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Democracy on a blockchain: The cure for populism?

1. Introduction

In just a few short weeks in August of 2023, a previously little-known folk crooner by the name of Oliver Anthony shot to the top of music charts in the United States with the release of "Rich Men North of Richmond", a single described by *Rolling Stone* as a "populist anthem" (Millman 2023). The song gives voice to the perception that the country's political elites have become corrupt, unaccountable, and tyrannical. "These rich men north of Richmond[3]," the chorus goes:

> *Lord knows they all just wanna have total control. Wanna know what you think, wanna know what you do. And they don't think you know, but I know that you do. 'Cause your dollar ain't s---, and it's taxed to no end, 'cause of rich men, north of Richmond.*

While the song has seemingly been more popular among right-leaning listeners than their left-wing counterparts (Hudak 2023), it appears to have tapped into a broader undercurrent of populist sentiments afflicting U.S. Americans of various political persuasions. In light of a recent Gallup survey showing that a plurality of both Democrats (23%) and Republicans (28%) identified "The government" as "the most important problem facing this country today" (Jones 2022), perhaps it should be of little surprise that a song which remains light on specific policy critiques but is heavy on ambiguously-placed disdain of political elites has found a receptive audience among the American populace.

The surge in populist sentiments is not merely a U.S.-American problem. In the decades following the Cold War, many nation-states were moving towards democratic governance, and a series of international agreements promised a future based on the rule of law and mutual economic cooperation (Mearsheimer 2019). While open, liberal societies are naturally composed of individuals with diverse ideas and visions, there was general agreement that liberal

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democracy was here to stay – perhaps, even, as "the final form of human government" (Fukuyama 1989, 4). However, this shared vision, which has influenced both the domestic and foreign policies of Western democracies over the past decades, has faced challenges. Where there was once some unity of vision, fractures have emerged. In contemporary parlance, we refer to these fractures of vision as the concept of "political polarization". Not surprisingly, one central theme within contemporary social science research and public discourse more broadly is the attempt to understand where such polarization comes from, what effects it may have on the quality of democracy, and how liberal societies may protect themselves from balkanization (Kaltwasser, Taggart, Ochoa Espejo, and Ostiguy 2017).

In this context, different conceptions of *populism* have been employed to both diagnose and explain reoccurring political rifts found throughout Europe and the Americas (Roberts 2021). This collected volume brings together a number of contributions that look at populism and polarization from a distinctively classical liberal vantage point. Classical liberal thought is a broad church that comprises a wide-ranging number of theoretical frameworks for analyzing socio-economic processes. Over generations, classical liberalism has gathered a thick patina. Its ideas are well-rehearsed and well-known by the academic circle that might feel tempted to consult this collected volume. For this reason, we have decided to discuss an altogether new and fresh line of thinking that has emerged within the broader framework of classical liberalism. This line of thought – sometimes called *cryptodemocracy* – has developed out of the Virginia School of Public Choice, which features such iconic theorists as James Buchanan and Gordon Tullock.

In their new book, *Cryptodemocracy: How Blockchain Can Radically Expand Democratic Choice*, classical liberals Darcy W.E. Allen, Chris Berg, and Aaron M. Lane (2019) from the Royal Melbourne Institute of Technology put forward a novel explanation and remedy for the malady of populism that has gripped the West. Their view can be summarized in two simple claims:

The cause of populism, according to the authors, is primarily a mismatch between what voters (principals) want their representatives (agents) to do on their behalf, and what these representatives actually do. The reason that this mismatch can occur in the first place is explained in terms of "agency costs". Agency costs here are simply the costs that principals incur in holding the agent accountable.

The remedy to populism, the authors suggest, is an institutional innovation that promises to decrease agency costs for voters vis-à-vis the legislative and executive branches of government. The institutional innovation these authors have in mind is a blockchain-based

system of democracy that allows voters to more efficiently reach and enforce agreements with their representatives than is feasible under existing forms of representative democracy.

This chapter serves two purposes. Since the advent of Bitcoin and other cryptocurrencies, techno-optimists have often suggested that the underlying technology of cryptocurrencies – so-called blockchain technology – might be capable of solving a number of institutional problems that modern democracies face (Nabben 2023).[4] Now that such ideas are not only discussed in online forums but also in serious academic outlets, it seems an opportune time to take stock of these developing debates. Accordingly, the first goal of this chapter is to provide an introduction and overview of the state of the art within this emerging field. The second goal is to provide a critical appraisal of the diagnostic framework presented by Allen, Berg, and Lane (2019).

