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The Rise of Decentralized Autonomous Organizations (DAOs)

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The rise of decentralized autonomous organizations (DAOs): a first empirical glimpse

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Abstract: Blockchain technology and smart contracts are catalysts for decentralization and disintermediation. These new technologies reduce transaction costs, agency costs, and offer a basis for trustless social and economic interactions. They are fueling new business models for decentralized platforms and have revolutionized crowdfunding. A recent trend, Decentralized Autonomous Organizations (DAOs), stands to fundamentally transform organizing and governance. DAOs are blockchain-native, decentralized organizations that are collectively owned and managed by their members via smart contracts. In this note, we assess the promises and challenges of DAOs, with a focus on decentralized governance and disintermediation, and offer a first empirical glimpse at the rise and functioning of DAOs. Overall, DAOs may introduce a new era in organizational economics, transforming the global corporate landscape from hierarchical organizations to democratic and distributed organizations powered by organizational entrepreneurship and innovations.

Keywords: DAO, Decentralized Autonomous Organization, Blockchain, Ethereum.

1. The emergence of decentralized autonomous organizations (DAOs)

Decentralized autonomous organizations (DAOs) are blockchain-native, decentralized organizations that are collectively owned and managed by their members via smart contracts. DAOs represent a new organizational model that can fundamentally change how organizations operate. Organizational innovations associated with the rise of DAOs are enabled by a novel technological infrastructure. Blockchain technology serves as the platform on which DAOs are set up. Blockchain technology refers to a distributed and digital ledger that records transactions in a transparent and immutable way (Nakamoto, 2008). The advent of this technology had a major impact on the business world and is one of the major pillars of the movement towards a decentralized economy (e.g., Yermack, 2017; Chawla, 2020; Sydow et al., 2020) and a decentralized financial system (e.g., Chen and Bellavitis, 2020; Cumming et al., 2022), partly driven by new ventures' tokenizations through initial coin offerings (ICOs) (e.g., Bellavitis et al., 2021; Fisch, 2019).

The blockchain based-nature of DAOs has several implications that distinguish DAOs from traditional organizations. First, *organizational governance* is significantly different from current, more traditional forms of governance in organizations. While traditional organizations are driven by top-down, private, and centralized decision-making, DAOs operate through public and distributed decision-making, in which any DAO member can typically put forward proposals for any type of corporate decision and vote on them. This framework facilitates collaboration and community engagement among all members of the DAO that share common goals and ideals. These goals are diverse and codified in DAOs' underlying smart contracts. For example, DAOs can set out to raise and distribute donations or can collect and invest funds in promising venture projects (e.g., Bove, 2022). The funding of DAOs is often based on token sales, such as ICOs (e.g., Bellavitis et al., 2021; Fisch, 2019; Momtaz, 2020) or non-fungible token (NFT) sales (e.g., Chalmers et al., 2022). These token sales enable ventures to raise substantial amounts of funding from a crowd of investors, and the funds can only be accessed with members' approval or smart contract activation. The tokens sold can carry voting rights and multiple voting mechanisms exist, some of which are highly innovative.

DAOs' organizational governance is also different from more recent trends such as crowdfunding or ICOs. Both funding sources are innovative, but they still rely on more conventional corporate governance mechanisms. In crowdfunding or ICOs, entrepreneurs raise funding through the crowd, either with the help of crowdfunding (e.g., Angel List) or ICO (e.g., Coinbase) platforms. However, in both cases, there is a controlling party (i.e., the company that raises funds) that decides on the company strategy. In some cases, the CEO or entrepreneur

might try to engage with their community and, for example, survey investors or customers on certain aspects of the company such as product development. Yet, in crowd- or ICO-funded ventures, the ultimate decision-making remains mostly centralized and top-down. A DAO is a step forward. In this case, the organization fundraises through the issuance of tokens sold to a crowd of investors, as in an ICO, but then the governance is entirely public and distributed.

Second, the decentralized nature of DAOs enables new business models that are catalysts for further *disintermediation*. As of 2022, some of the most successful organizations are intermediated platforms, such as Amazon. DAOs have begun to disrupt intermediated business models and industries in which such platforms are dominant through disintermediation. At the core of the movement toward greater disintermediation is the promise of more favorable rent sharing, as entrepreneurs and investors or sellers and buyers get to share the transaction surplus exclusively, without the need to pay for intermediation services thanks to smart contract technology (Momtaz, 2022). In principle, markets, industries, and entire economies could be governed by smart contracts, powered by robotics, and independently regulated by the DAOs' members. Consider the example of Amazon: Today Jeff Bezos is the main shareholder of Amazon, Amazon's CEO is the manager, and Amazon sellers are the service providers. Through a DAO, Amazon sellers could cooperate and share decision-making and a DAO could allow every Amazon seller to be a shareholder, manager, and service provider at the same time.

The number of DAOs and their impact is rapidly increasing. The raising impact is evidenced by headline-grabbing stories, such as a *Constitution DAO*'s $40 million bid on an original copy of the U.S. constitution in 2021 (Bove, 2022). Similarly, as we outline below, the number and value of DAOs have exploded since 2019. Against this background, this note aims to provide an initial description of DAOs. Specifically, we aim to outline the promises of DAOs as a new organizational form, offer an initial empirical glimpse at the prevalence and functioning of DAOs, and discuss some of their limitations. By this, we seek to provide an early introductory view on DAOs that future research can base on to develop novel research questions to fully explore DAOs and their underlying mechanisms.

2. A description of DAOs and their voting mechanisms

DAOs are internet-native businesses powered by blockchain technology. The main component of a DAO is its smart contract. The contract defines the rules of the organization and holds the DAO's treasury. It can include, for example, rules on who is able to launch a proposal, or vote on one, or how the treasuries are disbursed. The smart contract can only be changed through a vote by the DAO's members. In general, anything can be put to the members' vote, including

hiring, product development, strategy, investments, and fundraising. However, the range of decisions that can be put to vote depends on the industry and mission of the DAO. For example, at the moment, most DAOs operate in the DeFi and investment sphere. These organizations might invest in NFTs, hence members can propose NFTs collections to invest in and vote on which will ultimately receive investments. The investment process could also be automated through the smart contract. For example, a DAO could offer loans to any individual who applies and has a certain credit score and pre-determined chacacteristics. In sum, decisions are either automated and embedded in the smart contracts, or are put to vote and voted on by the DAOs members.

