behave cooperatively. For these individuals, the discounted value of the revenue lost from being unable to interact in the future with just one other person exceeds the one-shot payoff of behaving uncooperatively toward him. Bilateral punishment is fully effective here. (Leeson 2014: 15).

In a society of highly impatient individuals the result is reversed: bilateral punishment is ineffective here as well as 50 percent-encompassing multilateral-punishment. Encompassing punishment in this regard, is understood as all-encompassing punishment, meaning that cheating involves "foregoing the earnings of interacting in future with every person in the population" (Leeson 2014: 18). More encompassing multilateral-punishment, consequentially, would be much more effective. This also applies to a society of persons with different degrees of patience. To be more effective, multilateral-punishment needs to be more encompassing. Leeson (2014: 16f) gives three factors needed for encompassing multilateral-punishment:

> The first important factor is the ease with which information about the history of individuals' conduct – about whether individuals have behaved cooperatively or uncooperatively in the past – reaches their population's other members. Where such information flows with less difficulty, a higher proportion of the population knows who to punish. The second important factor is the extent to which members of the population share ideas about what kinds of behaviors are uncooperative – which kinds constitute

> "cheating" and which don't. Closely related is the extent to which members of the population share ideas about the appropriate way to respond to uncooperative behaviors, namely through the termination of future interaction. Where more of the population's members share these ideas, a higher proportion of them will respond to undesired behaviors with the punishment required to deter uncooperative behavior.

While this is true for small, homogenous populations, large or socially diverse populations have problems with all-encompassing multilateral-punishment, making it ineffective to ensure cooperation (e.g. Greif 1989/2002, Landa 1994, Zerbe/Anderson 2001). This is mainly the case because the reputation mechanism of ex post self-governance is insufficient (Dixit 2003). For instance, speaking different languages makes communication more difficult as does increasing the size of the population to communicate uncooperative behavior. Moreover, socially diverse people may view contractual obligations differently or have other expectations for when to punish uncooperative behavior (Leeson 2014: 17). In addition to these problems, related research concerning ethnic fractionalization highlights the barrier heterogeneity creates in providing public goods (e.g. Cutler et al. 1993, Easterly/Levine 1997, Alesina et al. 1999) and in enabling trust (Alesina/La Ferrara 2002). Furthermore, the already discussed belief that without strong governments, heterogeneous groups will be involved in inevitable eruptions of violence, must be taken into account (e.g. Horowitz 1985; Moynihan 1993; Kaplan 1993).

Hence, research has concluded that effective self-governance is limited to small, socially homogenous societies. However, looking at history defies this research empirically. An interesting observation by Fearon and Laitin (1996: 718) points out that "in most places where ethnic groups intermingle, a well-functioning state and legal system does not exist" while "interaction between social distant persons in these places is common and overwhelmingly peaceful" (Leeson 2014: 17).

It turns out that existing research has concentrated on ex post self-governance, because it has seen no possibility for ex ante self-governance. Research stressing the inability of self-governance for large, socially diverse groups missed out on the possibility of ex ante

self-governance because it has treated “the extent of homogeneity between individuals as exogenously determined and social distance between actors as fixed” (Leeson 2014: 17). Since 1997, however, growing research on identity economics (Akerlof 1997, Akerlof/Kranton 2000) suggests that individuals are able to manipulate their social distance from others. Treating social distance as a variable of choice, which is endogenously determined by individuals themselves, makes ex ante self-governance possible (Leeson 2014: 17). This ex ante self-governance does not rely on ex post reputation mechanisms, but rather includes the mechanism of social-distance-reducing signaling.

In this regard, social-distance-reducing signaling means that “socially distant individuals adopt ‘degrees of homogeneity’ with outsiders they want to trade with. Doing so signals their credibility to one another. The use of social-distance-reducing signals separates cheaters from cooperators ex ante [...]” (Leeson 2014: 17). Together with ex post self-governance by partially encompassing multilateral-punishment mechanisms, this ex ante mechanism ensures cooperation between socially diverse and large populations. Therefore, enforcement of contracts is possible without relying on government control.

Discussing the whole theory behind social-distance-reducing signaling is beyond the scope of this thesis. For the theoretical implications on why social-distance-reducing signaling works in providing ex ante self-governance, see Leeson (2014: 18ff). Other researchers dealing with social-distance-reducing signaling as a means to overcome the challenge of social diversity include Posner (1998/2002), McElreath (et al. 2002) and Bowls and Gintis (2004). For signaling from a game theory perspective, see Spence (1973), Ippolito (1990) or Bacharach/Gambetta (2002).

I will now move on to historical evidence concerning ex ante self-governance by social-distance-reducing signaling, as well as explaining the most important theoretical implications. It turns out that social-distance-reducing signaling was an effective mechanism in providing ex ante self-governance, both in communities of Precolonial Africa and between

traders in Medieval international trade. In the next chapter, I will exclusively focus on how social-distance-reducing signaling has worked in practice in Precolonial Africa and between Medieval international traders. Afterwards, I will briefly point out the implications which result from social-distance-reducing signaling if it is to be applied to our modern world.

II. c. Ex Ante Self-Governance: Precolonial Africa and Medieval International Trade

The examples of self-governance in practice in both Precolonial Africa and Medieval international trade are based on previous multi-disciplinary research. In the case of Precolonial Africa, researchers like Evans-Pritchard (1940), Bohannan (1968), Howell (1968), Colson (1969), Curtin et al. (1995) and Leeson (2005) have studied relations of socially diverse group members without government involved. In the case of Medieval international trade, researchers like Lopez (1976), Trakman (1983), Berman (1983), North, Milgrom and Weingast (1990) and Leeson (2014) have studied the "law merchant", which enforced trade between socially diverse people despite the lack of governmental enforcement. Each example shows how social-distance-reducing signaling has worked in practice. It thus has provided effective ex ante self-governance.