The article is structured as follows: In section 2, we provide a short introduction to blockchain technology as well as some of the main hopes and fears attached to this technology from a political economy perspective. Section 3 reviews the framework of Allen, Berg, and Lane for diagnosing populism. Section 4 offers a critical appraisal of their framework. Section 5 provides a summary and a short outlook on the future of research within this subfield.

2. An introduction to blockchain

Blockchain technology remains a closed book, if not a mystery for most. This is likely true not only for the wider public but also for most academics working in the social sciences and humanities. If "blockchain" evokes any association for the reader, it is likely to be "Bitcoin" or "cryptocurrency". The question that we seek to answer in this section, then, is simply this: How might some intangible technology that is mostly used to support digital money be at all relevant for the very tangible problems of political polarization and populism? Let's find out.

2.1. The underlying philosophy of Bitcoin and blockchain

To properly understand why blockchain might be relevant to the functioning of democratic political systems, one needs to identify the "problem" this technology was originally designed to solve. As laid out in 2008 by Satoshi Nakamoto, the pseudonymous computer programmer who created the Bitcoin cryptocurrency, this problem was that

> *[c]ommerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments.*

[4] For a more general survey of techno-optimism, see Danaher (2022).

> *While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model (Nakamoto 2008, 1).*

The "trust based" model to which Nakamoto refers encompasses any system of exchange wherein individual actors are incapable of transacting directly with one another, and must instead do so through third parties such as banks or other payment processors. According to Nakamoto and fellow members of the largely online, libertarian-leaning "cypherpunk" community of programmers and bloggers,[5] such systems place individuals in a precarious position, as their ability to engage in mutually beneficial exchanges is vulnerable to interference by these third parties.

While there may be good reason for third parties to prohibit illegal exchanges, these actors often also possess the capacity to prohibit *legal* transactions that they find morally or politically problematic (Cohn et al. 2022). For example, some have argued that the Obama Administration's "Operation Choke Point" initiative successfully pressured banks and payment service providers to discontinue offering payment services to legal, albeit morally controversial businesses (Baker 2020) – though others have cast doubt on this narrative (Stevenson 2022). Other instances may be found in the decision by a number of payment processors to prevent individuals from transacting with Wikileaks in 2010 (McLaughlin 2020), or the Trudeau government's decision in Canada to freeze the assets of individuals who donated money in support of the 2022 "Freedom Convoy" protests (Austen 2022).

The idea that Nakamoto and his followers proposed was to essentially cut out the middlemen, by providing a piece of technology that allows individuals to transact units of a digital currency directly with each other (Nakamoto 2008; Swan 2015). However, a working proposal for how to create such a system long remained elusive. After all, this task is markedly more difficult than merely facilitating bilateral digital communications. There must exist some mechanism to keep track of how much currency a given individual rightfully possesses, while also adjusting this balance as she gives or receives units of said currency. Moreover, there must be some way to verify that individuals are who they claim to be and that they are not able to transfer more money than they possess.[6] It may appear that the most efficient (and perhaps only)

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[5] Cypherpunks adhere to a techno-optimist political philosophy of Crypto Anarchy, which stresses the desirability of "decentralised, technologically enabled self-governance" and "cryptographically anonymous, computerized communications and markets for a free market society" (Nabben 2023, 2).

[6] Technically speaking, these are referred to as the "Byzantine generals problem" and the "double spending problem", where the former describes the difficulties faced by a decentralized network in reaching a consensus on

solution is for individuals to outsource these functions to third parties that have invested in the creation of systems for managing this information.

Nakamoto (2008), however, contended that this need not be the case. Namely, he put forward a vision of a *decentralized* or *distributed* system called Bitcoin that would allow a network of actors to reach consensus amongst each other over the aforementioned bits of information, instead of outsourcing this task to powerful and untransparent third parties. It is this type of technological innovation – i.e., a protocol that is run by a decentralized network of computers, managed by many different actors, that are economically incentivized to be truthful in reaching a consensus with each other over sets of information, that is now referred to as "blockchain" or "distributed ledger technology (DLT)". In the case of the Bitcoin blockchain, this network allows users to acquire, store, and exchange units of the native "cryptocurrency" – i.e., bitcoins – without requiring all of the aforementioned information processing services to be undertaken by a third party. Instead, this third party is substituted by the aforementioned network – meaning that it is highly improbable for a single or small set of actors to acquire enough power within the system to freeze the assets of another actor, prohibit exchanges, or improperly manipulate individuals' bitcoin balances (Khettry, Patil, and Basavaraju 2021).