Although every DAO is built upon the premise of distributed ownership and decision-making, various voting mechanisms exist. At one end of the spectrum, there are voting mechanisms widely used in other settings. Most DAOs are governed through *token based voting*. This is the simplest form of governance where each token grants one voting right. A majority of voters is required to pass a resolution. The majority can be absolute where a pre-defined quorum needs to be reached, or relative, where any majority is sufficient to pass a proposal.

However, blockchain allows for some technological advances that enable more complex voting mechanisms. In *quadratic voting*, a larger number of tokens grant a disproportionate voting power. In this form, one token provides one vote, but two tokens grant four votes, and so on. This voting mechanism has the advantage of incentivizing ownership and commitment, but risks concentrating voting power in the hands of few large token holders. Although with its own merits, quadratic voting exacerbates the problems of large ownership stakes (Ferreira et al., 2022).

Conviction voting is another alternative voting mechanism. In this system, the weight of a vote increases the longer it remains unchanged. This reduces incentives to act "politically" and maintains a more stable voting environment. However, this might reduce necessary changes as voters who are in favor of changes might be underweighted.

Holographic consensus voting is also an innovative voting mechanism. This voting system tries to resolve the trade-off between resiliency and scalability. DAOs are launched with the idea of distributed decision-making. However, as in many situations with widespread ownership (e.g., public stock markets), small holders have little incentive to vote. An absolute majority is highly resilient as at least 50% of members need to vote in favor of a resolution, but it is not scalable when active participation is scarce. A relative majority enables more fluid decision making, but is not resilient as a small number of voters can steer the organization's strategy. A holographic consensus voting, created by *DAOstack*, tries to resolve this trade-off. The

holographic consensus is a multi-step voting process that involves boosting of and staking on (i.e., betting on) proposals (for more details see Faqir-Rhazoui et al., 2021).[1]

Liquid democracy is another voting mechanism that tries to help with the resiliency problem using delegation. This system is similar to elected democracies, where the entire population elects a few representatives to make voting decisions on their behalf. However, delegation in liquid democracy can be revoked at any time. This mechanism allows for greater accountability of the decision-makers, but at the expense of short-termism. Regardless of the voting mechanism implemented, the idea behind DAOs is to distribute ownership and voting power transparently and efficiently. This framework facilitates collaboration and community engagement among all members of the DAO that share common goals and ideals. In the next sections, we elaborate on the advantages and disadvantages of DAOs.

3. The promises of DAOs

Because of their decentralized nature, DAOs offer transparent, distributed, and decentralized decision-making that increases disintermediation not only within organizations, but also at the market, industry, and economy levels. The distinction between shareholders, managers, and other stakeholders, such as industry participants, is blurred, giving rise to numerous benefits (and challenges).

3.1 Decentralized governance: agency, transaction costs, and wisdom of the crowd

In traditional corporations, the literature on corporate governance has long emphasized potential *agency costs* associated with conflicts of interest between managers and shareholders (e.g., Jensen and Meckling, 1976). In DAOs, however, agency costs could be dramatically reduced because the roles of principals and agents overlap.

While conventional organizations are hierarchically governed by executives that make top-down decisions, DAOs follow a decentralized bottom-up approach. DAO members are typically identified via tokens, which, as previously discussed, represent digital voting rights that entitle the token holder to participate in decision-making (e.g., one token, one vote), thereby coordinating DAO governance. The decentralized voting-based governance process reduces the need for hierarchy and bureaucracy, decreasing the need for human managers (e.g., Hackl, 2021; Morrison et al., 2020). Also, while decision-making in traditional organizations is private, decisions made in DAOs are transparent and publicly visible on the blockchain.

[1] See also https://medium.com/daostack/holographic-consensus-part-1-116a73ba1e1c

Thus, *which* decisions were taken, and *how* the DAO members reached these decisions, is public knowledge.

Further, blockchain technology shapes the governance of DAOs, which is fundamentally different from traditional organizations. These organizations are governed by the blockchain code which is public and easily accessible. The DAOs' initial smart contracts, which outline the goals and governance framework, are hardly reversible. Any decisions taken in the DAO comply with this smart contract and changes to the smart contract require a voting process. Decisions are distributed and mostly based on codifiable information. Hence, the characteristics of DAOs – the overlap between principals and agents, as well as strong transparency – significantly reduce conflict of interests and moral hazard in this type of organization. This governance process could constitute a paradigm shift when it comes to transparency and agency costs (Lumineau et al., 2021). As such, governance and decision-making in DAOs could dramatically reduce *transaction costs* because smart contracts define the rules of the game and govern the decision-making process, but executing a smart contract is significantly less costly than the costs associated with corporate board meetings, corporate bottom-up decision-making, the involvement of labor unions, and so forth.

Finally, because decision-making power is distributed across members of the DAO, distributed and decentralized organizations like DAOs can benefit from "*wisdom of the crowd*". The importance of crowd-based decision-making is increasingly relevant in various fields, ranging from the development of new products (e.g., Afuah and Tucci, 2012, Poetz and Schreier, 2012), the funding of technology-based start-ups (e.g., Mollick, 2014), to scientific research (e.g., Franzoni and Sauermann, 2014). It has been found that crowds can predict events very efficiently (e.g., U.S. Presidential elections) (Ray, 2006) and can operate similar to experts (e.g., Mollick and Nanda, 2015). We argue that DAOs represent the natural evolution of crowd-based decision-making platforms.

3.2 Disintermediation: from centralized to decentralized platforms

DAOs not only disintermediate and decentralize decision-making within organizations, but also within markets, industries, and economies. As discussed above, the distinction between principals, agents, and other stakeholders, such as industry participants, overlaps to some extent in DAOs. Therefore, DAOs are the next evolutionary step toward platform-based markets, industries, and economies.

Not long ago, technological advances such as the internet and smartphones have powered a wave of new business models based on *centralized platforms*. Before the advent of these

technologies, many industries were governed by large conglomerates at the center of industries. Nowadays, many industries such as entertainment (e.g., *Netflix*), retail (e.g., *Amazon*), music (e.g., *Spotify*), and mobile applications (e.g., *iTunes*), have been disrupted by centralized platforms. The rise of platforms has concentrated market and economic power in the hand of a few companies. As soon as these platforms gain network economies, their behavior becomes less supportive toward complementors and suppliers (Rietveld et al., 2020). An example is *Etsy*, a platform for creatives. The platform started with fees of 3.5% in 2018, raised to 5% in 2018, and in 2022 raised again to 6.5%. These developments pushed regulators to consider breaking up large platforms[2], or fine them for unfair market practices.[3] Similar dynamics have existed in financial markets for centuries (Chen and Bellavitis, 2020). Financial institutions act as intermediaries between savers and borrowers that would otherwise struggle to transact independently (e.g., Cumming et al., 2022; Momtaz, 2022). Therefore, although platforms and intermediaries help reduce transaction costs, allowing transactions to be carried out efficiently, they gain significant (market) power, financial resources, and increase market concentration (Chen and Bellavitis, 2020).