Beginning with Precolonial Africa, "members of different social groups invested in the customs and practices of outsiders with whom they wanted to exchange, signaling their credibility by reducing their social distance. Three potential dimensions of homogeneity that Precolonial Africans used for this purpose proved particularly important: relationships to authority, land practices, and religious practice/association" writes Peter Leeson (2014: 25).

Authorities in Precolonial Africa were mostly village elders who established rules and resolved disputes They also acted as "gatekeepers, requesting gifts from individuals as a sign of good faith to access their communities" (Leeson 2014: 25). Failing to comply could cause formal punishment like imprisonment, but was mostly limited to informal ostracism. Howell (1968:

192) writes that if an individual “chose to ignore a ruling given by the chief, he could do so with impunity; but if public opinion was behind the chief’s decision, he might lose the privileges of membership in that community.”

While communities themselves were highly homogenous, the social distance between them was considerable. Thus, following a particular informal leader defined one’s identity. Submitting to the authority of an informal leader or gift giving is applied social-distance-reducing signaling. It reduces the social distance between outsiders and members of the particular community. Both practices are linked to costs as Leeson (2014: 26) notes: “Adopting the practice of gift giving involved investing tangible resources – the gift – to reduce social distance with the community an outsider desired to interact with. Submitting to the headman's social rules and authority involved investing intangible resources – placing one in a vulnerable position vis-à-vis an unknown community leader – to achieve the same purpose.” Uncooperative behavior after investing in gifts or the leader’s favour made rejection possible. Hence, outsiders showed their willingness to be honest by social-distance reducing signaling, because “the one-time payoff of cheating was smaller than the value of the gift the outsider was required to give in the gift-giving case, or the cost of potentially unfavorable decisions in the submitting-to-authority case” (Leeson 2014: 26).

Concerning property, Precolonial African tribes had some control about who could use the land they occupied and how. The costly character of social-distance-reducing signaling appears here as well. As mystical regarded land was controlled by Earth Priests who established different customs and taboos, besides giving gifts to these Earth Priests, outsiders tried to reduce their social distance by subjecting to their taboos: “For example, one of the Earth Priest's taboos might be a prohibition on cultivating the more fertile land in the area because of its sacred status. Alternatively, if he wanted to join a land-using community, an outsider might have to accept the Earth Priest's decision that directed him to work a less productive plot of land on the grounds that he was a newcomer, or because the more productive land was already in use” (Leeson 2014: 27). Thus, only a long-term investment to cooperate made sense for outsiders. By adopting a

community's ritual land customs and taboos, outsiders signaled their credibility and reduced social-distance.

Another costly way for outsiders to reduce their social distance was adopting religious beliefs and participating in the religious practices of another community, if not converting fully to their religion. As Colson (1969: 59) notes: "Cult membership was open to any who wished to join and agreed to adopt the customs and practices of the society." Leeson (2014: 28) concludes:

> [...] Religious adoption was costly to outsiders, and more so for impatient outsiders than for patient ones. If a membership fee was required to join the society, this cost was partly financial. Even when it wasn't, outsiders who participated in or converted to these quasi-religious associations had to adopt costly customs that could include surrendering their goods to spirits, submission to potentially costly procedures for conflict resolution, restrictions on behavior such as diet, and the recurrent investment of their time in society-related activities.

Leeson continues, discussing impatient individuals who would not profit by cheating. However, "for patient outsiders things were different. Because their honest conduct ensured they would remain in the community long enough to recover the investment cost of engaging in the community's religious practices, they willingly did so. By sorting outsiders according to their willingness to make costly religious investments ex ante, Precolonial Africans selected outsiders they could cooperate with, facilitating intergroup trade" (Leeson 2014: 29).

Costly social-distance-reducing signaling was also used in Medieval international trade in Europe. Under the law merchant, a polycentric system of polycentric law, trade could flourish in socially diverse populations without government. Based on documents collected and translated by Lopez and Raymond (1990), I will show how this worked in practice. Coming back to the results of the former chapter, ex post self-governance by reputation mechanisms indeed played an important role, but often was only partially encompassing. Thus traders had to supplement ex post self-governance with ex ante self-governance by social-distance-reducing signaling (Leeson 2014: 30). These mechanisms to reduce social distance worked similarly to those in Precolonial

Africa. As Lopez and Raymond (1990: 418) note, according to a Neapolitan merchant, "Merchants must not have the fierce manners of husky men-at-arms, nor must they have the soft manners of jesters and comedians, but they must be serious in speaking, walking, and in all actions." Instead of submitting themselves to authorities or being involved in gift-giving like in Precolonial Africa, the signal of credibility here is the dimension of "manners". As a further example, see the advice of a Fiorentinan merchant who advised wearing modest colors, being humble and being dull in appearance if travelling to England in the fourteenth century (Lopez/Raymond 1990: 423). Most entertaining, admittedly, is the advice for Westerners willing to trade with the Chinese: "First, it is advisable for him to let his beard grow long and not shave. And at Tana he should furnish himself with dragomans…And besides dragomans he ought to take along at least two good manservants who know the Cumanic tongue well. And if the merchant wishes to take along from Tana any woman with him…he will be regarded as a man of higher condition than if he does not take one" (Lopez and Raymond 1990: 356f). Like in Precolonial Africa, adopting religious beliefs and practices was a further signal of trust (Lopez/Raymond 1990: 423), (Berman 1983: 342). Similarly, traders submitted themselves to the customary law of the law merchant. For example, they voluntarily agreed on witnesses to contract (North 1990: 121), standardised weights and measures (Lopez and Raymond 1990: 147ff) or membership in transnational guilds (Berman 1983: 342).

