Measuring the Concentration of Power in Optimism

By Chain_L and team

Preface

This research report has been prepared for submission to the Optimism Collective with the primary aim of analyzing the distribution and concentration of power within its governance structure. As Decentralized Autonomous Organizations (DAOs) continue to evolve, understanding the dynamics of power concentration becomes increasingly important to ensure fairness, transparency, and true decentralization.

The report introduces and applies a new metric, the Concentration of Power Index (CPI), which builds upon the traditional Herfindahl-Hirschman Index (HHI) to offer a more nuanced view of power distribution within the Optimism Collective. By considering the voting power of individual delegates and the roles of various governance bodies—such as the Token House, Citizen House, and various councils and committees—the CPI provides a comprehensive measure of how influence is spread across the Collective.

In addition to the CPI, the report also examines the Nakamoto Coefficient, a key indicator of decentralization that measures the minimum number of members required to control a majority of the voting power. Comparing the Optimism Collective with other prominent DAOs such as Compound, Aave, and Uniswap, this report offers valuable insights into how different governance structures impact power distribution.

The findings presented in this report inform future governance decisions, helping to maintain and enhance the decentralized nature of the Optimism Collective. As the Collective grows and adapts, continuous monitoring of power dynamics will be essential to uphold its core principles of fairness and inclusivity.

This report is a collaborative effort, reflecting the collective expertise and commitment of all contributors to advancing the goals of the Optimism Collective. We hope that the insights gained from this research will serve as a valuable resource for the ongoing development and refinement of governance practices within the Collective.

Acknowledgement

We would like to extend our sincere gratitude to the Optimism Collective for sponsoring and supporting this research task. The support has been instrumental in enabling us to explore and analyze the governance structures within the Collective.

We want to thank Emily for her continuous support and guidance throughout this research task. Her insights and advice were essential in shaping the direction and outcomes of our research.

We are grateful to Varit and the curiaLab team for their invaluable contributions on the data side, wherever required.

This report would not have been possible without the collaboration and commitment of all involved, and we are deeply appreciative of their efforts.

Team Information

Chain-L

With 4 years of experience in the blockchain industry, Chain-L has developed and built various projects across multiple ecosystems. His deep understanding of underlying technologies, particularly Layer 2 solutions, allows him to proficiently evaluate and modify economic metrics to assess complex blockchain governance structures. Chain-L is a versatile contributor to the Collective, actively involved in building experimental projects on application layers and developing dashboards for Season 5 Missions.

Twitter Profile
Dework Profile (20 tasks completed – numbaNERDs)

ARDev097

ARDev097 specializes in data warehousing, ETL processes, and database management systems like MySQL and PostgreSQL. His expertise in blockchain data analysis, particularly with tools like Dune Analytics, enables him to create interactive and insightful Dune Dashboards. He is skilled in quantitative analysis, integrating advanced metrics into data dashboards, and has a strong background in analyzing the efficiency of governance mechanisms and economic models within blockchain networks.

Twitter Profile
Dework Profile (18 tasks completed – numbaNERDs)

Dhruvi

A gold medalist in both her Bachelor of Science in Information Technology and Master of Science in Data Science, Dhruvi is an expert in data visualization and reporting. She excels in creating visualizations using tools like Tableau, Power BI, and Matplotlib, translating complex data into easy-to-understand dashboards and reports. Dhruvi is highly skilled in storytelling with data, driving business decisions, and is proficient in front-end development for custom visual analytics solutions. Her expertise also includes developing temporal visualizations to track changes and trends.

LinkedIn Profile

Other Contributions by Our Team in the Optimism Ecosystem

Our team has been actively involved in various initiatives within the Optimism ecosystem including numbaNERDs and BadgeHolder Onchain Analysis Report , contributing to its growth and development. You can check out our other contributions here.

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Concentration of Power Index (CPI)

A metric adapted from the Herfindahl-Hirschman Index (HHI) to measure the concentration of power in decentralized autonomous organizations (DAOs), considering both the voting power of individual delegates and their roles across various governance bodies.

Herfindahl-Hirschman Index (HHI)

A traditional measure of market concentration calculated by summing the squares of the market shares of all firms in a market. In the context of DAOs, it measures the concentration of voting power among delegates.

Decentralized Autonomous Organization (DAO)

An organization governed by smart contracts and blockchain technology, where decision-making is distributed among its members rather than a centralized authority.

Houses, Councils, and Committees (HCC)

Various governance bodies within the Optimism Collective that influence decision-making processes and power distribution.

Token House (Th)

A governance body within the Optimism Collective that represents token holders and their voting power.

Citizen House (Ch)

A governance body within the Optimism Collective representing a broader range of stakeholders, segmented into different rounds.

Grants Council (Gc)

A governance body responsible for managing and distributing grants within the Optimism Collective, including various seasons and sub-committees like Builders & Growth Experiments and Milestone & Metrics.

Code of Conduct Council (CoC)

A governance body within the Optimism Collective responsible for maintaining and enforcing the code of conduct.

Developer Advisory Board (DAB)

A committee within the Optimism Collective providing advice and guidance to developers.

Nakamoto Coefficient

A measure of decentralization indicating the minimum number of members required to hold over 51% of the total voting power within a DAO.

B. Abbreviations

CPI
Concentration of Power Index

HHI
Herfindahl-Hirschman Index

DAO
Decentralized Autonomous Organization

HCC
Houses, Councils, and Committees

Th
Token House

Ch
Citizen House

Gc
Grants Council

Gc(M&M)
Grants Council (Milestone & Metrics Sub-committee)

Sc
Security Council

CoC
Code of Conduct Council

DAB
Developer Advisory Board

V
Voting Power

I
Influence Factor

List of Graphs

Executive Summary

This report delves into the power dynamics within the Optimism Collective, focusing on measuring and analyzing power concentration within its decentralized governance model. Our study began with an examination of the Collective's unique organizational structure, where members of various Houses, Councils, and Committees (HCCs) are elected each season, each playing distinct roles in governance.

To evaluate the influence of each HCC, we established a set of standardized parameters. Assigning scores to these parameters and calculating weighted results, we developed a framework to map spheres of influence within the Optimism ecosystem.

Our research spans three seasons of the Optimism Collective, from Season 3 to Season 5, concentrating on key HCCs such as the Token House, Citizen House, Grants Council, Security Council, Code of Conduct Council, Developer Advisory Board, and Anticapture Commission. We meticulously compiled data on all members across these seasons to build a comprehensive dataset.

A detailed spreadsheet was created to visualize and analyze this data. This tool lists delegates and their voting power in the Token House and tracks their membership and influence across all HCCs.

To quantify power concentration, we applied the Herfindahl-Hirschman Index (HHI) to individual HCCs. Furthermore, we developed a Concentration of Power Index (CPI) to measure power concentration across the Optimism Collective.

For a broader context, we applied our methodology to other prominent DAOs, including Compound, Aave, and Uniswap. This comparative analysis provided insights into governance structures across the DeFi ecosystem, allowing us to understand how Optimism power dynamics compare to other decentralized organizations.

This report presents our methodology, findings, and insights, offering a nuanced understanding of power distribution within the Optimism Collective and its implications for decentralized governance.

Governance Bodies: Roles and Responsibilities in the Optimism Collective

Token House

- OP holders submit, deliberate, and vote on various governance proposals within the Optimism Collective.
- Voting can be done directly or by delegating OP voting power to their own address or an eligible third party.
- Non-grant proposals require approval from the top four out of 100 delegates in the Voting Cycle Roundup thread to proceed to the voting phase.

Citizens' House

- Allocates rewards in Retro Funding.
- Votes on vetoes for upgrade proposals.
- Non-grant proposals need approval from four citizens to move forward to the voting phase.

Grants Council

General Responsibilities:

- Handle Delegate Mission Applications and review them in different cycles.
- Evaluate whether grant recipients meet their predefined milestones.
- Ensure council operations and performance are transparent to the community.