As *decentralized platforms*, DAOs have the potential to reshape markets, industries, and entire economies and shift power to members of the different ecosystems such as *Amazon* sellers, *Spotify* artists, and *Etsy* creators. By reducing the involvement of centralized platforms, DAOs can reduce transaction costs and create network effects without incurring monopoly costs (Catalini and Gans, 2019). If an industry is dominated by a DAO, no single entity will accumulate monopoly power, allowing all DAO members to benefit from the network effects to enlarge transaction possibilities, cooperation, and community building with the outcome of enhanced innovativeness and efficiency.

Several studies discuss the benefits of cooperation to increase innovation. The entire *open innovation* literature is centered around the idea that firms should leverage cooperation with external firms to innovate (e.g., Chesbrough, 2004). Cooperating, rather than competing with other firms, allows partners to access complementary resources that can contribute to the development of innovation (e.g., De Faria et al., 2010). Extending these concepts to individuals, DAOs allow a multitude of members to contribute toward innovative goals and projects, sharing knowledge, resources, and ideas. By distributing the power and decision-making within an

[2] For example, the U.S. Congress has introduced a bill to break up large tech firms. For more information see here: https://www.cnn.com/2021/06/11/tech/house-tech-antitrust-bills/index.html.

[3] For example, Google has been fined by the European antitrust for unfair market practices. For more information see here: https://www.nytimes.com/2021/11/10/business/google-eu-appeal-antitrust.html.

organization, DAOs emphasize and promote community building which is crucial in creating sustainable ecosystems. Distributed organizations based on large communities such as Wikipedia or Anonymous (hackers) have existed for several years. However, the implementation of a DAO facilitates interaction, alignment of interests, trust, and transparency in a way that was not possible before. A DAO does not necessarily have a controlling party and, therefore, allows for open access and permissionless innovation—that is, developers can experiment with new products and ideas without fearing repercussions from a central governing entity (Chen and Bellavitis, 2020). By facilitating permissionless innovation and community building, decentralized organizations empower developers, allowing them to contribute to the DAO in original and unexpected ways.

Further, DAOs can increase organizational and industry efficiency. A longstanding literature argues that firms internalize transactions to reduce transaction costs that would otherwise occur in the open market, the so-called "*make or buy dilemma*" (Williamson, 1978). DAOs take advantage of modern technologies like smart contracts, robotics, and remote tracking to automate the entire transaction process, across multiple unrelated parties, potentially located in different parts of the world. These technologies increase efficiency and reduce transaction costs and decision-making time (Momtaz, 2022). As a consequence, DAOs can significantly reshape our understanding of organizations and the benefits of internalization as well as different organization structures.

4. Limits to DAOs

4.1 Decentralized governance: Coordination costs, participation barriers, and security risks

While smart contract-based, on-chain governance is a core feature of DAOs that enables transparent and democratized decision-making, this form of governance can induce *coordination-related inefficiencies*. For example, the fact that every decision needs to be voted on by the members of the DAO can be more time-consuming than traditional top-down decision-making by executives. Hence, the voting-based governance structure has limitations when it comes to time-critical decisions. In a similar vein, recent research finds that DeFi markets create only half of the welfare they could create because of search- and coordination-related frictions (Momtaz, 2022). Some of the voting mechanisms discussed above try to reduce the participation costs (e.g., liquid democracy), but at the same time might reduce the benefits of distributed decision making.

Another aspect that can complicate the decision-making in DAOs is the fact that DAO members can become inactive and cease participating in votes (The Economist, 2016). Further, decisions in DAOs can be influenced by large shareholders, such as institutional investors or the project's initial developers that often own a large share of the tokens, which undermines the integrity of the democratic voting process (The Defiant, 2021). If only a small part of the crowd becomes actively involved in the DAO management, they may exploit the remaining crowd's inattention to extract private benefits of control, losing some of the potential for DAOs to reduce agency costs. These problems with blockchain conglomerates are discussed by Ferreira et al. (2022). Alternatively, the delegation of management and decision-making of DAOs to some parts of a decentralized crowd plausibly raises the issue of freeriding behavior, as active voters do not (necessarily) get rewarded for their engagement. Whether delegated management without compensation is a sustainable way of organizing and decision-making in DAOs is an empirical question for research in the future.

Relatedly, there are participation barriers for individuals to partake in DAOs. Participation costs refer to the effort that individuals need to spend to understand and enter a market (Allen and Santomero, 1997). Because DAOs are based on blockchain technology and smart contracts, the technological knowledge required to understand DAOs is relatively high. Similarly, there are now many different governance modes. As discussed above, the one token - one vote is the most prevailing mode, but there many different modes. Familiarizing oneself with the technological and economic intricacies of DAOs is thus associated with high costs, and may lead to a segmentation of investors who invest and do not invest in DAOs and the potential need to reintroduce some degree of intermediation or hierarchy (Cumming et al., 2022).

The potentially inefficient voting process also poses *security risks*. Bugs and security gaps in the code also require a voting process to be fixed. Because this process can be time-consuming and requires consensus, it opens up DAOs to malicious attacks and fraud (Hackl, 2021). For example, the lack of human-led governance led to a slow response to the famous 2016 hack of "The DAO", in which $60 million were stolen via an exploit in the DAO's code (Morrison et al., 2020). In addition to an inefficient response, this example illustrates that DAOs can fall victim to hacks or exploits if their smart contract setting is flawed. In another example, a DAO was subject to a coup because an individual obtained enough tokens to vote and pass proposals by themselves and gave himself access to the DAO's treasury (Ongweso Jr, 2022).

4.2 Institutional void: regulatory uncertainty

There is some uncertainty about the legal status of DAOs in most jurisdictions, which translates into commercial uncertainty which is prevalent in the entire crypto industry (Bellavitis et al., 2021; Huang et al., 2020; Momtaz, 2021b). The problem is also compounded by the fact that many DAOs are unincorporated, and most members are unidentified. There is also tremendous uncertainty as to whether only the smart contracts or also token-holders are subject to the law and the associated liabilities (Allen, 2021). So far, the majority of regulatory regimes tries to embed DAOs into existing laws. For example, in a 2017 press release, the SEC clarified that DAO tokens can be treated as securities in the U.S., and therefore follow securities regulation, introducing regulatory hurdles (SEC, 2017). Practitioners have also suggested considering DAOs as *unincorporated nonprofit associations.* This would facilitate basic business activities such as filing and paying U.S. taxes, opening an entity bank account, signing legal agreements, and limiting liability for DAO members (A16Z, 2021), while keeping intact some of the existing benefits of DAOs. However, a few cases of tailormade regulatory frameworks exist.