All in all, social-distance-reducing signaling provides in both examples, Precolonial Africa and Medieval International Trade, a re-examination of a widely believed paradigm. Unlike many scholars (e.g. Greif 1989/2002, Landa 1994, Zerbe/Anderson 2001) arguing that self-governance is limited to small, homogenous groups, it indeed could work in large, socially diverse populations. Researchers have yet to overcome the belief that self-governance is limited to ex post self-governance provided by reputation mechanisms. As I showed in this chapter, self-governance is improved by ex ante self-governance via social-distance-reducing signaling. In the next chapter, I will briefly state which implications this insight has.

II. d. Implications of Social Distance Reducing Signaling and a Solution

In this chapter I will conclude the previous research and state the implications on which I will then build part three of my thesis. So far I have shown that self-governance is indeed possible not only in small, homogenous communities. Most previous research is wrong that large, socially diverse populations are unable to exercise self-governance. They indeed can if adopting means of ex ante self-governance - social-distance-reducing signaling. However, unlike ex post self-governance by reputation mechanisms, social-distance-reducing signaling is costly. One might, of course, argue that ex post self-governance is costly as well, as it provides only governance after theoretical costs for some have emerged. This is exactly the reason why both mechanisms should not be treated as detached but rather are unified. Most effective self-governance is reached through a combination of both ex ante and ex post self-governance by means of either social-distance-reducing signaling or reputation mechanisms. As Leeson (2014: 31) puts it: "Social-distance-reducing signaling is itself but one, supplementary mechanism of self-governance that facilitates intergroup cooperation without government. [...] Signaling should not be seen as panacea for overcoming the problems of intergroup cooperation without government. But it should open our minds to the possibility of a variety of mechanisms that serve this purpose."

Costliness is a problem for social-distance-reducing signaling if the concept is to be applied to modern times. Although costs involve a great deal of the actual signaling (Smith et al 2001), are they really necessary? Does everyone first have to invest a lot of time and work, giving gifts, subjecting to authorities or adopt other religions? Or is there another way signaling could work to reduce social distance?

The answer might be yes. Technology has developed tremendously since the times of Precolonial Africa and Medieval international trade. Along with this come new opportunities to reduce social-distance. Certainly, the internet is one of those technologies which reduces social-distance between large, socially diverse populations. The internet enables people to connect with

everyone on a global scale. Ex post reputation mechanisms are found to a great extent anyplace where things can be bought. Reviews and comments are a good way to identify the strengths and weaknesses of a product. However - and this is the problem with the internet - it is centralised, hypothetically anonymous and easily manipulated. On the one hand, reputation can be obtained by fraud and deceiving trusting customers. Its hypothetical anonymity creates a wide range of abusive purposes possible as well, from terrorism to cybercrimes. On the other hand, its centralisation, depending on server providers, makes it increasingly prone to control through secret services and governmental monitoring of innocent citizens. If one follows contemporary media, both are regarded as problems; however no solution is proposed which could improve the internet's advantages as well as remove its problems. This thesis cannot discuss these common problems in more detail, but there is a great deal of research concerning each problem. Considering centralisation as a problem of the internet may seem counterintuitive, as the internet is widely regarded as decentralised. However, centralisation in this regard means the inevitable influence governments and their secret services can have in monitoring the internet by controlling and regulating providers (e.g. Dai 2000: 190, Brady 2003: 44, Knahl/Cox 2008: 330). Nevertheless, problems with anonymity (e.g. Kling et al 1990: 79, Margetts 2009: 1, Stieglitz 2011: 1395) and manipulation (e.g. Simpson 2007: 115, Bose et al 2012: 674, Ben-Ner/Putterman 2003) still remain despite all possible controls.

Luckily, technology is still advancing rapidly. Since 2009, crypto-currencies, headed by Bitcoin, have been gaining increasing popularity. Even more important than its potential as currency is its technology. The blockchain, a decentralised public ledger, stores every transaction publicly and is non-manipulable. Moreover, the blockchain mechanism makes it possible to rebuild essentially all systems that are still centralised, the internet included. Could a decentralised, public and virtually impossible to manipulate internet greatly improve transactions between individuals? It indeed might, but this will not be the point here. This thesis will only deal briefly with the possibilities of the blockchain technically enforcing contracts - a possibility first coined as "smart contracts" by Nick Szabo (2005). From a social science view, it should be argued that social-distance-reducing signaling over the blockchain serves as yet another, until now,

overlooked mechanism which can be applied complementarily to technical self-enforcement. As technical self-enforcement has its own challenges, such a complementary mechanism might improve self-governance by the blockchain even more.

In the following chapter of my thesis, I will shed light on the emerging blockchain technology and crypto-currencies. I will then analyse its developments with concepts by social philosopher F.A. Hayek. Teaming his theories with blockchain technology, I will show that self-governance over the blockchain could indeed work. While technical self-enforcing mechanisms of blockchain applications are promising, they are still under development and may come with problems. I will show that signaling degrees of transparency over the blockchain can complementarily add an additional layer of effective self-governance, albeit possibly restricted in its use. Concepts by F.A. Hayek on framing emergent order self-governance will help to prospect the evolution this might possibly take.