2.2. From Money to Contracts

Bitcoin and other blockchain networks that were created to perform the sole function of supporting cryptocurrencies are considered within the relevant literature as belonging to the "first generation" of blockchain (Casino, Dasaklis, and Patsakis 2019). In the "second generation" of such networks, attention shifted from the use case of cryptocurrency to a more general consideration of blockchain's abilities to provide a framework for permitting "distributed consensus" over an arbitrary set of issues to emerge within networks of actors, where participants do not know or trust each other (Buterin 2014; Yaga, Mell, Roby, and Scarfone 2019). In other words, the real "novelty" of blockchain is that it can generate consensus over "the true state of a *ledger*[7]" – i.e., an organized collection of facts about actors' claims and duties with respect to others (Davidson, De Filippi, and Potts 2018, 639). While these ledgers might only contain information about cryptocurrency, they need not be so limited. Rather, they could, in principle, also log information about property rights, personal identities,

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a state of facts (Lamport, Shostak, and Pease 1982), and the latter refers to a particularly challenging hurdle that digital currencies historically faced in creating a scarcity of money (Chohan 2021).

[7] Emphasis ours.

or more generally, contracts (Berg, Davidson, and Potts 2019; Davidson, De Filippi, and Potts 2018, 639).[8]

The last of these applications – contracting – is arguably the most important functionality to have been developed in recent years, and it plays a crucial role in arguments made for why blockchain might improve government. This is because newer blockchains enable actors not only to *write up* contracts with one another but also to have these contracts *monitored* and *enforced* – a trio of functionalities that, if adequately provided, directly tackle several of the most important types of transaction costs that actors face in coordinating with each other. On a blockchain, these types of automatically-enforcing agreements are called "smart contracts".[9] At their core, smart contracts are simply lines of code hosted on a blockchain that execute sets of "if, then" operations (Szabo 1997; IBM 2023). These operations correspond to the terms of an agreement – for example, *if Manchester United beats Liverpool on December 26th, then transfer* x *bitcoins to wallet* y. Insofar as the terms of an agreement refer to events that occur in the real world, smart contracts rely upon so-called "oracles" to observe these events and then quantify them in a manner that informs the smart contract of whether the relevant terms have been met (Carron and Botteron 2019, 108). This category may encompass a wide variety of entities – from simple physical sensors to trusted individuals or even artificial intelligence algorithms.

However, as will become an important part of the main critique presented in this chapter, it is important to note that the term "*smart* contract" may be a bit of a misnomer. While they are *smart,* in that they possess the capacity to automatically enforce agreements according to specified conditions, they are also quite *dumb*, in that they can only act upon the imperative logical structures they are endowed with (O'Hara 2017). But more on that later.

2.3. The main idea – blockchain as a novel institution

This section began by asking the question, what, if anything, might the obscure underlying technology behind cryptocurrencies have to do with addressing the issues of political polarization and populism? While this is more thoroughly addressed in the following section, the main takeaway from our brief foray into the world of blockchain should be that it might provide a novel set of tools to help people more efficiently coordinate with each other. Though

[8] In fact, each of these use cases, along with several others, are currently in practice on different blockchains. See Daley (2023).

[9] For an overview of how smart contracts work and an exposition of their existing applications within blockchain systems, see Mohanta, Panda, and Jena (2018).

this may sound trivial, if it is generally true, then blockchain could have profound implications not only for how people exchange currency with each other, but also on how they vote, form political organizations, and hold their governments accountable. To more effectively locate this point within an economic analytical framework, blockchain may lower the *transaction costs* incurred by actors seeking to coordinate and exchange with one another. Or, as Davidson, De Filippi, and Potts (2018, 641) provocatively argue, blockchain may not merely lower these transaction costs by, for example, making it logistically easier for voters to cast their ballot – instead, blockchain may, itself, be a novel type of institution that could compete with, instead of complement, existing forms of governance.[10]

3. Democracy on a blockchain

If Satoshi Nakamoto is still alive, there is a good chance that he is a fan of Oliver Anthony and hence rather skeptical towards "these rich men north of Richmond". As pointed out by Gikay and Stănescu (2019), the engineers behind Bitcoin (and blockchain itself) might share with populists a deep skepticism – if not disdain – for elite institutions that enjoy a great deal of centralized power. While Nakamoto's proposal for an alternative financial system that constrains the power of centralized entities within the financial realm has not only been specified but also successfully implemented, any similar desires he may have had for disrupting government more broadly remain unexpressed and unrealized. Yet, others seem to have taken up the mantle in his stead. In particular, Allen, Berg, and Lane (2019), and Berg (2017) present a rather detailed account for how they envision blockchain enabling the emergence of novel forms of democratic governance that meet the challenge of populism head-on.