Specific Responsibilities of Reviewers

- Evaluate and vote on grant proposals within their sub-committee, requiring subject matter expertise, including at least one technical member per sub-committee.
- Provide feedback and answer applicants' questions via public channels.
- Help proposers ensure their milestones are clear, measurable, and achievable within the timeframe.
- Maintain over 70% participation in Council votes and sub-committee meetings.
- Record reasoning behind votes for each grant undergoing substantive review.
- Provide necessary information for regular reports and updates promptly.
- Dedicate sufficient weekly time to fulfill reviewer duties.

Info: For a comprehensive overview of the Grants Council's duties and processes, visit the Grants Council Overview.

Governance Bodies: Roles and Responsibilities in the Optimism Collective

Security Council

Responsibilities of Security Council Key Holders:

- Ensure effective communication and coordination among participants.
- Maintain the security of their keys and verify/implement upgrades and permission changes approved by Optimism Governance.
- Notify others and work together to resolve emergencies promptly.
- Provide continued access to keys via periodic liveness checks, where participants must prove that they can access their keys within a set time limit.

Responsibilities of the Council Lead:

- Alert key holders about upcoming upgrades or permission proposals.
- Manage timelines for required actions, schedule and set agendas for Council meetings, and facilitate discussions.
- Monitor and ensure compliance with the Council's procedures, onboard new Council participants, and communicate with external stakeholders about Council operations.

Accountability

- The Security Council is accountable to Optimism Governance.
- **Removal for Violations:**

1. Governance Vote: The Token House can vote to remove Security Council members for severe Code of Conduct violations.
2. Emergency Response: The Council can remove a participant who fails to meet the Charter's requirements in an emergency.
3. Automatic Removal: If a key holder fails to prove key access during scheduled checks, a vote for their replacement will occur in the next voting cycle. The decision-making threshold may be adjusted to ensure it remains above 75% of the signers. If the number of signers drops below eight, control of the Security Council transfers to the Foundation.

Info: Detailed guidelines and responsibilities of the Security Council are available in the Security Council Charter.

Governance Bodies: Roles and Responsibilities in the Optimism Collective

Code of Conduct Council

Goals

- Replace the Foundation in processing reported Code of Conduct violations.
- Eliminate enforcement responsibilities for Token House delegates by entrusting the Code of Conduct Council with dispute processing.
- Maintain accountability through the Token House's power to veto enforcement actions.
- Process any violation reports filed in the Citizens' House involving a member of the Citizens' House Code of Conduct Council.

Special Considerations

- Code of Conduct Violation reports related to Security Council members will still be subject to a full Token House vote due to high-security requirements.

Member Responsibilities

- Process all Code of Conduct Violation reports, except for Grant Misusage reports, by the end of the nearest review period.
- Publish a summary of enforcement decisions by the end of each Voting Cycle's review period (Wednesday at 19:00 GMT) to the forum for optimistic approval.
- Process violation reports from the Citizens' House involving its Code of Conduct Council members.

Council Lead Responsibilities

- Coordinate reviews and host regular meetings at least once per Voting Cycle with reports filed.
- Facilitate community access to meeting minutes or summaries.
- Act as a tie-breaker in case of a deadlock on administrative or operational matters.

Info: Review the Code of Conduct Council's procedures and goals in the Code of Conduct Council Guidelines.

Governance Bodies: Roles and Responsibilities in the Optimism Collective

Developer Advisory Board

- Established by the Foundation to assist Optimism Governance in making informed technical decisions.
- The board does not vote on proposals but must approve all Delegate Mission Requests under Intent #1 with a simple majority.
- Review all Delegate Mission Request drafts under Intent #1 and provide feedback if approval is not given.
- Create and publish a rubric for evaluations, and provide a statement on each approved Delegate Mission Request either affirming its importance or registering skepticism regarding its technical merits
- Work with the Grants Council to assess the merits of Mission Applications under Intent #1 and potentially other Intents.
- Assess the completion of technical milestones for Intent #1 Missions and other advised Mission Requests.
- Board members may also create their own Delegate Mission Requests but are not required to do so.
- Members should expect to dedicate 5-8 hours per week to these responsibilities.

Advisory Board Lead Responsibilities

- Publish the board's internal operating procedures before Season 5.
- Facilitate board member reviews, host regular meetings at least once per Grants Cycle (every 6 weeks), and provide public meeting minutes or summaries.
- Ensure milestones on technical Missions are met before milestone-based disbursements.
- Exercise decision-making authority on administrative or operational matters if the board cannot reach a consensus.

Info: Find out more about the Developer Advisory Board's operations and requirements in the Developer Advisory Board Operating Procedures.

Governance Bodies: Roles and Responsibilities in the Optimism Collective

Anticapture Commission

Established to uphold high standards of delegate engagement and prevent any single token holder or group of token holders from capturing control of the Token House.

Membership Responsibilities

- Attend office hours at least once per Voting Cycle to listen to and raise community concerns.
- Provide delegate approvals or a reason for not approving more than 10% of proposals requiring approval.
- In Season 4, only delegates with more than 0.25% voting power could provide delegate approvals on proposal drafts. In Season 5, the top 100 delegates will be able to provide approvals, which will include all members of the Anticapture Commission.
- Failure to meet expectations disqualifies a member for the subsequent period.
- Members can designate leadership roles among themselves as needed.
- Members will receive group delegation, but not OP rewards, for their participation in the Anticapture Commission.

Commission Lead Responsibilities

- Must be a qualifying member of the commission.
- Organize regular commission meetings and make summaries available to the community.
- Execute votes from the delegation wallet according to the commission vote outcomes.
- Author or coordinate authorship of any reports circulated to the Citizens' House. A report must have four delegate approvals from commission members to be considered valid.
- Calculate qualifying delegates at the midpoint of the Season and before the start of the next Season, including the assessment of whether Members have upheld the Member Responsibilities.
- Exercise decision-making authority if the commission cannot come to a consensus on a matter (i.e., serve as a tie-breaker).

Info: The **Anticapture Commission Charter** provides detailed information on the commission's objectives and member responsibilities.

Parameters for Measuring Influence in the Optimism Collective

To accurately assess the influence of each House, Council, and Committee (HCC) within the Optimism Collective, we developed a comprehensive set of parameters. These parameters capture the unique roles and contributions of each governance body, enabling a quantitative analysis of their decision-making authority, scope of influence, and overall impact on governance. Below is a detailed description of each parameter:

Decision-Making Authority

This parameter measures the extent to which a council or committee can make binding decisions that directly affect the governance or operations of Optimism.

Scope of Influence

This parameter assesses the breadth of a council or committee's impact within the Optimism ecosystem, including the range of areas or activities they influence.

Community Engagement

This parameter evaluates the level of active interaction between the council or committee and the community, including activities such as gathering feedback, holding public meetings, and providing updates.

Operational Independence

This parameter measures the degree of autonomy a council or committee has in its operations, including control over its budget, decision-making processes, and procedural oversight.

Voting Power

This parameter assesses the extent of voting authority held by the council or committee members, including their ability to approve or reject proposals.

Veto Power

This parameter evaluates whether a council or committee has the authority to veto or reject decisions made by other governance bodies.