In 2021, the U.S. state of Wyoming passed a bill that allows DAOs to obtain legal company status and register as a limited liability company (LLC).[4] This would give DAOs the possibility to act as a traditional business in conducting business transactions (e.g., hiring employees), clarifying accountability, and providing DAOs with legitimacy. In the Wyoming law, DAOs would be classified as either *member-managed* or *algorithmically managed* organizations. Both legal forms undermine DAOs' full potential. In the member-managed case, several provisions (e.g., the necessity to maintain a registered agent in Wyoming), would reintroduce human, centralized control. In the *algorithmically managed* case, Wyoming law requires that the smart contracts can be modified or otherwise updated at any time, torpedoing the immutability of public records on the blockchain and potentially requiring consensus mechanisms that would either be impractically decentralized or centralized (JDsupra, 2021). In the U.S., Vermont has also created a legal framework for Blockchain-Based Limited Liability Company (BBLLC).[5] This allows a DAO to validly enter into contractual agreements and protects its "owners, managers and blockchain participants from unwarranted liability" (Riva, 2021).

Outside of the U.S., Monaco has regulated and defined smart contracts and recognized their legally-binding effects. Switzerland is another country that has been friendly toward blockchain-powered companies. Within the country's legal framework, DAOs have opted to

[4] The bill is available at: https://www.wyoleg.gov/Legislation/2021/SF0038

[5] For more details see here: https://legislature.vermont.gov/statutes/section/11/025/04173

register as Swiss Associations, or DAAs (Decentralized Autonomous Associations). These frameworks embed DAOs into an existing regulatory framework, allowing them to better interact with an offline world and achieve limited liability.

Another case is the Cayman Islands, which introduced a novel form of legal entity known as a "foundation company". These companies can operate like an incorporated trust while retaining the separate legal personality and limited liability of a company. The issuance of the Virtual Asset Service Provider Act allows DAOs to use a foundation company as a legal basis for their operations. Although our paper does not intend to be an exhaustive representation of DAOs' legal frameworks, to the best of our knowledge, no other DAO-specific regulations have been issued so far. The lack of more precise regulatory framework is surprising considering the potential and rapid proliferation of this organization form. We hope our paper sparks discussion on both the potential and the challenges of DAOs, and how to create opportunities for this new form of governance to flourish.

5. An empirical glimpse at DAOs

5.1 Data and sample construction

Because DAOs are still a very recent phenomenon, data availability is highly limited. To provide an empirical glimpse of the aggregate market for DAOs, we combine data from various sources. First, we retrieve statistics on the number of DAOs, members, proposals, and votes for the period from February 2019 to February 2022 from *DAO Analyzer*.[6] We were able to obtain data on more than 2,300 active DAOs, with more than 26,000 members and 8,000 active voters on over 43,000 proposals. Second, we obtain data on the market capitalization, trading volume, and returns on DAO-issued tokens from *Coinmarketcap* and *CoinGecko*. In particular, we reconstruct the "DAO Index" published by *Coinmarketcap*[7] by retrieving all available token prices and trading volumes on a daily basis from *CoinGecko* for the full trading history. This allows us to study the time series of aggregate and average DAO market capitalization, the cumulative trading volume, and the equally- and value-weighted returns of DAO tokens since January 2016. Third, we obtain data on important governance parameters of DAOs like ownership thresholds for proposals, DAO networks, and governance strategies (for proposing and

[6] The website https://dao-analyzer.science/daohaus was accessed for the purpose of data extraction over a period of several days in the first two weeks of March 2022. Note that the website is still under construction and therefore appearance and data coverage are dynamically changing.

[7] Available from https://coinmarketcap.com/view/dao/, accessed the last time on May 11, 2022.

voting) from *Snapshot Governance*[8], which constitutes the dominant platform on which DAOs base their decentralized governance.

5.2 The evolution of DAOs: the number of DAOs, members, proposals, and votes

Figure 1 illustrates the evolution of DAOs. Panel A shows that most of the 2,334 *active* DAOs have emerged in 2021; less than 20% of all active DAOs emerged before 2021. Active DAOs refer to DAOs that have activities, such as members putting proposals up for a vote and implementing proposals. However, relative to the number of active DAOs, more than twice as many *not-yet-active* DAOs exist and are currently in preparation of being launched.[9] Panel B shows that the 2,334 active DAOs have 26,177 active members, as of February 2022, suggesting that the average active DAO is mainly influenced by 11.2 unique individuals. These members have made 43,010 proposals, suggesting that the average DAO has had 18.4 proposals (Panel C). Finally, Panel D shows that the number of active voters is 8,502 (3.6 on average per DAO).

Taken together, the four Panels in Figure 1 lead to two interesting insights. First, while DAOs are, in principle, organizations with flat hierarchies (compare *Sections 1* and *2.1*) in which everybody can participate and decide on the DAO's strategy, it is interesting to see that the number of active members outsizes the number of active voters by a factor of three. Thus, about two-thirds of all members in DAOs do not get involved in the management and decision-making of the DAO. Second, those DAO members who engage as active voters need to spend, on average, a considerable amount of time making an informed vote because the average DAO puts 18.4 proposals up for a vote and these proposals can be rather lengthy or deal with complicated, technical matters. Therefore, the individuals who get involved in the management and decision-making of DAOs plausibly face substantial opportunity costs that *passive* members do not face.

[Please insert Figure 1 here.]

[8] Also retrieved in March 2022 from https://snapshot.org/#/.

[9] As of March 14, 2022, there are at least 4,832 DAOs created as per https://deepdao.io/.

5.3 The economics of DAOs: Market capitalization, trading volume, and investor returns

The rise in DAO activity is also accompanied by increasing market size and financial investor returns, as Figure 2 illustrates.[10] Panel A shows the aggregate (left axis) and average (right axis) DAO market capitalization. There are two periods of increased activity, the 2017-19 crypto boom and the post-2020 bull market. Both phases are characterized by high aggregate market capitalizations of more than $60 billion at times. Further, it is interesting to compare the market capitalization of DAOs to those of early ICOs. The average market capitalization over our sample period of $18.52 million per DAO is slightly higher than that of ICOs, with $14.13 million measured on the first day of trading (Momtaz, 2021c).