III. Governance 2.0 meets F.A, Hayek: The Blockchain as a Solution for Self-Governance?

III. a. The Blockchain and its Implications

Since 2009, crypto-currencies have gained widespread popularity, although their user base is still limited. Created by the still anonymous Satoshi Nakamoto in January 2009, Bitcoin evolved to a digital currency with a steadily growing user base. Despite still being subjected to heavy volatility, Bitcoin is increasingly coming into the focus of venture capitalists (Rizzo/Southurst 2014). Most of them, though, are more interested in the technology behind Bitcoin than its function as a digital currency, due to an innovation called “blockchain” (Frisby 2014). The blockchain and its connection to Bitcoin is best described by Ethereum’s - another crypto-currency - founder Vitalik Buterin (2014a: 1):

> "Bitcoin as an application can be described as a first-to-file system: if one entity has 50 BTC, and simultaneously sends the same 50 BTC to A and to B, only the transaction that gets confirmed first will process. There is no intrinsic way of determining from two transactions which came earlier, and for decades this stymied the development of decentralized digital currency. Satoshi's blockchain was the first credible decentralized solution. And now, attention is rapidly starting to shift toward this second part of Bitcoin's technology, and how the blockchain concept can be used for more than just money."

As this thesis deals with the Bitcoin blockchain from a purely social science angle, technical details will only be briefly discussed below if they relate to concrete challenges of blockchain signaling. Next to Bitcoins' Whitepaper - its founding document which basically presents the idea (Nakamoto 2009), see for instance Brito/Castillo (2013), Barber (et al 2012) or Ron/Shamir (2013) for a critical examination of the Bitcoin blockchain. It should be noted, that the blockchain is neither a technology solely behind Bitcoin nor behind every crypto-currency - it is limited to both so-called proof-of-work and proof-of-stake crypto-currencies. These are necessarily, although not exclusively, decentralised peer-to-peer applications - unlike other centralised digital currencies which also want to profit from increasing popularity and acceptance. A good distinction between centralised and decentralised digital currencies that is needed for further progress in this thesis is provided by a report by the Financial Action Task Force 2014: 5): "Centralised Virtual Currencies have a single administrating authority (administrator)—i.e., a third party that controls the system. An administrator issues the currency; establishes the rules for its use; maintains a central payment ledger; and has authority to redeem the currency (withdraw it from circulation). [...]. Examples: E-gold (defunct); Liberty Reserve dollars/euros (defunct); Second Life 'Linden dollars'; PerfectMoney; WebMoney 'WM units'; and World of Warcraft gold." In contrast, "Decentralised Virtual Currencies (a.k.a. crypto-currencies) are distributed, open-source, math-based peer-to-peer virtual currencies that have no central administrating authority, and no central monitoring or oversight. Examples: Bitcoin; LiteCoin; and Ripple" (Financial Action Task Force 2014: 5).

I will concentrate on Bitcoin when speaking of the blockchain, because other decentralised crypto-currencies similar to Bitcoin lack its user base, market capitalisation and applicability up to now. Nevertheless, promising recent projects like Ethereum (Buterin 2014a), Mastercoin (Willet et al 2014), Colored Coins (Assia et al 2014) or BitNation (Tarkowski-Tempelhof 2014) may become serious opponents in the future or provide additional possibilities for Bitcoin and its blockchain. While Ethereum and BitNation provide a completely standalone platform, Mastercoin or Colored Coins are developed to improve either Bitcoin as a currency or the blockchain - they are grounded in Bitcoin Maximalism (Buterin 2014b). Apart from those developments, other interests want to have truly anonymous, decentralised crypto-currencies without the blockchain, like what is currently provided by Anoncoin or Darkcoin (Greenberg 2014).

While this thesis discusses self-governance possibilities over the blockchain from a purely social science perspective, the blockchain also has technical possibilities of self-enforcing contracts. In particular, both Ethereum and BitNation are currently being developed to modify the blockchain's capability in providing contract enforcement. While BitNation focuses on replacing traditional governance services (Tarkowski-Tempelhof 2014: 12), Ethereum (Buterin 2014a: 12) will provide a Turing-complete crypto-currency called Ether, implying that everyone is fully able to code applications on it – something that is not possible on the Bitcoin blockchain to date. This means, for example, that ex post self-governance mechanisms like identity and reputation mechanisms can be easily implemented (Buterin 2014a: 22). Currently existing crypto-currencies like Namecoin already provide some of these services, for example censor-free domain registration (Namecoin 2014). As of now, the crypto-currency "Burst" is the first example of making smart contracts a reality (Maina 2015).

Having sufficiently described the relevant key characteristics of emerging crypto-currencies like Bitcoin, I will now shift my attention to the concrete implications of signaling over the blockchain. In the previous chapter, I concluded that signaling over the internet is severely

restricted by problems of centralisation, anonymity and manipulation. How could the blockchain overcome these problems?

As previously described, there is no “the” blockchain, but many blockchains, as there are not only one, but rather many competing crypto-currencies. The most prominent blockchain is the blockchain of Bitcoin. It serves as a public ledger which stores all information about past transactions. The Bitcoin blockchain (2015) in its current modification shows as main features the public keys of the transactors, the time of the transaction, the location of the transactors by country, the amount of Bitcoin traded, the number of all previous transactions, the total value of Bitcoin received and the current account balance. Value can be denoted in both the number of Bitcoins and their value to current chart prices in diverse currencies. The also blockchain indicates things like the transaction size, fees paid to the Bitcoin miners or the website from which a transaction comes. Among special search futures and several statistics it is also possible to follow all Bitcoin transactions in real time. However, how does the blockchain solve the problems of centralisation, anonymity and manipulation which are currently experienced by the internet? And what are the blockchain’s own limitations?