Method for Measuring the Influence of Optimism Governance HCC

Parameters

Let P represent the set of parameters used to measure influence, where:

$P = \{D, S, C, O, V, Ve\}$

- $D = Decision\ Making\ Authority$
- $S = Scope\ of\ Influence$
- $C = Community\ Engagement$
- $O = Operational\ Independence$
- $V = Voting\ Power$
- $Ve = Veto\ Power$

Weights

Let W_P represent the set of weights assigned to each parameter, where:

$W_P = \{W_D, W_S, W_C, W_O, W_V, W_{Ve}\}$

- $W_D = Weight\ of\ Decision\ Making\ Authority$
- $W_S = Weight\ of\ Scope\ of\ Influence$
- $W_C = Weight\ of\ Community\ Engagement$
- $W_O = Weight\ of\ Operational\ Independence$
- $W_V = Weight\ of\ Voting\ Power$
- $W_{Ve} = Weight\ of\ Veto\ Power$

Houses, Councils, and Committees (HCCs)

The HCCs within the Optimism Collective are as follows:

- $Th = Token\ House$
- $Ch = Citizens'\ House$
- $Gc = Grants\ Council\ (Builders\ \&\ Growth\ Experiments\ Sub\ committee)$
- $Gc(M\&M) = Grants\ Council\ (Milestone\ \&\ Metrics\ Sub\ committee)$
- $Sc = Security\ Council$
- $CoC = Code\ of\ Conduct\ Council$
- $DAB = Developer\ Advisory\ Board$

Weighted Scores Calculation for Each HCC

The weighted score for each HCC is calculated by summing the products of each parameter's score and its corresponding weight:

Token House:

$$W_{Th} = \sum_{i \in P} W_i \times Th_i$$

$$W_{Th} = W_D \cdot D_{Th} + W_S \cdot S_{Th} + W_C \cdot C_{Th} + W_O \cdot O_{Th} + W_V \cdot V_{Th} + W_{Ve} \cdot Ve_{Th}$$

W_{Th} is the weighted score of the Token House

Citizens' House

$$W_{Ch} = \sum_{i \in P} W_i \times Ch_i$$

$$W_{Ch} = W_D \cdot D_{Ch} + W_S \cdot S_{Ch} + W_C \cdot C_{Ch} + W_O \cdot O_{Ch} + W_V \cdot V_{Ch} + W_{Ve} \cdot Ve_{Ch}$$

W_{Ch} is the weighted score of the Citizens' House

Grants Council (Builders & Growth Experiments Sub-committee)

$$W_{Gc} = \sum_{i \in P} W_i \times Gc_i$$

$$W_{Gc} = W_D \cdot D_{Gc} + W_S \cdot S_{Gc} + W_C \cdot C_{Gc} + W_O \cdot O_{Gc} + W_V \cdot V_{Gc} + W_{Ve} \cdot Ve_{Gc}$$

W_{Gc} is the weighted score of the Grants Council (Builders & Growth Experiments)

Grants Council (Milestone & Metrics Sub-committee)

$$W_{Gc(M\&M)} = \sum_{i \in P} W_i \times Gc(M\&M)_i$$

$$W_{Gc(M\&M)} = W_D \cdot D_{Gc(M\&M)} + W_S \cdot S_{Gc(M\&M)} + W_C \cdot C_{Gc(M\&M)} + W_O \cdot O_{Gc(M\&M)} + W_V \cdot V_{Gc(M\&M)} + W_{Ve} \cdot Ve_{Gc(M\&M)}$$

$W_{Gc(M\&M)}$ is the weighted score of the Grants Council (Milestone & Metrics)

Security Council

$$W_{Sc} = \sum_{i \in P} W_i \times Sc_i$$

$$W_{Sc} = W_D \cdot D_{Sc} + W_S \cdot S_{Sc} + W_C \cdot C_{Sc} + W_O \cdot O_{Sc} + W_V \cdot V_{Sc} + W_{Ve} \cdot Ve_{Sc}$$

W_{Sc} is the weighted score of the Security Council

Code of Conduct Council:

$$W_{CoC} = \sum_{i \in P} W_i \times CoC_i$$

$$W_{CoC} = W_D \cdot D_{CoC} + W_S \cdot S_{CoC} + W_C \cdot C_{CoC} + W_O \cdot O_{CoC} + W_V \cdot V_{CoC} + W_{Ve} \cdot Ve_{CoC}$$

W_{CoC} is the weighted score of the Code of Conduct Council

Developer Advisory Board:

$$W_{DAB} = \sum_{i \in P} W_i \times DAB_i$$

$$W_{DAB} = W_D \cdot D_{DAB} + W_S \cdot S_{DAB} + W_C \cdot C_{DAB} + W_O \cdot O_{DAB} + W_V \cdot V_{DAB} + W_{Ve} \cdot Ve_{DAB}$$

W_{DAB} is the weighted score of the Developer Advisory Board

Percentages Calculation

Total Weighted Score:

$$Total\ Weighted\ Score = W_{Th} + W_{Ch} + W_{Gc} + W_{Gc(M\&M)} + W_{Sc} + W_{CoC} + W_{DAB}$$

Influence Calculation

$$I(HCC) = \left(\frac{W_{HCC}}{Total\ Weighted\ Score}\right) \times 100$$

Where $I(HCC)$ is the influence of the respective HCC, and W_{HCC} is the weighted score of that HCC.

Examples of Influence Calculations

Influence of Token House

$$I(Th) = \left(\frac{W_{Th}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of Citizens' House

$$I(Ch) = \left(\frac{W_{Ch}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of Grants Council (Builders & Growth Experiments)

$$I(Gc) = \left(\frac{W_{Gc}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of Grants Council (Milestone & Metrics Sub-committee)

$$I(Gc(M\&M)) = \left(\frac{W_{Gc(M\&M)}}{Total\ Weighted\ Score}\right) \times 100$$

Examples of Influence Calculations

Influence of Security Council

$$I(Sc) = \left(\frac{W_{Sc}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of the Code of Conduct Council:

$$I(CoC) = \left(\frac{W_{CoC}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of Developer Advisory Board:

$$I(DAB) = \left(\frac{W_{DAB}}{Total\ Weighted\ Score}\right) \times 100$$

Influence of Governance Bodies Within Optimism Collective

The following table presents the final influence values of each governance body within the Optimism Collective, calculated based on the weighted parameter scoring method detailed above. These values represent the relative influence of each House, Council, and Committee in the decision-making processes of the Optimism DAO.

Governance Body	Percentage (%)
Token House (Th)	**32.33%**
Citizens' House (Ch)	**34.59%**
Grants Council Builders & Growth Experiments Sub-committee (Gc)	**10.15%**
Grants Council Milestone & Metrics Sub-committee (Gc(M&M))	**2.82%**
Security Council (Sc)	**13.17%**
Code of Conduct Council (CoC)	**4.32%**
Developer Advisory Board (DAB)	**3.01%**

Observations

- **Citizen House (Ch)** holds the highest influence within the collective, accounting for **34.59%** of the total influence.
- **Token House (Th)** follows closely with **32.33**%, making it another significant governance body within Optimism.
- **Grants Council (Gc)** and **Security Council (Sc)** also contribute notable influence, with **10.15%** and **13.17%,** respectively.
- **Grants Council Milestone & Metrics Sub-committee (Gc(M&M)), Code of Conduct Council (CoC), and Developer Advisory Board (DAB)** have relatively lower influence, reflecting their more focused roles within the governance framework.

These influence values provide insight into how decision-making authority and power are distributed among the various governance bodies, highlighting the balance between them within the Optimism Collective.
For a detailed example of this influence calculation, please refer to the Behind the Scenes Document attached below in the Resources section.

Herfindahl-Hirschman Index (HHI) for Power Concentration Measurement

The Herfindahl-Hirschman Index (HHI) is a key metric used to assess market concentration and competitiveness, particularly in scenarios involving mergers and acquisitions. In the context of the Optimism Collective, the HHI serves as a tool to measure the concentration of power among various Houses, Councils, and Committees (HCCs). By evaluating how influence is distributed across the governance structure, the HHI provides valuable insights into the centralization or decentralization of power within the Collective.

Formula and Calculation of the HHI

The HHI is calculated by squaring the market share of each entity within a market and then summing the resulting values. The index ranges from close to zero to 10,000, where a lower HHI indicates a more decentralized distribution of power, and a higher HHI suggests greater centralization.