Panel B shows the aggregate trading volume. There has been a steep increase recently. As of January 2022, the amount of DAO tokens that have been exchanged nears $250 billion, with almost two-thirds of the volume occurring in 2021 alone.

Finally, we show investor returns to DAO token ownership in Panel C. The graph shows the evolution of investor abnormal returns benchmarked against an equally- and a value-weighted overall crypto market index. If an investor had invested in each DAO token on the first day of trading and held it until January 2022, then the investor would have made an abnormal buy-and-hold log-return roughly between 100% (value-weighted benchmark) and 160% (equally-weighted benchmark) since January 2016, depending on the risk adjustment. This indicates that DAOs seem to be financially highly attractive for investors.

[Please insert Figure 2 here.]

5.5 Decentralized governance

5.5.1 Ownership thresholds, networks, and governance strategies

Figure 3 illustrates key features of DAOs that concern their governance. In principle, DAOs have flat hierarchies and each member should be equally privileged to participate. Yet, as Panel A of Figure 3 suggests, 15% of all active DAOs impose ownership thresholds for members to make proposals. Most DAOs have relatively low ownership thresholds for proposals (i.e., less than ten tokens), although some have relatively high thresholds. For example, *Cook Finance*, a two-sided DeFi index platform, requires its members to hold five million *COOK* tokens to

[10] These graphs are based on the DAO index published by *Coinmarketcap* as of March 25, 2022, retrieved from https://coinmarketcap.com/view/dao/, with the historic price and trading volume information obtained from https://www.coingecko.com/.

make a proposal, which corresponds to almost USD 10,000.[11] Ownership thresholds reintroduce hierarchy into DAOs, by creating two separate classes of token holders: those with decision-making rights and those without.

Panel B shows the predominant networks DAOs are based on. Ethereum leads the list with 69%, followed by Binance (17%), Polygon (6%), Gnosis 2%, Huobi (1%), and others (5%). Ethereum is popular because its technical standards ERC20 for fungible tokens and ERC721 for non-fungible tokens are widely accepted in the crypto industry, and ensure that the tokens are interoperable. Additionally, Ethereum is the first choice for DAOs because its consensus mechanism is distributed and established, the code is immutable and cannot be modified ex-post, smart contracts on Ethereum can send and receive funds so that Ethereum-based DAOs are completely disintermediated, and the "Ethereum community has proven to be more collaborative than competitive, allowing for best practices and support systems to emerge quickly" (Ethereum Foundation, 2022[12]).

Finally, DAOs can employ various governance strategies, which are typically run on the *Snapshot* platform. Snapshot is an open-source off-chain governance voting platform. It is off-chain because most DAOs are Ethereum-based, and voting would incur high gas fees, which is the obstacle to efficient DAO governance that *Snapshot* resolves. Panel C of Figure 3 shows all governance strategies that are employed by at least ten DAOs on *Snapshot*. By far the most common DAO governance strategy is erc20-balance-of (adopted by 1,196 DAOs), followed by erc721 (83), contract-call (62), multichain (41), erc20-with-balance (26), erc1155-balance-of (11), balance-of-with-min (11), comp-like-votes (10), pagination (10), whitelist (10), and others (180). The DAO governance strategy "erc20-balance-of" refers to a JavaScript function that computes the voting power as "One Voice, One Vote" (OVOV), depending on the number of the DAO's token holdings. As such, most of the DAOs' governance strategies are deeply democratic. Yet, a small number deviates from this paradigm, e.g., 62 use "contract call," which lets them use any strategy to compute voter scores, and 26 DAOs employ a "erc-with-balance" strategy, which "checks whether the participant has a minimum amount of token required to vote and assigns all the votes to 1."[13]

Thus, while most DAOs are democratic and have implemented coin-voting in the form of OVOV, several DAOs deviate and implement other, less democratic governance strategies on off-chain voting platform *Snapshot*.

[11] USD 9,675 as of March 14, 2022, see https://coinmarketcap.com/currencies/cook-protocol/.
[12] For details, see https://ethereum.org/en/dao/.
[13] See here https://docs.snapshot.org/strategies/what-is-a-strategy , retrieved March 14, 2022.

[Please insert Figure 3 here.]

5.5.2 Engagement, Collaboration, and Community Building in DAOs

Figure 4 sheds additional light on how DAOs operate. Panel A shows the cumulative number of votes per voter and the per voter average of votes. It shows that the average voter has voted on 160 proposals, and the per-voter average has decreased to a relatively stable level, suggesting that the average voter votes on slightly more than 4 proposals per month. Panel B shows the number of approved versus rejected proposals, as well as the average approval rate. The average approval rate is 87% in February 2022, down from 93% in February 2020. Indeed, the number of rejected proposals has somewhat increased since October 2021. Panel C shows the type of proposals. Of all proposals, 44%, 22%, and 6% were grant-, new-member-, and donation-related proposals, respectively, with the remaining portion being other matters. Grant-related proposals, by far the most important activity, refer to proposals that wish to allocate a certain amount of the DAO's treasury funds to a specific project. Typically, the DAOs issue grants to projects that help build the ecosystem around the DAO. For example, the *OceanDAO*[14] funds projects that develop the *Ocean Ecosystem* that revolves around the *Ocean Protocol*, which broadly refers to software that leads start-up firms and incumbents to wrap their data services as ERC20 tokens, so that they can be stored and exchanged through the existing blockchain/crypto ecosystem. Panel C is interesting because it illustrates that only half of all DAO activity revolves around the allocation of funds (grants and donations make up for 50% of all proposals), while the other half is centered around other proposals that often concern the governance of DAOs.

[Please insert Figure 4 here.]

6. Concluding remarks

We provide initial insights into the rise of DAOs, a new organizational form that has the potential to disrupt existing organizational and governance structures. This note assesses the promises and challenges of DAOs and focuses on the areas of decentralized governance and disintermediation. In addition to discussing the pros and cons of DAOs, we offer a first empirical glimpse at the rise and functioning of DAOs. Specifically, we show that the number and

[14] See here: https://oceanprotocol.com/dao, information retrieved on March 14, 2022.

value of DAOs have exploded since 2019. We also present initial empirical insights into the market capitalization, trading volume, and investor returns as well as governance strategies and community building in DAOs. Our initial thoughts suggest that DAOs may introduce a new era in organizational economics that transforms the global corporate landscape from hierarchical organizations to democratic and distributed organizations powered by organizational entrepreneurship and innovations.