This is succinctly summarized in the title of Berg (2017) – i.e., "Populism and Democracy: A Transaction Cost Diagnosis and a Cryptodemocracy Treatment". Simply put, this argument, fleshed out further in Allen, Berg, and Lane (2019), posits that populism mainly arises as voters experience high agency costs. This means they perceive that their representatives do not effectively represent their interests, and that they are unable to secure better representation. The authors contend that this issue could be alleviated through innovative blockchain-based systems of democracy that utilize smart contracts and oracles to ensure that representatives more

[10] Their argument refers specifically to market institutions instead of political ones. We have applied their reasoning to the political market, as the analysis is consistent with theirs.

effectively advocate for voters' interests. This section expands upon this argument, before critiquing it in the section that follows.

3.1. The transaction cost diagnosis of populism

Berg (2017) and Allen, Berg, and Lane (2019) argue that populism within representative democracies is primarily caused by citizens developing the perception that the "elite class" (in this case, those who make up the apparatus of government) are insufficiently aligned with or accountable to the preferences of the electorate. They model democratic systems on the basis of economic exchange, such that democracy is viewed effectively as a chain of principal-agent relationships. Voters (principals) form quasi-contractual agreements with representatives (agents) to advocate for their interests, who in turn delegate decision-making power to an executive, who then tasks bureaucrats with actually implementing public policy.[11] The tacit assumption behind the model is that a political system that maximizes the satisfaction of voters' political preferences is something desirable[12] – or at a minimum, resistant to populism.

In their framework, the first step in this chain – i.e., between voters and representatives – involves the exchange of votes in return for representatives' promises to work to satisfy voters' preferences. In particular, they cast votes as "bundles of *property rights*[13] to participate in a collective choice" (Allen, Berg, and Lane 2019, 38). The institutional structure of representative democracy, they argue, places unnecessarily stringent constraints on how voting property rights may be exchanged – meaning that voters are often stuck choosing from a small basket of candidates who are neither closely aligned with their preferences nor particularly accountable to their promises.

Similarly, the rules governing the exchange of voting property rights in society impact the ability of voters and representatives to reach mutually beneficial agreements. For instance, in a representative democracy, voters are typically limited to voting for individuals or political parties to represent them on *all* issues if they are elected. This means voters do not have the option to choose different representatives across different policy areas – instead, they must select from preordained, bundled platforms. For example, if Daniel favors the Republicans for domestic issues and the Democrats for foreign policy, in a representative democracy, he must

[11] This understanding of democracy is based on that provided by Strøm, Bergman, and Müller (2003).

[12] This is in line with the idea that a democracy should largely strive to be "responsive" to the preferences of voters (Mair 2009).

[13] Emphasis ours.

still choose one party to represent him in both policy areas. Even if he finds a party that mirrors his preferences, there is still no guarantee that by voting for them, they will win an elected office. Furthermore, if they do come into power, they might deviate from their promises, and Daniel is unable to hold them accountable until the next election cycle (Allen, Berg, and Lane 2019, 45-46).

While there may be compelling reasons for why these specific constraints exist, it is not self-evident whether they are integral to a legitimate democratic system. Namely, it would be *possible* to permit voters to authorize one representative to vote on their behalf over issues in policy area *a* while authorizing another to do so for policy area *b*, and one could also conceive of a system in which voters could retract their vote from representatives at any point in time. The presence of rules prohibiting such actions may have the effect of preventing otherwise mutually beneficial agreements between voters and representatives from materializing, thereby leading voters to incur higher agency costs than they might under an alternative system without such constraints (Allen, Berg and Lane 2019, 49-66).

3.2. The cryptodemocracy treatment

According to the authors, reducing these constraints on how voters participate in democracy is the key to mitigating agency costs, and therefore tackling populism. They advocate a transition away from representative democracy and toward an altogether different system – one of "delegative" or "liquid" democracy (Berg 2017, 2).