Formula

$$HHI = S_1^2 + S_2^2 + S_3^2 + \ldots + S_n^2$$

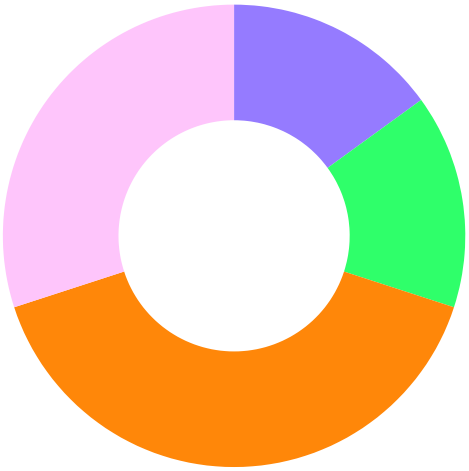
Where

- $S_n = market\ share\ percentage\ of\ firm\ n$
- $expressed\ as\ a\ whole\ number,\ not\ a\ decimal$

Example of the HHI

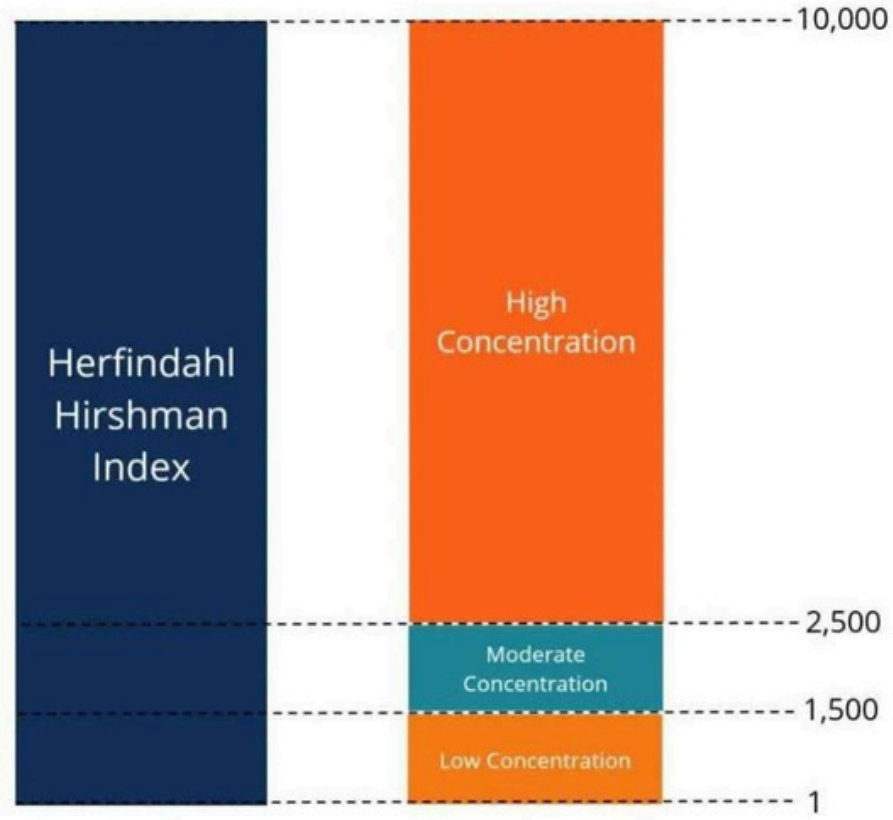
Consider a hypothetical industry with four firms:

- Firm 1 market share = 40%
- Firm 2 market share = 30%
- Firm 3 market share = 15%
- Firm 4 market share = 15%



$$HHI = 40^2 + 30^2 + 15^2 + 15^2$$
$$= 1600 + 900 + 225 + 225 = 2950$$

Interpretation of the Herfindahl-Hirschman Index (HHI):



- A market with an HHI below 1,500 is considered competitive.
- An HHI of 1,500 to 2,500 indicates moderate concentration.
- An HHI of 2,500 or greater signifies high concentration.

Info: For a detailed explanation of the Herfindahl-Hirschman Index, including its calculation and applications, refer to the **Herfindahl-Hirschman Index (HHI).**

Concentration of Power Index (CPI)

What is CPI?

The Concentration of Power Index (CPI) is an adaptation of the traditional Herfindahl-Hirschman Index (HHI) tailored to measure the concentration of voting power in decentralized autonomous organizations (DAOs) like the Optimism Collective. While the standard HHI simply sums the squares of market shares or voting power, the CPI introduces a more nuanced approach by incorporating the influence of various Houses, Councils, and Committees (HCCs). This modification provides a more accurate reflection of power concentration within DAOs, where governance is distributed across multiple entities, each with varying degrees of influence.

CPI Formula:

$$CPI = \sum_{i \in D} (V_i)^2$$

where

- D is the set of delegates in the organization: D={d1, d2, d3, . . . , dn}
- Vi is the weighted voting power of delegate i, calculated as:

$$V_i = \sum_{j \in HCC} (V_j * I_j)$$

where

- HCC represents the set of Houses, Councils and Committees in the governance structure:HCC={Th, Ch, Gc, Gc(M&M), Sc, CoC, DAB}
- Vj is the voting power of delegate i in house or council j.
- Ij is the influence factor of house or council j in the overall Optimism governance.

How CPI is Modified and Different from the Original HHI

The CPI is a modified version of the traditional HHI, designed specifically for decentralized governance models like those found in DAOs. The key differences between CPI and the original HHI are as follows:

Weighted Voting Power

In the traditional HHI, the index is calculated by summing the squares of each entity's market share or voting power. In contrast, the CPI weights each delegate's voting power by the influence of the governance body they belong to (e.g., Token House, Citizens' House, or various councils). This adjustment ensures that the influence of different governance structures is accurately reflected in the calculation.

Multiple Governance Bodies

The original HHI assumes a single layer of power distribution, whereas the CPI accounts for multiple layers of governance within a DAO, including Houses, Councils, and Committees. This modification allows for a more comprehensive assessment of power concentration by recognizing that different governance bodies wield varying levels of influence over decision-making.

Influence Factors

The introduction of influence factors (Ij) for each governance body distinguishes CPI from the traditional HHI. These factors adjust the impact of each governance body on the overall concentration of power, acknowledging that some bodies may have more significant influence than others.

By incorporating these modifications, the CPI offers a more nuanced and accurate measurement of power concentration within decentralized organizations, effectively capturing the complex, multi-layered governance structures that characterize them.