Centralisation and manipulation, actually, are a combined problem. Where something is centralised, there is some authority involved which can manipulate itself or get manipulated. Crypto-currencies are decentralised peer-to-peer networks. There is no single point of access to manipulate the blockchain itself. There is some danger, but it is restricted. The main danger lies in the fact that the use of Bitcoin or other crypto-currencies is in turn centralised on the user or applications (Bitcoin Wiki 2015a). If there is loss of access to a wallet, very weak passwords, leaking of information or badly secured servers, hackers might be able to steal crypto-currencies. This happened, for example, in the infamous case of the Bitcoin Exchange MtGox, where hackers stole an amount of 750.000 Bitcoin totaling to 575 million US dollars in February 2014 (Campbell 2014). The failure of MtGox - not the only exchange affected - nevertheless is not a failure of crypto-currencies, but a failure of applications built on them. Examples of unhacked exchanges and the increasing encryption of wallets prove this.

The only dangers to manipulating decentralised crypto-currencies themselves are bound to both Denial of Service (DoS) and Sybil attacks and a more than 50-percent-attack, albeit limited in their scope (Bitcoin Wiki 2015a). Denial of Service attacks, similar to their internet counterparts, send large amounts of data to a node to make it too busy to process normal Bitcoin transactions. Bitcoin itself has several built-in protections to make this difficult. Among many technical features, the existence of transaction fees make long lasting attacks improbable; indeed there has not been one yet. The only significant consequence would be a rise in still minimal transactions fees. Sybil attacks, on the other hand, mean that an attacker fills the networks with clients controlled by him, making it likely to connect only to attacker nodes. This could mean a stop in transactions as the main danger (Bitcoin Wiki 2015a). The worst implications for Bitcoin would have a "more than 50-percent attack", meaning that someone with superior computer power able to control more than the half of the network hashrate could exclude and modify transactions. This would enable the attacker to reverse transactions while he is in control, prevent some or all transactions from gaining confirmations and prevent some or all miners to mine new Bitcoins. However, it could not reverse other people's transactions, prevent transactions from being sent at all, change the number of coins generated per block, create coins from nothing or send coins which do not belong to the attacker. With less computing power, similar attacks are possible, but decrease from a 100% success rate. That said, it is unlikely someone will attempt an attack. Although a big pools of miners already reached 50% on June 13, 2014 (Gill 2014), there is no incentive to try, as Bitcoin journalist Daniel Cawrey (2014) writes: "In theory, one might be able to affect the next block or two, launching a double-spending attack by holding on to enough power to confirm the majority of transactions. However, this would take a huge amount of expense and effort [...]. Worse, such an attack could possibly destroy the integrity of the system as a whole, causing the price to crash. This is not something anyone with a vested interest in Bitcoin would want – especially miners, whose profits depend largely on the price of Bitcoin being high. Hence, there is no real incentive to attack the network." Consequently, manipulation on the Bitcoin network is highly unlikely and in its scope massively restricted when compared to the internet. The only future problem one could imagine is breaking the cryptographic-protocols

behind Bitcoin as computation power grows exponentially. However a shift to stronger algorithms, which equally improve themselves, would not be a problem to implement into Bitcoin (Bitcoin Wiki 2014).

Decentralisation shows itself best in the fact that the Bitcoin code is open-source to everyone. This means that any bugs or gateways in the code can be strongly excluded after five years of existence, because everyone is able to access and validate it. Decentralisation also marks the peer-to-peer nature of the Bitcoin network, which enables no single point of entry for control or monitoring by government services, although tracing individuals is not excluded. Like they do with internet providers, governments can only regulate providers of Bitcoin applications. That said, crypto-currencies do not even need a working internet connection; the blockchain could possibly be operated by radio waves as shown by a successful transaction in Finland (Bradbury 2014). Decentralised DNS-independent domain registration provided by the crypto-currency Namecoin (Gilson 2013) additionally makes censorship impossible. Hence, decentralisation makes Bitcoin itself virtually impossible to regulate or ban. Even attempts of manipulation as previously discussed would only harm Bitcoin, not crypto-currencies themselves. Users could just adapt to another crypto-currency providing the same or a better code, one which might be even harder to control. Still, for governments there exist several reasons to try to regulate Bitcoin by regulating its eco-system, mostly for companies building applications for it. Summarised by Filipi de Primavera (2014: 4f) these reasons might be: illegal activities like online gambling, black markets for drugs, weapons and more, money laundering, fraud, jeopardy of economic and financial policies, consumer protection, currency monopoly and tax evasion. However as Andreoulaki (et al 2013) notes, the transparency of the blockchain makes some of these points less appealing. For further research on Bitcoin regulation see for instance Brito & Castillo (2013), Kleiman (2013), Twomey (2013) or Stokes (2012) arguing for, and Kaplanov (2012) arguing against regulation.