DAOs are also a natural governance evolution that is associated with new sources of entrepreneurial finance or business models. In recent years, a growing number of entrepreneurs decided to fundraise through crowdfunding or ICOs. These sources allow entrepreneurs to fundraise from the crowd online or via a blockchain. However, most decisions remain concentrated in the hands of entrepreneurs. Similarly, many businesses decided to operate via a platform-based business model (e.g., Uber). A DAO seems to be a natural corporate governance framework for these innovative firms. It can be imagined that an entrepreneur raises funds via crowdfunding to launch a competitor to Uber. The entrepreneur will then allow both investors and drivers to decide on the corporate strategy, distribute profits and, eventually, decide on the next CEO. DAOs allow for seamless distributed decision-making.

The innovativeness of this structure creates multiple fruitful avenues for future research. Within the area of entrepreneurial finance, future studies could investigate the success factors of DAOs' fundraising activities. Theorywise, this research could draw on signaling theory. We outline several characteristics that are DAO-specific (e.g., proposals, community engagement, organizational design) and which could qualify as signals that separate DAOs of high and low quality. In addition to investigating the determinants of funding received within the group of DAOs, future research could compare these determinants in DAOs with other organizational forms. Also, it will be especially interesting to see how DAOs interact with new mechanisms of decentralized finance, such as ICOs (e.g., Fisch, 2019) or NFTs (e.g., Chalmers et al., 2022). Currently, a large number of DAOs are funded via ICOs and it is unclear whether and how ICO investors value DAOs in contrast to more traditional organizational forms.

It would also be interesting to evaluate the different voting mechanisms, both in terms of DAOs, but also related to more conventional businesses. Which voting mechanisms are more effective and under what circumstances? Taking a step back, what constitutes "effective"? Can some of these voting mechanisms improve offline decision makings, for example in political elections or public markets? Taking a step forward, scholars could investigate whether blockchain and distribute voting systems and technologies can be applied in other settings.

Another research avenue refers to a comparison of DAOs and traditional organizations. For example, it would be interesting to see whether DAOs can compete with traditional organizations in terms of performance and the efficiency of decision-making, despite their decentralized and potentially less efficient governance structure. Borrowing from the previous example, can "UberDao" compete with Uber? Similarly, it would be interesting to better understand the contextual factors that shape the efficiency and applicability of DAOs. For example, it could be that DAOs are better suited than traditional organizations to perform in certain industries. Understanding the contextual factors that influence DAOs' performance would also enable a better understanding of the potential and challenges of DAOs.

Another interesting avenue for future research is the investigation of agency issues and voting mechanisms. Scholars can provide insights into what types of situations are more prone to misconduct, and what are the best mechanisms that DAOs can implement to reduce agency costs. In the voting mechanisms discussions, we explained that in some cases, a few voters could try to manipulate the blockchain. New theories related to these aspects are needed and can better guide entrepreneurs and regulators.

Finally, future research could zoom in on how DAOs function and analyze the governance mechanisms in more detail. For example, future research could try to identify the types of decisions for which community-based voting mechanisms and the decentralization of DAOs are more or less efficient. This would enable a better appraisal of the significance of the DAO phenomenon from a theoretical and practical viewpoint.

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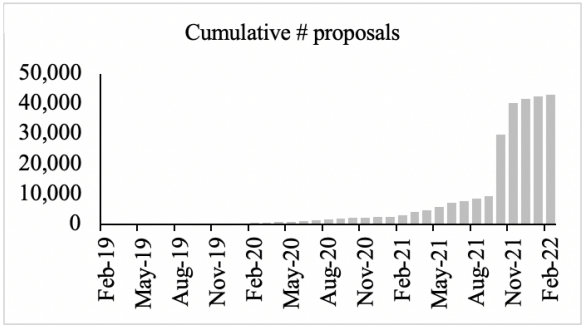
Figure 1: The Evolution of DAOs, Members, Proposals, and Active Voters

Panel A



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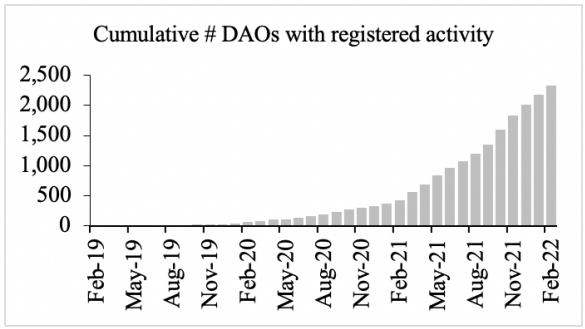

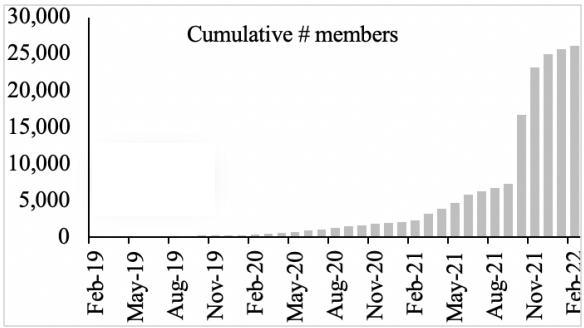

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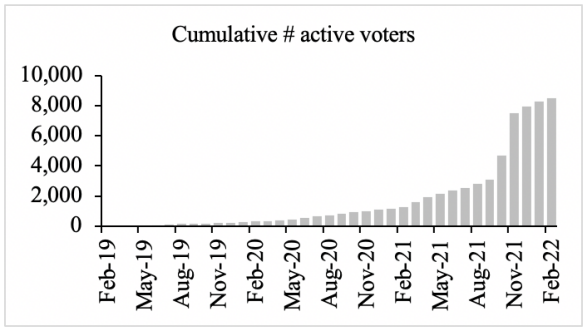
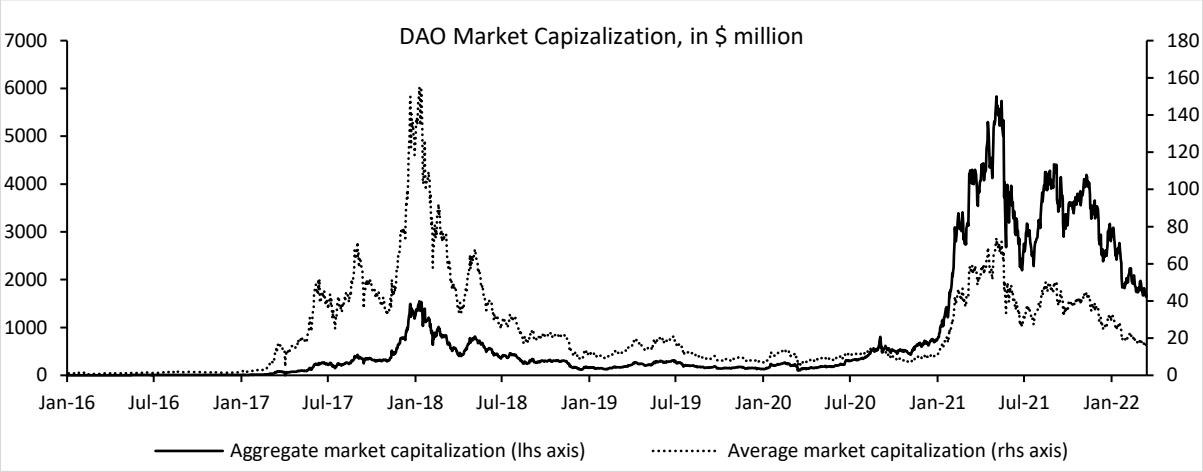