Data Sheet Creation

To analyze the concentration of power within the Optimism Collective, a comprehensive dataset was compiled. This dataset consolidates information about delegates, their voting power, and their memberships across various Houses, Councils, and Committees (HCCs) within the governance structure.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		token_house		citizen_house			season 3	season 4	season 5				influence				
2	members	voting_power	th_influence	member_r2	member_r3	member_r4	gc_member	gc_member	gc_member	gc_member_m&m	coc_member	dab_member	round2_season3	round2_season4	round2_season5	round3_season5	round4_season5
3	0x3eee61b92c36e97be6319bf9096a1ac3c04a1466	10536142.77	11.43545369	0	0	0	0	0	0	0	0	0	4.57	4.57	3.66	3.66	3.66
4	0xf1fb8a8c3cb8bb7dbc1518a613b10ceb0bbfc06b	5216990.675	5.662285499	0	0	0	0	0	0	0	0	0	2.26	2.26	1.81	1.81	1.81
5	0x1b686ee8e31c5959d9f5bbd5122a5868278deead	5213153.08	5.658120995	0	0	0	1	1	0	0	0	0	3.93	3.93	2.81	2.81	2.81
6	0xef8d84e0fd304550da242040ccd45bd44ce71f1	5031814.327	5.461304103	0	0	0	0	0	0	0	0	0	2.18	2.18	1.75	1.75	1.75
7	0x5e548eea2dc61abcd9dd90ce94d04136151a09ee	4155727.754	4.510439268	1	1	1	0	0	0	0	0	0	2.42	2.42	1.92	1.71	1.7
8	0x429f9ada43e9f345cbb35ec8868fbb70ef808d92	3412532.007	3.703508177	1	1	1	0	0	0	0	0	0	2.1	2.1	1.66	1.45	1.44
9	0x2b838954421b424c5d3d9ce9bb67c9bd47537d12	2709244.323	2.940491476	1	1	1	0	0	0	0	0	0	1.79	1.79	1.42	1.21	1.2
10	0x4b0558b9b6f53e60a186d2b0478ce841991d8fa	2612297.915	2.835270221	0	1	1	0	0	0	0	0	0	1.13	1.13	0.91	1.17	1.16
11	0xa6e8772af29b29b0202a0738e36f447689beef6	2390798.751	2.594655929	0	0	0	1	1	1	0	0	0	2.7	2.7	1.83	1.83	1.83
12	0x4f41877773e44f2275da1942fee890556621bf66	1862659.847	2.021640906	0	0	0	1	1	1	0	0	0	2.48	2.48	1.65	1.65	1.65
13	0x496b607644c5d7bfda95963201e45a4c8ab1c159	1681480.867	1.82500342	0	0	0	1	1	1	0	0	0	2.4	2.4	1.58	1.58	1.58
14	0x48a63097e1ac123b1f5a8bbffafa4afa8192fab0	1587666.831	1.723181901	1	1	1	0	0	0	0	0	0	1.31	1.31	1.03	0.82	0.81
15	0x6eda5acaff7f5964e1ecc3fd61c62570c186ca0c	1339424.693	1.45375044	0	1	1	1	1	1	0	0	0	2.25	2.25	1.47	1.73	1.72
16	0x94db03720f76fb697dbd33524aadffd1068190c8	1266186.522	1.374261687	1	1	1	0	0	1	0	0	0	1.17	1.17	1.92	1.7	1.7
17	0xed11e5ea95a5a5440fbaadc4cc404c56d0a5bb04	1261872.786	1.369579753	0	0	0	0	0	0	0	0	0	0.55	0.55	0.44	0.44	0.44
18	0x7fc80fad32ec41fd5cfcc14eee9c31953b6b4a8b	1196816.795	1.298970917	0	1	1	0	0	0	0	0	0	0.52	0.52	0.42	0.68	0.67
19	0x070341aa5ed571f0fb2c4a56414096b1a46b4961b	1195176.909	1.297191959	0	0	0	0	0	0	0	0	0	0.52	0.52	0.42	0.42	0.42
20	0xb55a948763e0d386b6defcd8070a522216ae42b1	1085892.277	1.178578453	0	0	0	0	0	0	0	0	0	0.47	0.47	0.38	0.38	0.38
21	0x3d2d722b443a5cae8e41877bb7cd649f3650937c	1080558.611	1.172789533	0	0	0	0	0	0	0	0	0	0.47	0.47	0.38	0.38	0.38

Data Sheet Link

The columns in the dataset are described as follows:

Members

The Optimism address of each delegate within the Token House.

Token_house.voting_power

The voting power is associated with each delegate, representing their influence within the Token House.

Token_house.influence

The percentage share of voting power held by each delegate in the Token House.
(Calculated as (voting_power / total_voting_power) * 100)

citizen_house.member_r2

Indicates whether the delegate is a member of the Citizen House Round 2.
(1 = member, 0 = not a member)

citizen_house.member_r3

Indicates whether the delegate is a member of the Citizen House Round 3

citizen_house.member_r4

Indicates whether the delegate is a member of the Citizen House Round 4.

season 3.gc_member

Indicates whether the delegate is a member of the Grants Council for Season 3.

season 4.gc_member

Indicates whether the delegate is a member of the Grants Council for Season 4.

season 5.gc_member

Indicates whether the delegate is a member of the Grants Council for Builders & Growth Experiments Sub-committee during Season 5.

season 5.gc_member_m&m

Indicates whether the delegate is a member of the Grants Council for Milestone & Metrics Sub-committee during Season 5.

season 5.coc_member

Indicates whether the delegate is a member of the Code of Conduct Council (CoC) during Season 5.

season 5.dab_member

Indicates whether the delegate is a member of the Developer Advisory Board (DAB) during Season 5.

influence.round2_season3

The influence score for delegates participating in both Citizen House Round 2 and Season 3.

influence.round2_season4:

The influence score for delegates participating in both Citizen House Round 2 and Season 4.

influence.round2_season5

The influence score for delegates participating in both Citizen House Round 2 and Season 5.

influence.round3_season5

The influence score for delegates participating in both Citizen House Round 3 and Season 5.

influence.round4_season5

The influence score for delegates participating in both Citizen House Round 4 and Season 5.

Calculation of Influence Columns

The influence columns in the data sheet represent the weighted influence of each delegate, calculated based on their participation across multiple governance bodies within the Optimism Collective. These bodies include the Token House, Citizen House, Grants Council, Code of Conduct Council, and Developer Advisory Board.

The influence score is computed using the following steps:

Weighted Voting Power (Vi)

For each delegate, their voting power in different governance bodies (Token House, Citizen House Rounds, Grants Council Seasons, etc.) is multiplied by the respective influence factor (Ij) of those governance bodies.

Summation of Weighted Voting Power

The influence of each delegate (Vi) is calculated by summing the products of their voting power across all the governance bodies in which they participate.

Influence Column Calculation

Each delegate's influence score for specific combinations of governance bodies (e.g., Citizen House Round 2 and Season 3) is calculated by summing the products of their voting power in those bodies and their respective influence factors.

CPI Calculation

To measure the concentration of power within the Optimism Collective, the Concentration of Power Index (CPI) is calculated. CPI is the sum of the squares of each delegate's influence score across all governance bodies.

This calculation provides a comprehensive view of each delegate's influence, considering their involvement across multiple layers of governance. The resulting influence columns are then used to analyze power concentration and decentralization within the Optimism Collective.

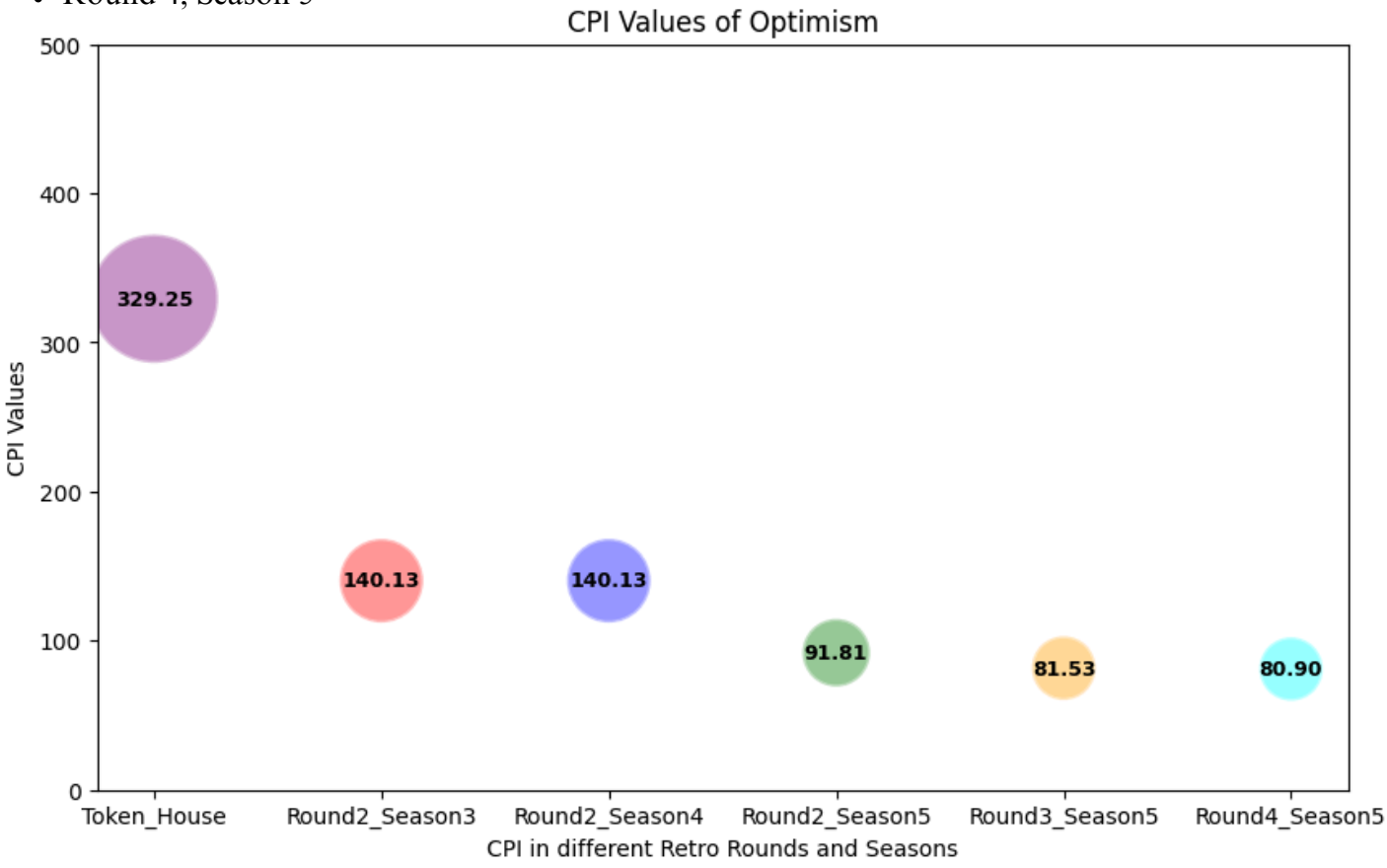
Concentration of Power Index (CPI) Across Different Rounds and Seasons