The nature of the transparency of the blockchain brings us to consider anonymity finally. Although the word “crypto” implies this, not all crypto-currencies are anonymous. Bitcoin and

its blockchain can be merely regarded as pseudonymous. As described above, the blockchain stores some kind of information about past transactions publicly. What it does not store is the exact name of each user - it only stores their public key address consisting of a long row of letters and numbers. Public keys are automatically generated by creating new wallets to store Bitcoins. As everyone may open as many wallets as they like and transactions between wallets have only a minimal fee, sending Bitcoins between different wallets further enables the user to diversify his pseudonymity. The danger of getting discovered is based on the responsibility of the user. If a user publicly shares his key address or someone is able to copy it in some way, all transactions by a user might be traced back. Users in the Bitcoin network can protect themselves significantly by using external mixing or Ewallet-services (Bitcoin Wiki 2015b).
However, the question concerning anonymity might be re-answered. Although Bitcoin might be less anonymous than the internet, other crypto-currencies will not be. Even Bitcoin can alter its code to implement more anonymity by reducing the information stored on the blockchain. Certain different crypto-currencies like Darkcoin do not have a public blockchain at all (Greenberg 2014). On the other hand, it would also be possible to make the blockchain even less anonymous. For example, the crypto-currency Namecoin, similar to Bitcoin in its specifications, offers the ability to store data within its blockchain (Namecoin 2015). This concludes that the blockchain might be generally able to solve the problems of centralisation, manipulation and anonymity experienced by the internet. Building on the blockchain, even a new decentralised, non-manipulable and anonymous internet could be created. Projects like the SuperNet or MaidSafe are beginning to do exactly this (Isgur 2014).

Admittedly, to come back to the overall aim of this thesis, what are the implications for signaling and self-governance? The more anonymous a blockchain is, the less probable signaling would be. Doing this in reverse could, however, greatly enhance transparency; there might even be a blockchain originated which is able to implement full transparency. In such a blockchain, signaling would be easier. Moreover, and this is the most important point, by agreeing to participate in one transparent or several blockchains with varying transparency, every user signals his credibility in varying degrees. By committing to varying degrees of transparency,

users are able to signal that they are trustworthy. Users who commit to full transparency are probably much more credible than users who commit to less transparency. This powerful signaling can indeed reduce social-distance and enable self-governance in our modern times, improving already existing self-enforcing contracts which could be built on top of each blockchain. Moreover, as there is no coercion involved, entering into various states of transparency to transact with others is voluntary. People choosing to voluntarily commit to transparency show their willingness to commit to effective self-governance by signaling ex ante. Although limited by the number of users who commit to such self-governance, it could provide self-governance to those who want it.

Grasping the implications of this idea is not easy. While I already discussed some technical challenges of the blockchain, I have not dealt with the political and economic concepts behind crypto-currencies and the blockchain. The implications of self-governance by signaling transparency over the blockchain could probably be best described by theories taking into account decentralisation. For this reason, I will turn towards economist and social philosopher F.A. Hayek. Three of his theoretical concepts - currency competition, nature of knowledge and spontaneous order - provide a lens to understand the possible evolution of blockchains in providing self-governance by signaling transparency. In the following chapter, I will briefly discuss these concepts from a normative perspective and clarify why I have chosen them. Finally, I will team his theory with blockchain technology to provide an outlook on how these theoretical ideas might turn out in practice.

III. b. F.A. Hayek and Three Concepts Explaining Blockchain Signaling

Discussing blockchain signaling as part of self-governance makes us re-examine the nature of self-governance itself. As shown in the first chapter of this thesis, I have dealt with the term self-governance understood as emergent order. It suggests that theories dealing with the

applicability of the blockchain in practice need to take into account this concept of emergent order. For this reason, I have chosen economist and social philosopher F.A. Hayek. I have three reasons for approaching blockchain signaling self-governance with Hayekian idea. First of all, the multi- and interdisciplinary research connected to signaling over the blockchain needs a scholar who takes into account this multitude of aspects in his own work. Hayek, extensively dealing with economics, law, politics, history and philosophy throughout his life, comes close to this. As Fleetwood (1995: 144) puts it: "Hayek's developed multidisciplinary social science can go into areas that others [...] cannot go". Secondly, Hayek's ideas are already interconnected with the idea of Bitcoin - most famously through his book "The Denationalisation of Money" (Hayek 1976). Hayek's idea, further developed by scholars of the Austrian School of Economics, is credited for providing the theoretical roots of Bitcoin, an ECB study suggests (Matonis 2012). Thirdly and most importantly, Hayek was dealing with self-governance and understood emergent order throughout much of his academic career. The emergent order he explicates is known as "spontaneous order" (1973) or "extended order" (Hayek 1988), but is traceable back to Hayek's essay "Economics and Knowledge" in 1937 [1948]. He is most likely influenced by the work of Scottish moral philosophers Adam Smith (1776 [1978]) and Adam Ferguson (1776), both already grasping the idea although not calling it spontaneous order.

Consequentially, analysing the emergent order of self-governance made possible by blockchain signaling means taking into account the Hayekian concept of "spontaneous order". Linked to his concept of "spontaneous order" are the concepts of "currency competition" (Hayek 1978) and the "nature of knowledge" (Hayek 1945). The concept of currency competition enables us to grasp the implications of the free market competition between crypto-currencies, because they are virtually impossible to be regulated themselves. As every blockchain is necessarily connected to some kind of crypto-currency, understanding competition between crypto-currencies also means understanding the possible outcome of self-governance by signaling. On the other hand, the concept of the implicit "nature of knowledge" (Hayek 1945) enables us to further grasp the implications of signaling itself. Signaling is essentially an action where new knowledge is discovered and communicated to other people in a competitive environment. If the environment

is not competitive, there is no reason to signal credibility before a transaction takes place; a transaction can just be executed. The blockchain as a transparent ledger might improve knowledge transmission and thus provide more effective self-governance. Further research might even examine the question of if the blockchain can be a solution to overcome the economic problems of "price rigidity" and "sticky wages" – a concept I cannot deal with in the limited scope of this thesis. In the final chapter I will team theory and technology, discussing the implications of blockchain signaling for self-governance from a Hayekian viewpoint, facilitating his concepts of spontaneous order, currency competition and the nature of knowledge.

