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Distributed governance and value creation in decentralized autonomous organizations: Evidence from a regression discontinuity design

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ABSTRACT

Distributed governance mechanisms increase tokenholders value in decentralized autonomous organizations (DAOs) when decision-making is contested. Using a comprehensive dataset of proposals voted on within blockchain-based DAOs from 2020 to 2024, we exploit a regression discontinuity design on proposals that pass or fail by a close margin around the majority threshold. Local average treatment effects indicate that proposal passage increases DAO token returns by 4.7 % at the margin. Further, a one standard deviation increase in vote participation amplifies this effect by 2.2 %. Proxies for democratization and decentralization also increase the value-creating effect of contested decision-making in DAOs. Our findings contribute to understanding how distributed governance structures create value in digital organizations.

1. Introduction

Blockchain technology has attracted considerable attention for its potential to create value and improve governance. On the one hand, proponents of blockchain technology argue that by giving *users* a stake in the platform (i.e., *governance tokens*), organizations are more likely to be governed in accordance with tokenholders' preferences and goals (Abadi and Brunnermeier, 2024), effectively reducing agency and thus enabling a "decentralized consensus" among shareholders (Cong and He, 2019; Yermack, 2017), and to facilitate more transparent decision-making, allowing firms to align their investments more closely with their strategic objectives (Harakeh et al., 2024). On the other hand, critics argue that decentralized decision-making might be ineffective due to collective action problems distributed tokenholders face (Cumming et al., 2025). Within this debate, decentralized autonomous organizations (DAOs) are attracting attention as laboratories for the study of governance in decentralized systems. A DAO is collectively owned, governed, and operated by its tokenholders. Tokenholders can submit proposals for collective decision-making through voting and participate in the voting themselves. When approved, the DAO's underlying smart contract may automatically execute these proposals, ensuring governance decisions are implemented without centralized oversight.[1] Our study's objective is to provide well-identified evidence as to whether decentralized decision-making creates or destroys value in DAOs.

We examine whether passing a governance proposal creates value for tokenholders and whether this effect is moderated by vote participation and proxies for the democratization and decentralization of DAOs. We analyze a sample of 26,363 proposals voted on within 457 DAOs during the 2020–2024 period. Using a quasi-experimental regression discontinuity design (RDD), we test whether the outcome of a proposal impacts DAO token returns. Because the outcomes of proposals that pass or fail by a large margin are often anticipated, which could confound causal inference, we leverage an RDD to address this endogeneity concern. The RDD approach addresses potential endogeneity by focusing on proposals with narrow margins around the majority threshold (Cuñat et al., 2012). Critically, for close-call proposals, the vote outcome remains inherently uncertain. Consequently, close-call proposals can be considered locally exogenous and plausibly uncorrelated with any observed or unobserved confounding factors as long as their effect is continuous at the majority

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[1] Appendix B describes in more detail the functioning of DAOs.

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threshold, ensuring that the vote is not subject to manipulation (McCrary, 2008). Accordingly, we observe continuity at the threshold and that passing is uncorrelated with DAOs or proposal characteristics. Hence, by focusing on close-call proposals, we plausibly estimate the causal effect on DAO token returns. By comparing the cryptocurrency market's response to these marginal proposals, we aim to estimate the causal effect on DAO token returns and explore the moderating influences of voting participation, democratization, and decentralization.

The results of our analysis show that proposals that pass by a close margin have significantly positive effects on DAO token returns, with estimated local average treatment effects of 4.7 % per passed DAO proposal. This effect is more pronounced in contexts characterized by higher vote participation, as a one standard deviation increase in vote participation amplifies the relationship between passing a proposal and DAO returns by 2.2 %. Furthermore, the positive effect on DAO returns is positively moderated by greater democratization, as measured by the Gini coefficient in token ownership, and increased decentralization, as measured by the minimum number of independent validators needed to control at least half of the network's consensus (i.e., the Nakamoto index). These results are coherent with the functioning of decentralized consensus, which inherently relies on the "wisdom of the crowd." As Stiglitz (2002, p. 469) observed, "different people know different things." The collective decision-making process of DAOs aggregates dispersed information from heterogeneous investors, often yielding superior outcomes compared to individual decisions. This study examines the effects of governance mechanisms that promote vote participation, democratization, and decentralization on value creation. Our results show that the positive impact of passing a close-call proposal on DAO token returns is more pronounced in contexts with higher vote participation.