Overview

- The CPI was calculated to measure the concentration of voting power in the Token House for different rounds and seasons of the Optimism Collective's governance.
- Below is a detailed presentation of the CPI values for various rounds and seasons, reflecting the concentration trends within the governance structure over time.

The following graph represents the CPI observed in the Token House, and across different governance periods:

- Round 2, Season 3
- Round 2, Season 4
- Round 2, Season 5
- Round 3, Season 5
- Round 4, Season 5



CPI Values of Optimism

These values reflect the concentration trends within the governance structure, allowing for a detailed comparison of how power has been distributed over time.

Token House (Standalone)

The initial CPI value calculated solely for the Token House was 329.25. This value represents the concentration of voting power when only the Token House delegates were considered.

Token House + Citizen House Round 2 + Councils and Committees (Season 3)

When the membership data for the Token House delegates, Citizen House Round 2, and the councils and committees from Season 3 were included, the CPI value decreased significantly to 140.13.

Token House + Citizen House Round 2 + Councils and Committees (Season 4)

Similar to Season 3, the inclusion of the Token House delegates, Citizen House Round 2, and the councils and committees from Season 4 resulted in a CPI value of 140.13, showing consistency in power distribution between these periods.

Token House + Citizen House Round 2 + Councils and Committees (Season 5)

With the membership data from Season 5 included, along with the Token House delegates and Citizen House Round 2 members, the CPI dropped further to 91.81.

Token House + Citizen House Round 3 + Councils and Committees (Season 5)

Including membership data from Citizen House Round 3 and the councils and committees from Season 5 resulted in a CPI value of 81.53.

Token House + Citizen House Round 4 + Councils and Committees (Season 5)

Finally, considering the membership data from Citizen House Round 4 alongside the councils and committees from Season 5, the CPI reached 80.90, indicating further decentralization.

Conclusion

Decentralization Trend: The overall trend observed from these CPI calculations shows a steady decrease in CPI as new rounds and seasons are introduced. This decline indicates a gradual reduction in the concentration of power, suggesting that the governance structure of the Optimism Collective is becoming increasingly decentralized over time.

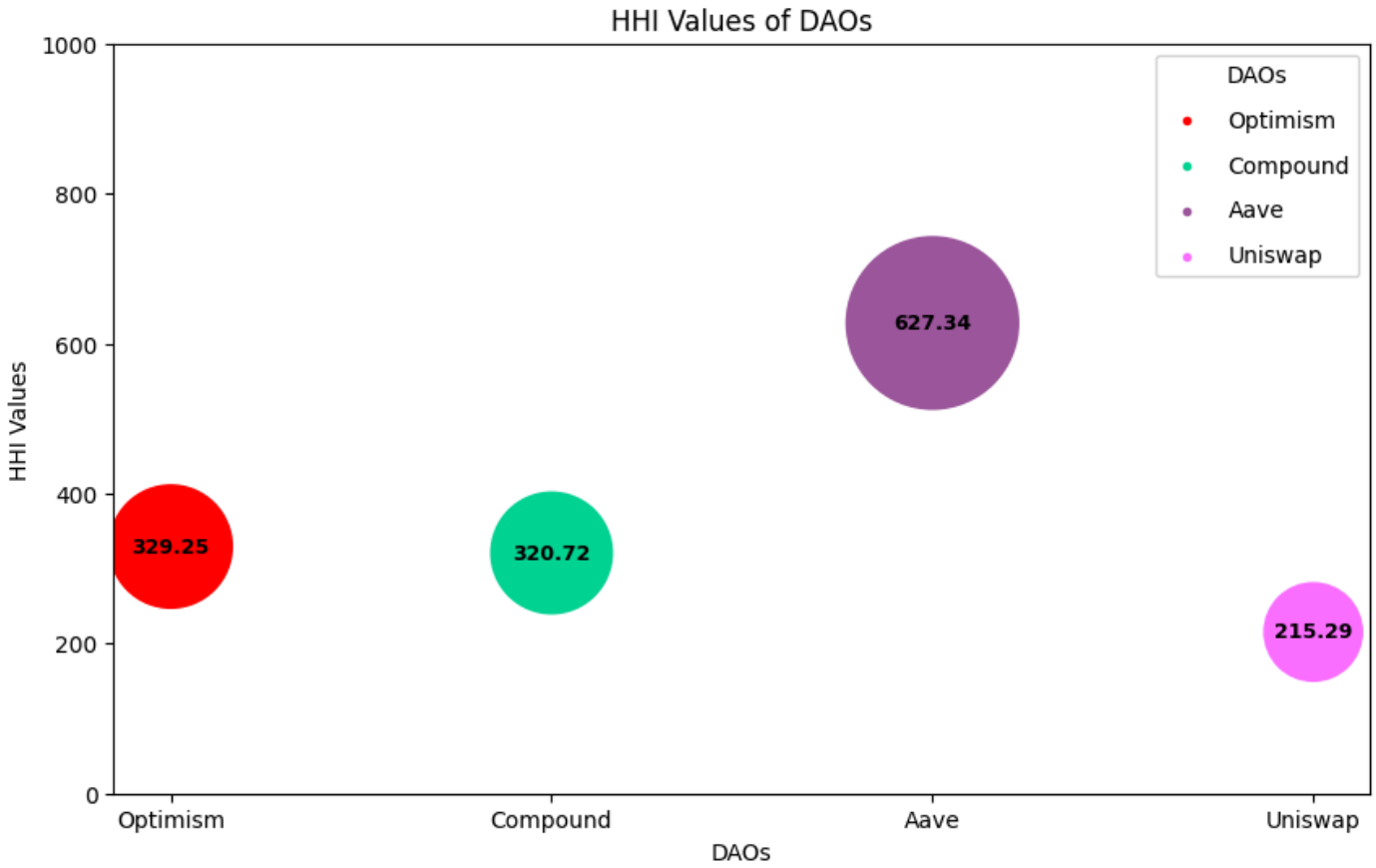
Herfindahl-Hirschman Index (HHI) Across Different DAOs

The graph below presents the HHI values calculated for four DAOs: Optimism, Compound, Aave, and Uniswap. These values reflect the concentration of voting power among delegates within each DAO, providing insight into their respective governance structures.

Methodology

- For Optimism, the HHI was calculated using only the Token House delegates and their voting power, deliberately excluding other governance layers such as houses, councils, and committees. This approach allows for a direct comparison with other DAOs that do not have similarly multi-layered governance structures.

- For Compound, Aave, and Uniswap, the HHI values were derived solely from the distribution of voting power among their respective delegates, offering a consistent basis for comparison.



HHI Values of DAOs

Observations

Optimism (HHI = 329.25):

The HHI for Optimism indicates a moderately high concentration of voting power among Token House delegates.