Delegative democracy can be categorized as a hybrid between direct and representative democracy, in that, for any given policy proposal that reaches the legislative agenda, voters may choose whether to cast their vote directly or to delegate it to a representative(s) who will cast it for them (Alger 2006; Blum and Zuber 2016). Thus, in principle, every legislative proposal is subjected to a society-wide referendum in that whether or not it passes depends on the final tally of how many individual voters' votes are ultimately cast in its favor. Representatives do not cast only one vote – instead, when they vote on legislation, they do so with the combined power of their own individual vote, plus all of the votes that they have been delegated. Moreover, there are no "elections" as such – voters may freely change their delegations when they please – and there are no *wasted votes,* as representatives are not engaged in competition with one another over a scarce number of seats in parliament (Ford 2014). Additionally, voters could *unbundle* their voting power and choose different representatives for different policy areas. For example, Daniel could authorize the Republicans to vote for him on domestic issues, while entrusting the Democrats to do so for those of foreign policy.

Where the authors' proposal differs from other forms of delegative democracy is to be found primarily in its focus on how blockchain may play a significant role in facilitating the "process[es] of contracting between voters" that underpin this system (Allen, Berg, and Lane 2019, 134). The authors refrain from offering much in the way of specific descriptions of how they envision the institutional structure of such a system to be constructed. Rather, they contend that through society establishing the basic features of a delegative democracy described above on top of a blockchain, institutions and organizations could emerge organically in a sort of Hayekian "catallaxy" (Allen, Berg, and Lane 2019, 2). This system of collective decision-making – a delegative democracy built on top of a blockchain – they call a "cryptodemocracy".

This argument is centered primarily around the idea that voters and representatives within such a system would bargain amongst each other to set the terms surrounding delegation contracts. For example, Daniel could bargain with an individual or organization *x* (perhaps the Democratic party) to permit *x* to vote on Daniel's behalf over all legislative proposals that are classified as belonging to foreign policy, while he may do the same with a Republican-aligned actor, *y*, to do so for those classified as domestic policy. Because representation in such a system would be "liquid", these delegations could occur at any point in time, as there are no preordained election cycles.

A significant concern that arises in this context is the likelihood that voters would incur increased decision and agency costs. In terms of decision costs, it may appear that this system would demand significantly more of voters than a representative democracy. In the latter, Daniel only incurs the costs associated with selecting a single candidate once per election cycle. In contrast, a cryptodemocracy requires him to continually gather information about upcoming legislative proposals and the platforms of various campaigning actors. Regarding agency costs, while Daniel would no longer be limited to voting solely based on his most salient issues, he would now need to manage the costs associated with overseeing and implementing sanctions on multiple representatives within his customized representation bundle, as opposed to a single representative.

However, the authors provide a "solution" to these problems in the form of smart contracts and oracles. Smart contracts could be used to formalize the agreements between Daniel and his representatives, while oracles could feed data about his representatives' performance to these smart contracts, such that Daniel would not need to monitor or enforce these agreements himself. Moreover, Daniel could theoretically attach conditions to his votes that would delineate the circumstances under which this delegation would persist or be revoked. For example, Daniel could allow *x* to vote on his behalf for foreign policy issues, *but* he could

stipulate that his vote shall not be cast in favor of legislative proposals that would reduce foreign aid to Israel. Similarly, he could decide that *x*'s decision to cast his vote or the vote of others in favor of such a proposal would trigger an automatic revocation of his vote delegation – either returning it to Daniel or transferring it to another actor. While this may lead to an increase in decision costs initially, it could end up decreasing agency costs, as the task of monitoring and enforcing these agreements would be taken on by oracles and smart contracts. The end result of this would appear to be a democratic system with lower agency costs than a representative democracy, as voters can customize for themselves a representation bundle that more closely matches their own preferences, while providing mechanisms to ensure that agents are not incentivized to deviate from these agreements.

4. Critical Appraisal

Populism, as the pages of this volume testify, is a complex topic along historical, socio-economic, and conceptual dimensions. The analysis of populism by Berg (2017) and Allen, Berg and Lane (2019) promises to cut to the chase by treating it as a simple principal-agent problem. In this section, we provide a critical appraisal of the framework provided by these classical liberal cryptodemocrats.