Overall, our empirical evidence demonstrates how distributed governance mechanisms influence value creation for stakeholders, emphasizing the role of participatory decision-making in enhancing stakeholder wealth. Furthermore, the findings show how democratization and decentralization amplify the positive effects of governance. While these results are based on evidence from decentralized finance—which improves market participation and reduces entry frictions—their validity might extend well beyond blockchain applications, as crowdsourcing becomes a prevalent value-creation strategy in may business domains.

2. Data and methodology

2.1. Data and sample statistics

Using data from DAO platforms *Aragon* and *DAOHaus*, we build a comprehensive dataset of tokenholder proposals. These proposals can be classified into different categories based on the content of the proposals (Zhao et al., 2022), as reported in Table A1 in the Appendix. The sample consists of 26,363 proposals from 457 DAOs from August 2020 to March 2024. We integrate data from multiple sources. First, we collect data on the daily prices, market capitalization, and trading volume of DAO tokens from *CoinGecko* and *Coinmarketcap*. We gather data regarding ownership and network structures with the *DAO analyzer* tool. We retrieve the number of votes for DAO proposals and the vote share. To measure democratization, we calculate the Gini index, which measures inequality in ownership. For the easiness of interpretation, we consider the 100-Gini index as a direct measure of equality within DAO. To measure decentralization, we utilize the Nakamoto index, a widely used metric by blockchain practitioners. The index identifies the minimum number of independent entities -or *validators*- that are needed to control at least half the network's consensus. By this design, a greater Nakamoto index indicates greater decentralization.

Table 1
Descriptive statistics.

Descriptive statistics for the sample of strategic proposals ($N = 26{,}363$)					
Variable	Mean	StdDev	Q1	Median	Q3
Outcome variables					
Daily log returns (log %)	1.026	12.844	−3.488	−0.172	3.335
Equally-weighted abnormal log returns (log %)	1.100	13.767	−3.062	−0.077	3.335
Value-weighted abnormal log returns (log %)	1.112	13.792	−3.045	−0.030	3.277
Proposal outcome					
Vote share in favor (%)	87.417	32.521	100	100	100
Pass (dummy)	0.872	0.334	1	1	1
Participation and governance					
Vote participation (number)	42.3	107.1	1	4	26
100-Gini index (score)	31.907	33.928	0.023	20	55.556
Nakamoto index (number)	3.3	5.4	1	2	4
Controls					
Number of investors (number)	1344.7	3891.6	6	27	650
Proposer request payment (dummy)	0.365	0.481	0	0	1
Proposer requests governance tokens (dummy)	0.327	0.469	0	0	1
Proposal lead time (days)	4.8	18.5	0	2	4
DAO age (years)	0.4	0.7	0	0	1
Number of past proposals (number)	378.2	810.1	2	21	132
Number of competing proposals (number)	893.7	14.0	1	2	782
Gas at proposal execution date (mGwei)	22.938	47.154	0.611	10.528	16.417
ETH price at DAO creation date (USD, K)	1.044	1.150	0.186	0.587	1.859

Notes. This table reports the descriptive statistics for the sample of 26,363 strategic proposals within 457 DAOs listed in Aragon and DAOhaus from August 2020 to March 2024.