Compound (HHI = 320.72):

Compound's HHI is slightly lower than Optimism's, suggesting a relatively more decentralized distribution of voting power among its delegates.

Aave (HHI = 627.34):

Aave exhibits the highest HHI value among the four DAOs, indicating a significant concentration of voting power and a more centralized governance structure.

Uniswap (HHI = 215.29):

Uniswap has the lowest HHI, reflecting the most decentralized distribution of voting power among the DAOs analyzed.

Conclusion

The comparison of HHI values reveals varying levels of power concentration across these DAOs. Uniswap demonstrates the most decentralized voting power, while Aave shows the highest concentration. Optimism's HHI, when considering only the Token House, is relatively higher, underscoring the impact of governance structures on the distribution of voting power within decentralized organizations.

This comparison underscores the influence of governance structures on the distribution of voting power within decentralized organizations.

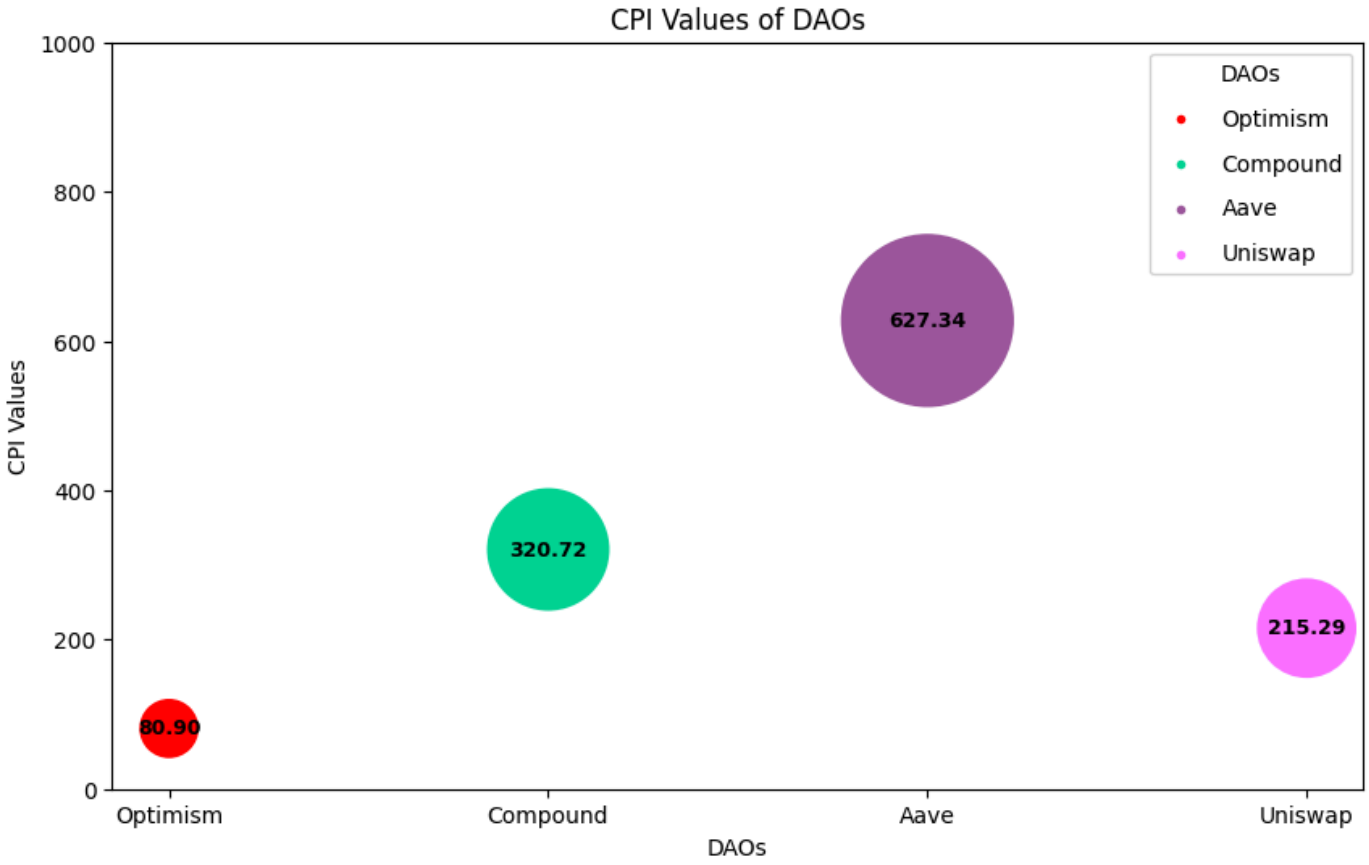
Concentration of Power Index (CPI) Across Different DAOs

The graph below showcases the CPI values calculated for four different DAOs: Optimism, Compound, Aave, and Uniswap. These values represent the concentration of power within each DAO, considering both the distribution of voting power among delegates and the influence of governance structures like houses, councils, and committees.

Methodology

- For Optimism, the CPI was calculated by including not only the Token House delegates but also the influence of other governance layers, such as houses, councils, and committees. This approach offers a more comprehensive measurement of power concentration within the Optimism Collective.

- For Compound, Aave, and Uniswap, the CPI values were determined solely based on the distribution of voting power among their respective delegates, as these DAOs lack the multi-layered governance structures present in Optimism.



CPI Values of DAOs

Observations

Optimism (CPI = 80.90):

The CPI for Optimism is significantly lower compared to the other DAOs, indicating a more decentralized distribution of power when considering the influence of all governance layers. This suggests that Optimism's multi-layered governance structure contributes to reducing power concentration.

Compound (CPI = 320.72):

Compound exhibits a moderately high CPI value, indicating that power is relatively concentrated among its delegates, though less so than in Aave.

Aave (CPI = 627.34):

Aave shows the highest CPI value among the DAOs analyzed, reflecting a significant concentration of power and a more centralized governance structure.

Uniswap (CPI = 215.29):

Uniswap's CPI is lower than Compound and Aave, suggesting a more decentralized power. However, it still reflects more concentration than Optimism.

Conclusion

Comparison of Power Concentration: The CPI values reveal varying levels of power concentration across these DAOs. Optimism, with its multi-layered governance structure, exhibits the most decentralized power distribution, as indicated by its lowest CPI value. In contrast, Aave has the highest concentration of power among delegates, as shown by its CPI. This comparison underscores the impact of governance frameworks—such as Optimism's inclusion of multiple governing bodies—on the distribution of power and the promotion of greater decentralization.

This analysis highlights the significance of governance structures in shaping power decentralization within DAOs and provides insights for designing more balanced and inclusive governance models.