III. c. Teaming Theory and Technology

Before teaming Hayek's theory with blockchain technology, I will briefly re-consider the three factors of encompassing multilateral-punishment discussed by Leeson (2014: 18f). They must be taken into account by a blockchain providing self-governance by signaling transparency. Leeson mentions the "ease with which information about the history of individual's conduct [...] reaches their population's other members", "the extent to which members of the population share ideas about what kinds of behavior are uncooperative" and "the extent to which members of the population share ideas about the appropriate way to respond to uncooperative behaviors" (Leeson 2014: 16). Below, I will further outline each concept and bring it in relation to Hayek's three concepts and blockchain technology.

The ease of information transmission is undoubtedly given by the blockchain. People just need to visit the public ledger of the blockchain to find out about the history of one's individual conduct; or better, they visit those blockchains with the same degree of transparency they expect of other individuals if they would like to have a transaction. The Hayekian concept of currency competition provides an idea of how this could work in practice. Hayek (1978: 106f) was

convinced that “competition would provide better money than would government.” His concept of currency competition is essentially the concept of free-market money, an environment crypto-currencies themselves potentially have as they are virtually impossible to regulate or manipulate. Hayek regards the transition as a main problem towards this free market money (Hayek 1978: 117) and identifies two main challenges applicable to crypto-currencies. The first challenge would be to prevent rapid depreciation of formerly exclusive currency (Hayek 1978: 117f). Crypto-currencies solve this challenge by evolving complementary to government money. A naturally occurring decepriation of state-issued currency would only incentivize crypto-currency growth. For example, the decline of the Russian Ruble led to huge interest in Bitcoin (Clinch 2014). Additionally, crypto-currencies do not trigger depreciations yet, although this might change with a bigger user base in the future. This also makes the second challenge of gradual introduction of new currencies obsolete, Hayek (1978: 118) fears. Crypto-currencies are each free to flow on a global scale and people can voluntarily opt to use them. This means that, in theory, the best currency wins. As crypto-currencies are by far not limited to their function as currency, there would be no single crypto-currency to win a monopoly. Even if this happens in a hypothetical case, the decentralised nature of a crypto-currency makes it impossible to exploit is monopoly. Instead, different crypto-currencies with different blockchain modifications or without a blockchain at all will complementarily exist with each other and state-issued currencies. As Hayek (1978: 127) notes, “good money can only come from self-interest, not from benevolence.” In this regard, new crypto-currencies will come on this virtually free market if there is a need for them. Consequently, if there is a need for self-governance, blockchains, allowing for signaling varying degrees of transparency, could evolve.

Different blockchain modifications have different outcomes in terms of ease of information transmission. Depending on the technical specification of each blockchain, signaling mechanisms would be different. To understand this, we can take into account Hayek’s concept of the “nature of knowledge” (Hayek 1945). For Hayek, knowledge only exists “solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess” (Hayek 1945: 3). Hence, the main challenge for a society “is a problem of

the utilisation of knowledge which is not given to anyone in its totality" (Hayek 1945: 3). The blockchain could possibly facilitate this utilisation of knowledge, providing socially distant persons with information about each other that they previously did not have. This information cannot be deceived as shown before. Additionally, the more transparent one is when providing his information on different blockchains with different degrees of transparency, the more credibility he has. For Hayek, the main question of economic order is not the existence of planning, but that of "who" does it - dispersed individuals or a central planner (Hayek 1945: 6). In this regard, the blockchain may be also described as a "planning mechanism." While it improves information transmission between individuals, its decentralised nature does not make it prone to the "pretence of knowledge," as coined by F.A. Hayek in his Nobel Memorial Lecture in 1974. In short, blockchains improve the transmission of knowledge. The main challenge for signaling - the ease of information transmission - is facilitated by the blockchain to varying degrees. As described above, some crypto-currencies would have no or strongly anonymous blockchains. They could be used for a whole range of activities, but would be limited to ensure self-governance by signaling transparency. An increasing transparency enables each blockchain to transmit information between socially distant individuals with growing effectiveness.

Consequently, a spontaneous order evolves because competition drives the signaling of knowledge, leading to effective self-governance. Self-governance can evolve, but only if people express their need for it. However, if it were not voluntary, it would not be self-governance. All opportunities of self-governance can only exist if people want to act on them. It is an emergent order - emerging of voluntary decisions of individuals. As Hayek (1973: 39): puts it: "Since a spontaneous order results from the individual elements adapting themselves to circumstances which directly affect only some of them, and which in their totality need not be known to anyone, it may extend to circumstances so complex that no mind can comprehend them all."

Concerning the challenge of both the "extent to which members of the population share ideas about what kinds of behavior are uncooperative" and "how to appropriately respond to them" (Leeson 2014: 16), the Hayekian concepts apply similarly. Firstly, individuals utilising the

blockchain as a tool for self-governance will be likely to share similar values, making it easier to have same ideas about uncooperative behavior. However, signaling transparency over the blockchain makes this challenge redundant. Because uncooperative behavior is likely to appear in a transparent blockchain, most people will not opt for it. The less transparent a blockchain is, the more likely it is for uncooperative behavior to be a gain for one individual. However, by only utilising less transparent blockchains, the individual signals that there must be a reason why he does not transact with a more transparent blockchain. This signals that he might be less credible. Combining this with the evolution of technical self-enforcement of blockchain applications, uncooperative behavior already restricted by smart contracts and ex post reputation mechanisms would be further decreased by ex ante social-distance-reducing signaling.