2.2. Regression discontinuity design

Our econometric approach is an RDD that exploits quasi-experimental variation in the probability that a vote passes to determine whether the tokenholder's proposals that pass *closely* around the majority threshold have a causal impact on the DAO token return on the day in which the proposal passes. We estimate the following model:

$$R_{it} = \beta_0 + Pass_{it}\beta_1 + Votes_{it}\beta_2 + (100 - Gini\_index_{it})\beta_3 + Nakamoto\_index_{it}\beta_4 + Pass_{it} * Votes_{it}\beta_5 + Pass_{it} * (100 - Gini\_index_{it})\beta_6 + Pass_{it} * Nakamoto\_index_{it}\beta_7 + X'_{it}\delta_1 + poly_l(v_{it}, \gamma^l) + poly_r(v_{it}, \gamma^r) + \varepsilon_{it}$$

The dependent variable is the daily log returns R_{it} when a proposal is voted in the DAO i at time t, and v_{it} is the share of percentage votes in favor. We capture with β_1 the effect of a discrete change in the dependent variable when the proposal passes using the dummy variable $Pass_{it}$, and with β_5, β_6, and β_7 the moderation effects of $Votes_{it}$, $(100 - Gini\_index_{it})$ and $Nakamoto\_index_{it}$ on passing a proposal, respectively. Allowing for different polynomials on the left-hand and right-hand sides gives us the approximation of the continuous underlying relationship between vote share and daily log returns. Finally, X'_{it} represents the control variables, which are *Number of investors, Proposer request payment, Proposer requests governance tokens, Proposal lead time, DAO age, Number of competing proposals, Gas at proposal execution date,* and *ETH price at DAO creation date*. We cluster robust standard errors at the DAO level, including year-fixed effects.

Table 2
The effect of a passing proposal on daily log returns, and the moderating effect of voting participation, democratization, and decentralization.

	(1) OLS Daily log returns	(2) OLS Daily log returns	(3) OLS Daily log returns	(4) OLS Daily log returns	(5) OLS Daily log returns	(6) OLS Daily log returns
Pass		4.677***	4.138**	1.253	3.316**	0.196
		(1.565)	(1.658)	(1.735)	(1.663)	(1.727)
(Pass) X (Vote participation)			2.024***			2.146***
			(0.215)			(0.215)
(Pass) X (100-Gini index)				0.072***		0.072***
				(0.007)		(0.007)
(Pass) X (Nakamoto index)					0.273***	0.102**
					(0.053)	(0.045)
Vote participation	−0.431	−0.425*	−2.287***	−0.407***	−0.414***	−2.377***
	(0.264)	(0.244)	(0.220)	(0.074)	(0.074)	(0.218)
100-Gini index	−0.018	−0.018	−0.018***	−0.078***	−0.017***	−0.078***
	(0.012)	(0.012)	(0.003)	(0.007)	(0.003)	(0.007)
Nakamoto index	−0.051	−0.049	−0.047**	−0.057***	−0.301***	−0.149***
	(0.040)	(0.037)	(0.021)	(0.020)	(0.048)	(0.040)
Number of investors	0.013	0.013	0.013***	0.012***	0.013***	0.012***
	(0.010)	(0.010)	(0.002)	(0.002)	(0.002)	(0.002)
Proposer request payment	−0.514	−0.490	−0.457	−0.315	−0.489	−0.280
	(0.649)	(0.616)	(0.360)	(0.361)	(0.360)	(0.361)
Proposer requests gov. tokens	2.277***	2.272***	2.264***	2.280***	2.255***	2.266***
	(0.604)	(0.608)	(0.383)	(0.381)	(0.384)	(0.381)
Proposal lead time	0.004	0.004	0.003	0.003	0.004	0.002
	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
DAO age	1.761*	1.757*	1.765***	1.655***	1.738***	1.656***
	(0.941)	(0.912)	(0.213)	(0.212)	(0.213)	(0.212)
Past proposals	−0.318**	−0.316**	−0.313***	−0.301***	−0.315***	−0.298***
	(0.148)	(0.139)	(0.024)	(0.025)	(0.024)	(0.025)
Competing proposals	0.041	0.041	0.040***	0.036***	0.042***	0.036***
	(0.039)	(0.038)	(0.013)	(0.013)	(0.013)	(0.013)
Gas at execution date	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.005)	(0.005)	(0.002)	(0.001)	(0.002)	(0.001)
ETH price at creation date	−0.246	−0.241	−0.236	−0.225	−0.232	−0.216
	(0.310)	(0.297)	(0.146)	(0.146)	(0.146)	(0.146)
DAO/Year Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Polynomial in the vote share	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Constant	0.783	−1.951	−1.297	1.492	−0.655	2.647*
	(1.271)	(2.203)	(1.300)	(1.384)	(1.290)	(1.380)
Observations	26,363	26,363	26,363	26,363	26,363	26,363
Log-Likelihood	−104,260	−104,254	−104,225	−104,196	−104,241	−104,161