Nakamoto Coefficient Across Different DAOs

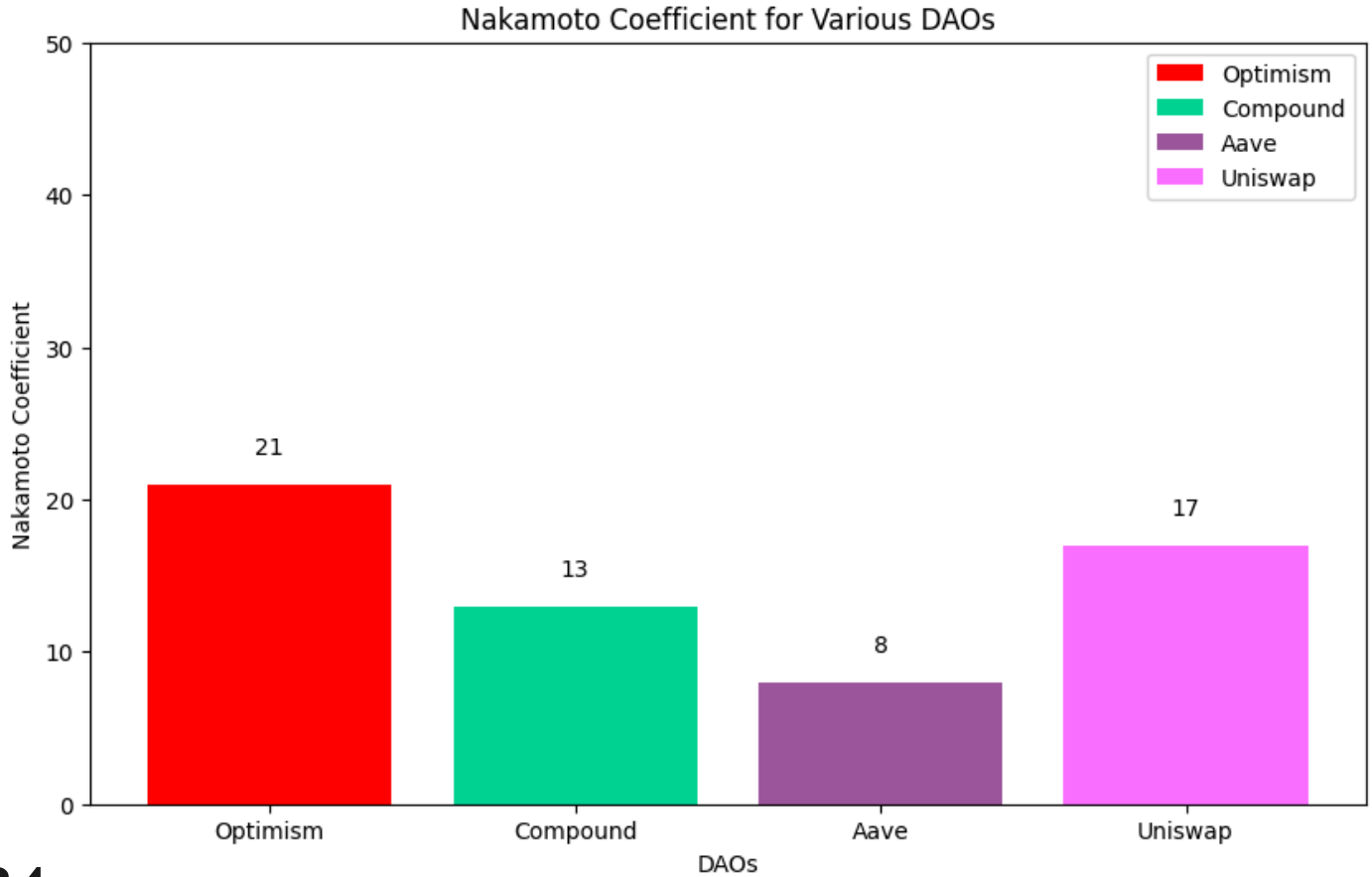
The **Nakamoto Coefficient** measures the minimum number of members required to control over 51% of the total voting power within a decentralized organization (DAO). This metric provides insight into power concentration and the degree of decentralization within DAOs.

Methodology

- Optimism: The Nakamoto Coefficient was calculated by distributing the voting power of a specific delegate address from the Anticapture Commission (a committee of 20 members) equally among its 20 members. The voting power was then sorted in descending order, and the number of members needed to exceed 51% of the total voting power was determined.

- Other DAOs (Compound, Aave, and Uniswap): For these DAOs, the Nakamoto Coefficient was calculated by arranging delegates based on their voting power in descending order and determining the minimum number of members required to surpass 51% of the total voting power.

The bar chart below illustrates the Nakamoto Coefficient for four DAOs: Optimism, Compound, Aave, and Uniswap.



Observations

Optimism (Nakamoto Coefficient = 21):

Optimism requires 21 members to control over 51% of the total voting power, indicating a relatively decentralized structure compared to other DAOs.

Compound (Nakamoto Coefficient = 13):

Compound has a Nakamoto Coefficient of 13, suggesting a higher concentration of power, though it remains more decentralized than Aave.

Aave (Nakamoto Coefficient = 8):

Aave shows the lowest Nakamoto Coefficient, with only 8 members holding over 51% of the total voting power. This reflects a higher concentration of power and a more centralized governance structure.

Uniswap (Nakamoto Coefficient = 17):

Uniswap has a Nakamoto Coefficient of 17, indicating a relatively decentralized distribution of voting power, though it is slightly more concentrated than Optimism.

Conclusion

Comparison of Decentralization: The Nakamoto Coefficient highlights the varying levels of decentralization across different DAOs. A higher Nakamoto Coefficient, such as in Optimism and Compound, indicates a more distributed voting power, whereas a lower coefficient, such as in Aave, signifies a higher concentration of power among fewer members.

Interpretation of Nakamoto Coefficient Values

- Higher Nakamoto Coefficient: Indicates more decentralization, with a greater number of members holding significant voting power and influence.
- Lower Nakamoto Coefficient: Suggests more centralization, with fewer members holding the majority of voting power, leading to a more concentrated governance structure.

Conclusion

The Concentration of Power Index (CPI) serves as a robust metric for measuring the concentration of power within the Optimism Collective. By adapting the traditional Herfindahl-Hirschman Index (HHI), the CPI incorporates not only the voting power of individual delegates but also the influence of various governance bodies—such as Houses, Councils, and Committees (HCC)—on the decision-making process.

Key Observations and Insights

Power Concentration:

The CPI offers a nuanced measurement of power concentration by integrating both individual voting power and the roles delegates play across different governance bodies. This dual perspective highlights where power is concentrated among a smaller group of delegates, indicating potential risks of over-centralization, and where it is more evenly distributed, promoting decentralization.

Influence of Delegates

By accounting for the weighted influence of delegates across various governance bodies, the CPI provides a more accurate representation of each delegate's impact. Delegates involved in multiple HCC roles have their influence amplified in the CPI calculation, reflecting their broader decision-making power. This approach addresses the limitations of the traditional HHI, which assumes equal influence for all voting power.

Flexibility in Governance

The CPI is adaptable to changes in governance structures over time. It can adjust to new councils, committees, or shifts in influence within existing bodies, ensuring accurate and real-time measurement of power concentration. This adaptability makes the CPI an essential tool for monitoring governance health and maintaining the Optimism Collective's decentralization goals.

Real-world Impact

The CPI has identified periods or governance rounds with higher power concentrations, signaling areas for potential reforms. Conversely, it has also highlighted successful efforts to distribute power more equitably, reinforcing the resilience of the governance system. Insights from CPI analysis can inform policy adjustments, delegate selections, and voting reforms, promoting a balanced and fair governance structure.

In conclusion, the CPI stands as a vital tool in safeguarding the decentralization of power in the Optimism Collective. By more accurately reflecting the influence of delegates, it helps prevent over-centralization, fosters fairness and provides ongoing insights to guide governance in a more inclusive and representative direction.

Resources

Observation File

- Description: Detailed observations and notes relevant to the analysis and calculations for council and committee influence.
- Access: Observations

Behind the Scenes Documentation

- Description: In-depth look at the underlying processes and methodologies used in the calculations, offering additional context and technical insights.
- Access: Behind the Scenes

Frontend Dashboard

- Description: A user-friendly dashboard showcasing each member's influence across various DAOs. Users can easily explore and compare the influence of different members. The dashboard also features the Daily CPI value for Optimism, providing a clear and interactive view of the ecosystem's dynamics.
- Access: Optimism CPI

Github Repo

- Description: The official GitHub repository containing the source code, scripts, and other resources used in the calculation and visualization of the Concentration of Power Index (CoP) within the Optimism ecosystem.
- Access: Measuring COP in Optimism

Influence Calculator

- Description: A tool for evaluating the influence of Houses, Councils, and Committees (HCCs) within the Optimism Collective, based on six key parameters. Community members can assign weights and scores to help identify power concentration within the ecosystem.
- Access: Influence Calculator

Presentation Link

- Description: A brief presentation highlighting the differences between the Concentration of Power Index (CPI) and the Herfindahl-Hirschman Index (HHI), along with an overview of the CPI calculation methodology within the Optimism ecosystem.
- Access: Measuring COP in Optimism