A sophisticated and thorough treatment and critique would certainly need to start with a number of methodological questions. First, one would need to ask whether the various political and socio-economic tensions throughout the Western world that we conveniently shove under the label of populism can be successfully captured by a simple principal-agent model. Secondly, the principal-agent model of democracy is built on a certain normative vision of democracy – the so-called "aggregative model" of democracy[14] – that itself is in tension with certain widely shared assumptions of democracy. This tension on its own raises a wide range of questions.

Rather than taking the contributions of Berg (2017) and Allen, Berg and Lane (2019) as a candidate for a theory that provides a comprehensive theory of populism and a solution to boot, we take it for what it is. The authors offer a partial analysis of the problem of populism based on the assumption that certain segments of society feel that their needs are neither heard nor respected.

[14] This is the belief that the purpose of a democracy is to, in some way, generate public policies as a function of the political preferences of voters (Fung 2007).

What we will offer in this section is perhaps then best characterized as an internal critique. That means that we will operate on the assumption that the authors' principal-agent, contract-centric model of democracy is a fruitful, albeit partial model of democracy. In order to critique the strongest possible version of this proposal, we critique it not according to the current state of blockchain technology – with all of the bugs and inefficiencies that plague early versions of technologies – but rather, we critique cryptodemocracy as it could be implemented in a future where these problems have been overcome.

In the following pages, we take up the main claim made in Berg (2017) and Allen, Berg, and Lane (2019) that agency costs will drop under a cryptodemocratic regime. Taking the agency cost claim head on, we argue that the tools that play a central role in reducing agency costs in the authors' proposal – i.e., smart contracts and oracles – are not, even in principle, capable of lowering agency costs. The root of this problem is that while these tools may be helpful in forming, monitoring, and enforcing "complete" contracts, the contracts formed between voters and representatives are "incomplete".

4.1. The problem of incomplete contracts

If cryptodemocracy were to succeed at reducing agency costs, it appears that it must do so by accomplishing two feats – first, by allowing the average voter to efficiently construct a representation bundle that more closely matches her own unique preference profile than would typically be available under representative democracy, and second, by providing her with tools to efficiently ensure that her chosen representatives are incentivized to uphold their promises. The two pieces of technology that the authors identify as being crucial for enabling these benefits to materialize are *smart contracts* and *oracles.* They write:

> *Through the deployment of smart contracts […] individuals may decompose their voting rights in different ways while maintaining trust that those agreements will be fulfilled. Opportunistic behavior by a delegate – for instance, not voting in the way intended – might be ameliorated through conditions coded into a smart contract, where a breach could result in the automatic transfer of voting rights back to the original holder. The process of vote buying and selling can be coded into smart contracts that rely on third party information oracles. Voters can effectively retain ultimate property rights over their vote even once it has been delegated to others, with trust that the code will execute if the agreement is broken (Allen, Berg and Lane 2019, 78).*

However, we have doubts about the ability of smart contracts and oracles to function in the manner that would be required of them to succeed in reducing agency costs, regardless of how advanced these technologies may become. This stems from the fact that agreements between voters and their representatives appear primarily to be "incomplete" instead of "complete" contracts. This is fleetingly mentioned by Allen, Berg, and Lane (2019) several times throughout their book,[15] but never meaningfully addressed. In fact, they state that, "[t]he extent to which these delegation contracts are possible will primarily relate to problems of delegation contract incompleteness", however they never return to expand on this crucial point (Allen, Berg, and Lane 2019, 49). Unfortunately, it appears that contract incompleteness within a cryptodemocracy would be extensive, and potentially fatal.

Contract (in)completeness is a key concept within the Law and Economics literature.[16] A complete contract is one that, "differentiates among all relevant states of the world, [where] a third party, such as a court, can verify, when necessary, which state has occurred" (Posner, Eggleston, and Zeckhauser 2000, 100). Putting it in the language of computer science, a complete contract is a node that can be queried in order to provide parties to the contract with a defined plan for how to behave under all possible scenarios that may arise. An incomplete contract is one in which these terms remain vague, and therefore subject to dispute by at least one of the parties. "That is," writes Hart (1995, 23), it "contain[s] gaps and missing provisions. In particular, it [is] silent about the parties' obligations in some states of the world and will specify these obligations only coarsely or ambiguously in other states of the world." Importantly, these "gaps" do not merely result from a lack of thoroughness by the contracting parties – rather, they are often inevitable, as the presence of transaction costs and uncertainty about future states of the world render many agreements incapable of being represented as complete contracts (Hart 1988, 123). This indeterminacy is not easily compatible with the structure of smart contracts.