Notes. This table reports the effect of passing proposals on daily log returns using an RDD. Model (1) is the baseline model including only control variables. Models (2–6) include polynomials of order four in the vote share on each side of the regression such that it estimates the effect at the discontinuity (50 % of passing votes at the threshold). In particular, Model (2) includes the dummy variable *Pass* and the polynomials in the vote share; Model (3) includes the interaction effect of *Pass* with *Vote participation*; Model (4) includes the interaction effect of *Pass* with *100-Gini index*, Model (5) include the interaction effect of *Pass* with *Nakamoto index*, and Model (6) is the complete model including all variables and interaction effects. The values of *Vote participation, Investors, Past proposals,* and *Competing proposals* are included in hundreds in the regression analyses. All models account for DAOs and fixed-year effects, and robust standard errors in parentheses are clustered by DAO. Significance at the 10 %, 5 %, and 1 % is indicated by *,**,***, respectively.

3. Results

Table 1 reports the descriptive statistics of the sample of 26,363 proposals employed in the econometric analysis. The average daily log return, regardless of vote outcome, is 1.026 %, indicating that, on average, daily token prices increase on proposal vote outcome days. On average, proposals received an approval rate of 87.4 % and vote participation of 42 votes per proposal. The data indicates concentrated ownership, with a mean 100-Gini index of 31.9, and relatively decentralized control, as shown by an average Nakamoto index of 4, suggesting that at least four entities are required to control DAO proposals. Table A2 in the Appendix reports the variable definitions while Table A3 shows the correlation coefficients and Variable Inflation Factor, which are consistently low enough to indicate that multicollinearity is not an issue.

The RDD results, reported in Table 2, demonstrate the causal impact of passing a proposal near the majority threshold on DAO token returns. Model 1 includes control variables only, while Model 2 introduces the effect of proposal passage. The results indicate that passing a proposal near the threshold is associated with a statistically significant increase of 4.677 % in daily log returns. This effect is higher than the estimated return of passing a proposal in traditional governance, as Cuñat et al. (2012) indicate an average price reaction of 1.3 % for approved close-call proposals, which increases to 2.8 % for implemented proposals. In fact, these proposals incorporate the dynamic effect of proposal implementation on market reaction. Cuñat et al. (2012) further note that the likelihood of a passing proposal being implemented is typically not greater than one-third. Conversely, in DAOs, the distinction between approval and implementation is significantly narrower, as passed proposals are directly executed by the development team on-chain through automated smart contracts. In DAOs, the lack of friction strengthens the causal relationship between governance and value creation.

Models 3 to 5 explore the moderating effects of vote participation, democratization, and decentralization, respectively. In Model 3, the interaction term between proposal passage and vote participation is positive and significant, with a coefficient expressed in unitary votes of 0.020. This implies that a one standard deviation increase in vote participation amplifies the positive effect of proposal approval by an additional 2.167 % (0.020×107.1). Similarly, Model 4 shows that