As there would hardly be uncooperative behavior in a system of competing blockchains, the third challenge of how to respond to uncooperative behaviour does not apply either. Even in the case of it occurring, the response would be simple. Because uncooperative behaviour is publicly transparent for everyone, everyone might avoid future transactions with the uncooperative individual. This alone is a powerful enough incentive to make individuals credible, because one instance of behaving uncooperatively is already associated with huge costs, such as the termination of every future interaction. A community of individuals opting for self-governance by signaling varying degrees of transparency over different blockchains will behave cooperatively, as this is exactly the reason they form the community. By voluntarily opting for self-governance, they create a “spontaneous order” in which different mechanisms can co-exist to bring about effective governance, either by technical self-enforcement opportunities of blockchains, yet mostly in development by ex post reputation mechanisms or by ex ante social-distance-reducing signaling of transparency over the blockchain. Technology truly provides an interesting case to re-examine the possibility of self-governance. By combining Hayekian insights with blockchain technology, the three factors of encompassing multilateral-punishment as mentioned by Peter Leeson (2014) can be applied to practice, showing that the blockchain is able to provide a solution to ensure cooperative behavior. This solution, simply stated, is the possibility of self-governance by ex ante social-distance-reducing

signaling of varying degrees of transparency by different modifications of blockchains connected to different competing crypto-currencies.

IV. Conclusion

Can crypto-currencies create a revolution? Are they the evolution for self-governance? Is Governance 2.0 feasible? My thesis affirms these questions implicated in its title. Crypto-currencies can indeed provide more effective self-governance. They do so on a threefold basis: technical-self enforcement, ex post reputation mechanisms of applications and ex ante social-distance-reducing signaling. My thesis has concentrated on the idea of ex ante signaling. Ex ante social-distance-reducing signaling of varying degrees of transparency by different modifications of blockchains connected to different competing crypto-currencies is an additional mechanism to ensure effective self-governance.

My thesis has re-examined the challenge of social diversity posed in social science literature. It finds that self-governance is not only possible in small heterogeneous populations, but also in larger heterogeneous ones. Signaling reduced social-distance has been identified in recent research as a mechanism for this, providing evidence with the examples of Precolonial Africa and Medieval international trade. Regardless, signaling has to overcome challenges like its costliness to be applied for effective self-governance in modern times.

Although the internet improves signaling on a global scale, it is itself limited by its inherent problems of centralisation, manipulation and anonymity. The new blockchain technology originating via competing crypto-currencies provides a solution for this. Crypto-currencies and their blockchains are decentralised, virtually impossible to manipulate and can adapt to different degrees of transparency. With their inherent capabilities of technical self-enforcement of contracts and ex post reputation mechanisms, they already provide promising self-governance

opportunities. However, my thesis concentrates on the opportunities that blockchain technology has in improving signaling.

Approaching signaling and the blockchain from the perspective of social philosopher F.A. Hayek provides ideas about this improvement. Applying his concepts of currency competition, the nature of knowledge and spontaneous order on the challenge posed, signaling turns out to be a solution as an additional mechanism for self-governance. By signaling degrees of transparency individuals want to commit to, they indicate their credibility. Crypto-currency competition provides different blockchains with varying degrees of transparency to commit to. As self-governance is voluntary, individuals who choose it agree on a certain degree of transparency to signal that their cooperation is credible. Thus, ex ante signaling is an additional mechanism to ensure self-governance and overcomes the challenge of social diversity, also working in modern times due to transparency provided by blockchains.

Ex ante social-distance-reducing signaling of varying degrees of transparency by different modifications of blockchains connected to different competing crypto-currencies is but one additional mechanism to ensure effective self-governance. This thesis is one of the first approaching the crypto-currency phenomenon from a social science perspective and may serve as inspiration for more. Further research must further elaborate on this theoretical idea of blockchain signaling and evaluate it with evidence. Social science also has a wide range of other opportunities to deal with concerning blockchains and self-governance. While there is certainly the need for more research on technical self-enforcement of blockchains and ex post reputation mechanisms from a more technical perspective, social science with its broad range of analytical instruments may provide important answers to the outcomes as well. The implications of blockchain self-governance could be huge, and could revolutionise every centralised system by replacing it with decentralised ones. Certainly, social science needs to address this opportunity. It should also concentrate more on researching self-governance from a perspective of emergent-order. Until now, self-organisational research has been mostly limited to a few scholars of political economy. A broader approach may bring out many new, different ideas on how

self-governance could work. Of course, social science must also research its limitations and dangers.

The main limitation of my thesis is its theoretical, partly speculative approach. More research must be provided to test my assumptions and reasoning. For example, the convertibility between competing crypto-currencies and blockchains might pose a problem. Seen from another angle, would governments tolerate transparent self-governance or enables this new, transparent opportunities of control? Or would people commit to transparency if everyone else can see their transactions? Moreover, I fail to provide empirical evidence on how blockchain self-governance might turn out in practice. However, this is impossible so far, as promising opportunities of blockchains are just evolving, with many applications still in development. I understand my thesis as an explorative, theoretical study delving into a hugely relevant, new area not yet researched from a social science perspective. Empirical evidence is the task of future research, which might be inspired by this basic thesis trying to provide a foundation for future social science research. Social science should not be ignorant to technological developments, but should use them to generate new ideas or tackle old challenges. This was my main intention, and I believe I provided a convincing view of how blockchain technology combined with signaling is able to provide effective self-governance; self-governance that might be coined “Governance 2.0” in the near future.

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