One problem with smart contracts is the intrinsic difference between natural language and the computer programming languages that smart contracts use to execute operations (Cannarsa 2018). As mentioned previously, smart contracts are, at their most basic level, merely lines of code that run operations of the following type – "if event *x* is observed, then execute function *y*". In principle, this may work well for defining and enforcing agreements where *x* and *y* can readily be objectively observed and quantified. For example, there would appear to

[15] For example, on pages 37, 41, and 49.

[16] Foundational works on the importance of incomplete contracts for affecting economic outcomes include Klein, Crawford, and Alchian (1978), Williamson (1985), and Grossman and Hart (1986).

be little *epistemic* difficulty in creating a smart contract that would define that the Democratic party may continue to cast Daniel's vote on foreign policy issues, insofar as they do not cast his vote in favor of reducing foreign aid spending to Israel. Nevertheless, when this operation is eventually executed by the smart contract, it does so exclusively in accordance with the computer code that defines it, not according to the understanding or intentions of those who have consented to the contract.[17] Accordingly, if Daniel wishes to insert this condition into a smart contract, it is not sufficient for him to merely stipulate this in natural language, he must also be able to ensure that this is reflected precisely as he intends it to be understood within the smart contract's code.

This problem becomes severely compounded in cases where it is epistemically difficult for computer code to accurately represent certain terms (Carron and Botteron 2019, 111-115). For the most readily comprehensible and easily quantifiable of terms, there may emerge technologies that could reliably perform this task on voters' behalf. Yet, it seems unlikely that a large proportion of the conditions that voters would like to attach to their votes would be so readily translated into code. For example, let us reconsider the previous case that appeared to be straightforward. There may, in fact, be a higher degree of epistemic uncertainty involved in translating Daniel's mandate than first appears to be the case. If the dollar is weaker now relative to the shekel than it was last year, should this be taken into account? Moreover, should funding sent to the Palestinian territories be counted under this definition? And what, exactly, should be considered "foreign aid"? In order for this smart contract to function automatically, these and surely other ambiguities must also be clarified.

Assume that Daniel wants to ensure that whomever he delegates his vote casts it in favor of legislative proposals that are "compassionate towards immigrants". How could he meaningfully encode this condition into a smart contract? What is meant by a "compassionate" policy towards immigrants? Does this imply an open-border policy, the exact opposite, or something in between? "Even the simplest of economic transactions can be so complex", writes Al-Najjar (1995, 432), "that it is it is practically impossible to list the entire range of outcomes and contingencies that might affect contractual performance." Yet, unless Daniel is able to precisely specify such conditions, he would be unable create an enforceable contract.

There is, however, one way in which Daniel could potentially avoid this problem – namely, by simply empowering an oracle to interpret these contractual terms, and delegates'

[17] For an example of this going wrong on a blockchain, review the case of the 2016 "DAO Hack", in which a hacker drained nearly $150 million worth of the Ether cryptocurrency from a decentralized autonomous organization by exploiting the smart contract code (Morris 2023).

performance in accordance with them. But while doing so may generate *an* enforceable contract, the extent to which enforcement of this contract is actually in line with Daniel's sincere preferences is unknown. Daniel may equate his definition of what qualifies a policy as being "compassionate toward immigrants" with that of the judgment reached by an oracle not because these are in fact identical, but rather because it was necessary for him to specify a proxy variable to stand in for his unobservable, sincere preferences so that the smart contract could be enforced. Yet, there may exist reasonable disagreement among a set of observers about whether a given policy should be thus classified, even if all observers have access to identical information about this policy. Insofar as the conclusions reached by Daniel's oracle correspond with those that Daniel himself would have reached if he had been exposed to the same set of information, then the enforcement of his smart contract does appear to successfully reduce agency costs. However, if the oracle's assessments diverge from those that Daniel would have made, then the successful enforcement of Daniel's smart contract would reward his representative for behaving in a way that diverges from his sincere preferences.

To illustrate this, assume that oracle *a* is a political watchdog organization that employs notable political philosophers and economists who thoroughly research and sincerely report their assessments of various policy proposals from an ideological perspectivethat appears to be very close to Daniel's. Now, assume that oracle *b* is run by an eccentric group that assesses the desirability of given policy proposals according to whether an octopus they have taken captive decides to pick up either a blue rock or a red rock after having been exposed to the proposal in question. One might assume that the assessments of *a* would be more likely to track with Daniel's preferences than those of *b*, but even this is not guaranteed. Namely, while the octopus may have a 50-50 shot at choosing the rock that indicates an assessment that would be shared by Daniel, if *a* possesses a different interpretation of what it means to be "compassionate toward immigrants" than does Daniel, then its judgments may very well have a lower than 50 percent probability of being compatible with those that Daniel would reach.