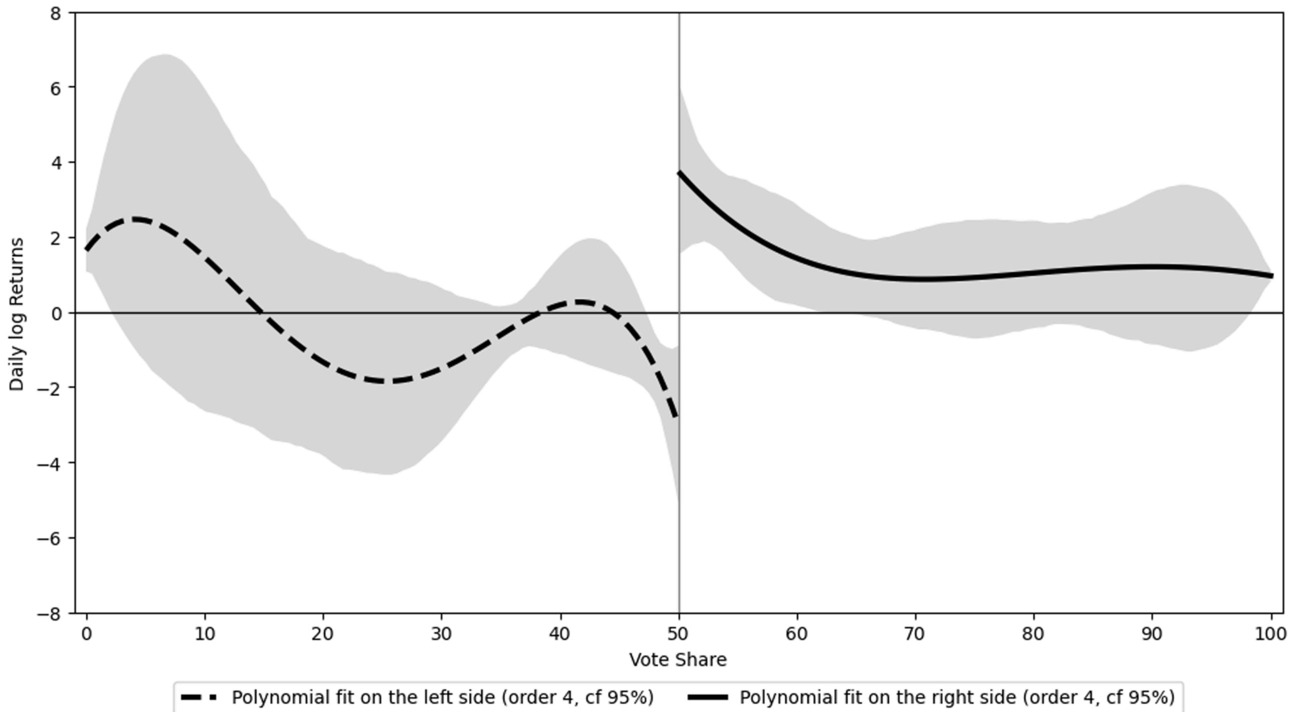

Fig. 1. Relationship between vote share and daily log returns on the day of the vote. The x-axis is the percentage of vote share in favor and the y-axis is the returns on the day of the vote outcome. The vertical line at the threshold (50 %) marks the cutoff for a proposal to pass. The solid lines on either side of the cutoff are fitted regressions using polynomials of order four with a confidence interval of 95 %. A noticeable discontinuity at the cutoff suggests a significant impact of proposal approval on excess returns, highlighting the influence of governance decisions on financial outcomes.

democratization, measured by the 100-Gini index, enhances value creation, with the interaction coefficient at 0.072. Greater equality in token ownership appears to foster confidence in governance outcomes, thereby positively impacting token returns. Model 5 examines decentralization, measured using the Nakamoto index, and finds that a higher degree of decentralization amplifies the effect of proposal passage, with an interaction coefficient of 0.273. This suggests that more distributed control contributes to value creation.

Model 6 incorporates all moderating variables, confirming the individual and combined significance of vote participation, democratization, and decentralization. Control variables also provide additional insights: daily log returns are positively influenced by the number of DAO investors, proposer requests for governance tokens, DAO age, and the number of competing proposals. Conversely, a higher number of past proposals within a DAO negatively correlates with daily log returns, potentially reflecting market fatigue or diminishing marginal returns to governance activity.