Panel D

Figure 2: Market capitalization, trading volume, and returns

Panel A



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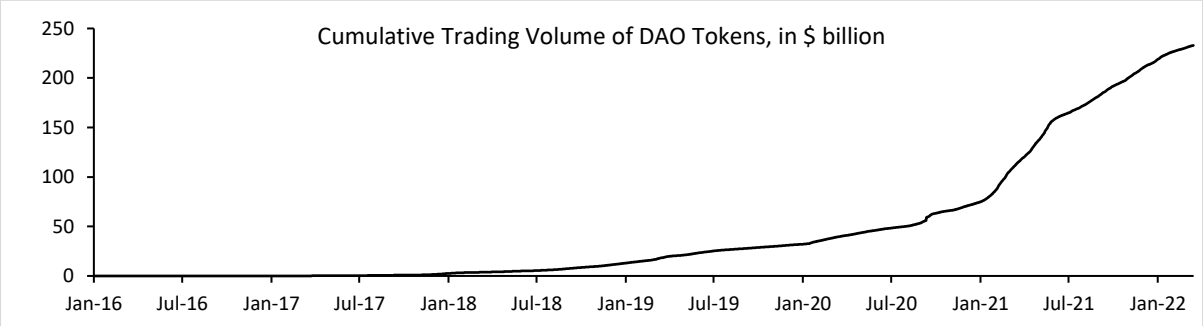

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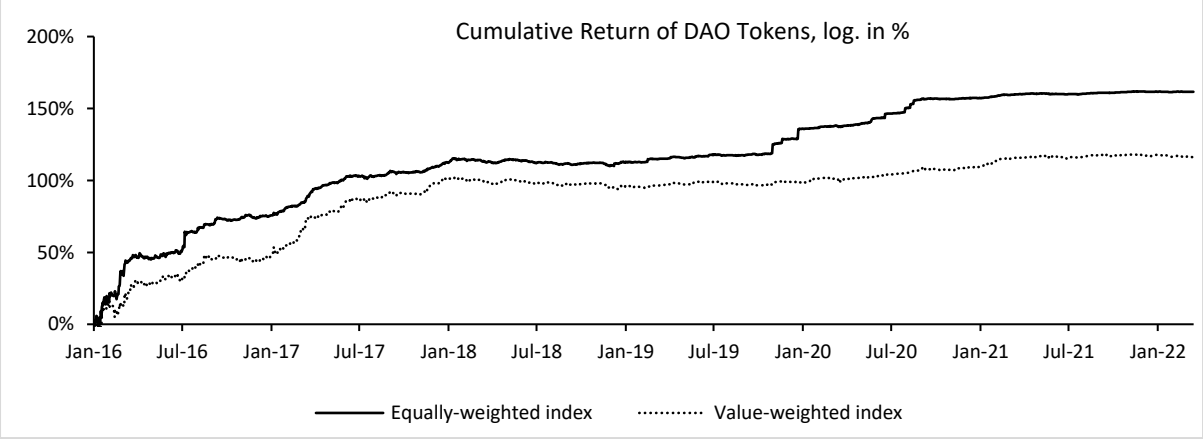
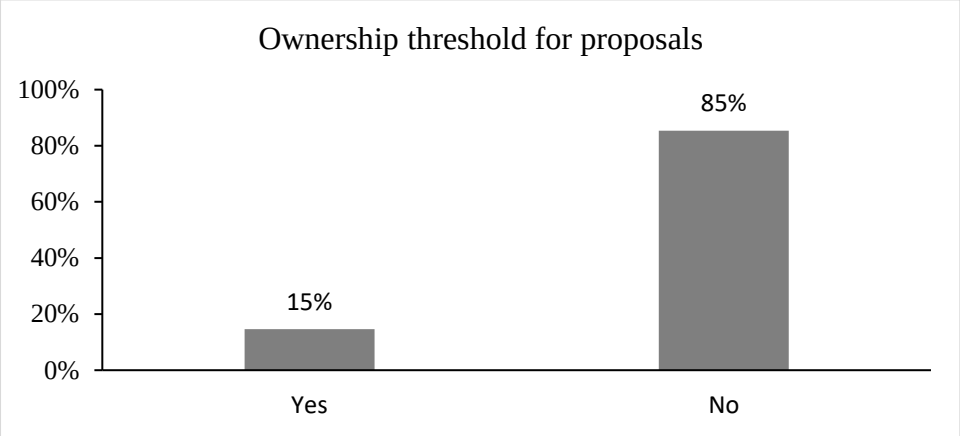