One might contend that there is no real problem here – namely, Daniel need only "choose wisely" the oracles that he authorizes to monitor and enforce his contracts. But this simply reintroduces the same problem that oracles are relied upon to mitigate – that of high agency costs. For Daniel to ensure that he has chosen the "right" oracle, he must incur substantial costs both in discovering the true type of an oracle, and in monitoring its performance to ensure that the oracle is reaching the same type of judgments that Daniel would. This shifts the problem of high agency costs from being between voters and delegates to now being between voters and oracles. It is not clear how this problem is to be resolved – Daniel

cannot simply enlist other oracles to monitor his primary oracles, as this problem would also apply to them.

Accordingly, voters within a cryptodemocracy must place a great deal of trust in oracles. Though they may not be engaged in directly voting on others' behalf over legislative agenda items, oracles would possess the capability to influence policy outcomes through the assessments they reach regarding the performance of delegates and the "qualities" embodied by legislative proposals. For example, if 1000 voters share Daniel's concern for immigrants and they all designate the same oracle as being responsible for determining whether a given policy proposal is sufficiently compassionate toward immigrants, then regardless of whom these voters have delegated their votes to, this oracle's assessment of an upcoming legislative proposal automatically determines how these 1000 votes are cast by the delegates that hold them. Moreover, oracles could use this power to punish or reward delegates to serve their own interests, instead of those of voters.

In summary, it appears that smart contracts and oracles would be of little help to voters within a cryptodemocracy. These tools are useful in enforcing complete contracts, but much less so in the case of incomplete contracts – a fact that renders them poorly suited to the task of mitigating agency costs suffered by voters, as the agreements they form with representatives are almost always incomplete. If voters were, nonetheless, to render their smart contracts enforceable by empowering oracles to use their own judgment in interpreting them, they would wind up recreating the same principal-agent dilemma that they face within a representative democracy, this time with oracles instead of representatives. Consequently, according to Allen, Berg, and Lane's (2019) own analytical framework, there is little reason to believe that populism should be less of a threat within a cryptodemocracy than within a representative democracy.

5. Conclusion

The cryptodemocracy proposal examined here presents classical liberals with exciting ideas for how blockchain technology could, at some point in the near future, be utilized to meet the various challenges that populism poses to liberal democracies in the 21st century. An important takeaway from this chapter is that blockchain, serving as a tool for facilitating coordination and collective decision-making processes, seems likely to have relevance well beyond the sphere of cryptocurrency and into the realms of politics and economics. It should be treated seriously by social scientists and political philosophers seeking to explore the ways in which emerging

technologies may provide society with opportunities to make the institutions of liberal democracy more stable and legitimate.

However, the cryptodemocracy proposal is in need of further refinement. Of primary concern is the question of how the delegations that form the basis of cryptodemocracy – and delegative democracy, more generally – could be undertaken in a reasonably efficient manner. The inherent incompleteness of such delegation contracts is a problem that does not appear capable of being "innovated away" – and is certainly not resolved by utilizing smart contracts and oracles. By depending on these tools to automatically monitor and enforce delegation contracts, voters may end up incurring agency costs that are not well accounted for under the authors' framework, and which could easily be higher than those experienced under a representative democracy.[18]

Finally, whether such a system that is aimed at reducing institutional barriers between voters and policy outcomes would be a *desirable* form of democratic governance remains a question for further research, even if it is shown to be feasible. While it may (or may not) prove to be desirable for various reasons, it remains doubtful that a cryptodemocracy could reliably tackle the challenge of populism by mitigating the agency costs suffered by voters.

[18] Another problem that we cannot discuss in this article is the problem of issue partitioning. Here we can only flag a few salient issues: - who should be in charge of determining what policy areas legislative proposals fit within? Namely, is there any "objectively true", finite set of relevant policy areas that legislative proposals can be classified under? And on what basis can it be determined that a given proposal falls under one policy area but not another? Without compelling answers to these questions, collective decision-making processes within a cryptodemocracy may encounter significant hurdles.

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