In Fig. 1, we graphically illustrate the result from the RDD with polynomials of order four on both sides of the majority threshold. The plot indicates that the curves are reasonably well-behaved as they approach the majority threshold of 50 % for our identifying local continuity assumption to hold. The reason for the variation in the left-hand-side curve for proposals that eventually failed is a relatively low number of such proposals being put to vote (Zhao et al., 2022), resulting in inflated standard errors for those with rather low success probability that were put to vote. As we identify local average treatment effects asymptotically at the majority threshold, Fig. 1 indicates our model fits the data locally well, with an economically highly significant discontinuity.

To further assess the validity of our approach, in line with Cuñat et al. (2012), we incorporate polynomials of varying orders on both sides of the vote-share threshold. Table A4 in the Appendix presents the results of estimating the polynomial coefficients by progressively increasing the orders on the left-hand and right-hand sides of the majority threshold. We observe that the highest level of statistical significance is achieved with the inclusion of fourth-order polynomials, whereas using polynomials of differing orders leads to a reduced level of significance. Our findings remain consistent when employing higher-order polynomials, suggesting that we are capturing a genuinely discontinuous effect.

The identification assumption of the RDD is that the probability of a proposal falling on either side of the threshold is continuous, as discontinuous changes at the vote-share threshold should not result from endogenous sorting. To validate this assumption, we apply the density test proposed by McCrary (2008), which evaluates the smoothness of the vote-share distribution around the threshold. The results confirm that the vote-share distribution is smooth near the threshold, supporting the validity of the identification assumption. Figure A1 in the Appendix shows the McCrary density test, illustrating the smoothness of the vote-share distribution around the threshold.

We then perform three additional robustness tests. First, we examine the effect of passing a proposal using OLS estimation by progressively restricting the sample to proposals that are closer to the majority threshold. As shown in Table A5, the results remain statistically significant despite the reduction in sample size as the observation window narrows. Specifically, the effect of passing a proposal within five percentage points around the threshold is 4.274 %, consistent with the results of the unrestricted models using the RDD and a fourth-order polynomial in vote share.

Second, we use abnormal returns as the dependent variable. To estimate abnormal returns, we reconstruct the “DAO Index” as a market benchmark using data from Coinmarketcap, which includes all available DAO-related token prices and trading volumes. We calculate the index using both equally weighted and market value-weighted methods. The results, presented in Table A6, confirm our main findings. Specifically, passing a proposal around the threshold leads to a 5.459 % increase in equally weighted abnormal returns and a 5.680 % increase in value-weighted abnormal returns.

Finally, considering the exceptional crypto market conditions of 2021–2022, characterized by pronounced volatility and intense speculative activity, we replicate the main analysis excluding this period. This analysis ensures that DAO token returns are not contingent on the unique market dynamics of this timeframe. We report the results of the RDD using the subsample of 10,648 observations (40.4 %) in Table A7. The results during this subperiod show that passing a proposal around the threshold leads to a 4.2 % increase, and one standard deviation of increase in vote participation amplifies this effect by 1.3 %. Further, although the proxy of democratization is positive but not significant for the subsample, we find that a higher degree of decentralization amplifies the effect of proposal passage. Overall, these results confirm the findings of our main analysis.

4. Conclusions

In this study, we employ an RDD to analyze the valuation effects of decision-making in distributed governance models, focusing on participatory mechanisms in DAOs. These mechanisms enable tokenholders to have a voice proportional to their contributions. The local average treatment effects indicate that the passage of proposals near the majority threshold significantly increases tokenholder returns. This effect is amplified by higher voter participation, more equal token ownership (reflecting DAO democratization), and more competitive consensus (reflecting DAO decentralization). Overall, the analysis provides compelling evidence that distributed governance mechanisms can create value for stakeholders.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econlet.2025.112233.

Data availability

Data will be made available on request.

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