Figure 3: The Governance of DAOs

Panel A



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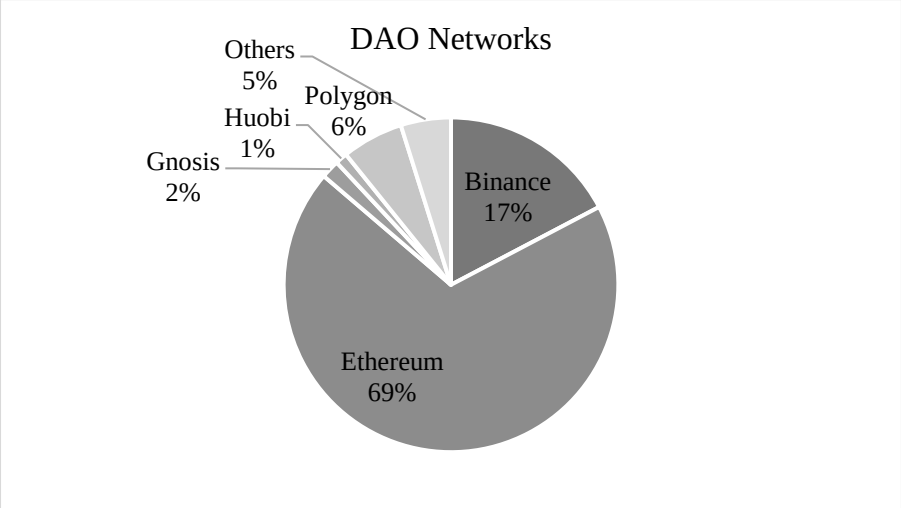

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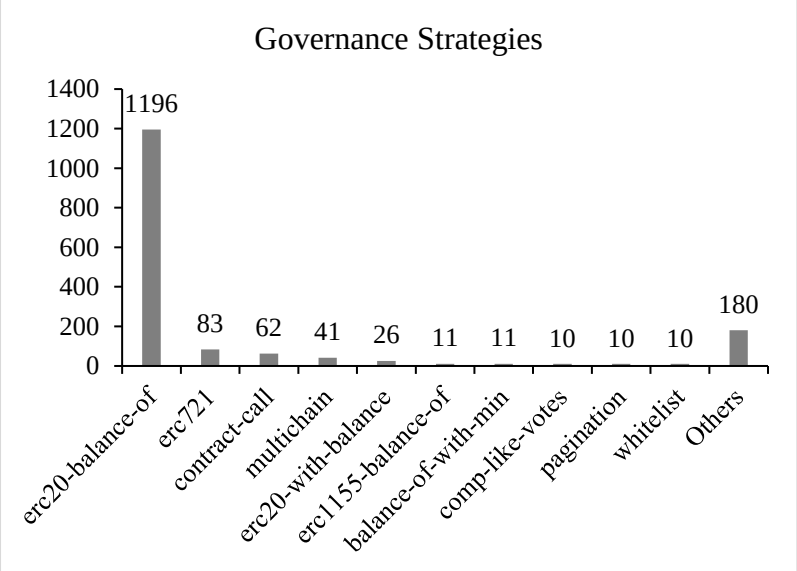
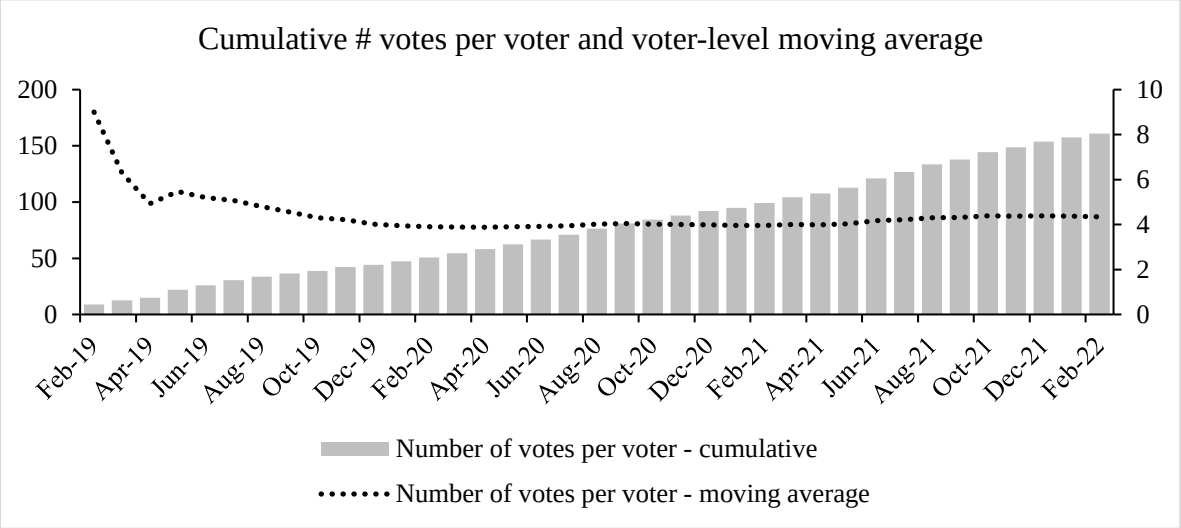


Figure 4: Engagement, Collaboration, and Community Building in DAOs

Panel A



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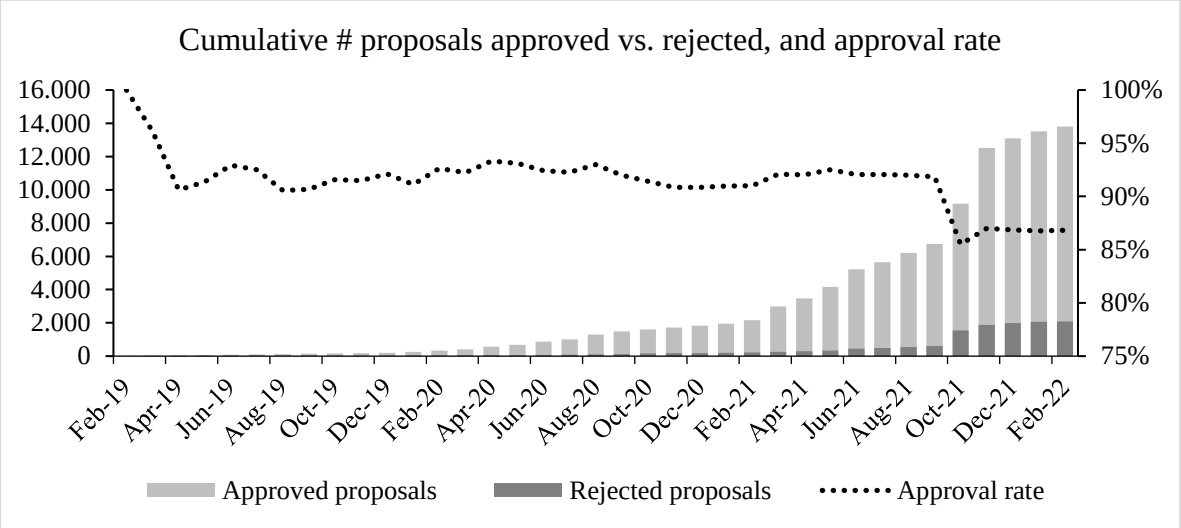

Panel C