OP MEASURING THE CONCENTRATION OF POWER IN OPTIMISM

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Introduction to PageRank

- Developed by Larry Page and Sergey Brin at Stanford University in the late '90s.
- Basis for creating the Google search engine.
- Designed to estimate the authority of web pages using a link-based system.

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Past of PageRank Algorithm

- Initially, links served as votes of trust for a page.
- More external links indicated higher value for users.
- PageRank score (0 to 10) reflected the relative authority of a page on the Internet.

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Present of PageRank Algorithm

- Original algorithm replaced in 2006 with a less resource-intensive one as the Internet expanded.
- Despite changes, Google still relies on link authority.
- Former Google employee Andrey Lipattsev confirmed the ongoing importance of link authority.

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Understanding the PageRank Formula

Original PageRank Formula

$$PR(A) = \frac{1-d}{N} + d\left(\frac{PR(B)}{L(B)} + \frac{PR(C)}{L(C)} + \frac{PR(D)}{L(D)} + \cdots\right)$$

PR(A)
PageRank of page A.

d
Damping factor (probability of a user getting bored and leaving a page, typically set to 0.85).

PR(B), PR(C), PR(D)
PageRanks of pages B, C, and D that link to page A.

L(B), L(C), L(D)
Number of outbound links from pages B, C, and D respectively.

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Explanation

> Each link to a page casts a vote.

> The weight of the vote depends on the PageRank of the linking page.

> Calculations are iterative and continue until PageRanks stabilize.

Simple Yet Powerful

> Despite its simplicity, the PageRank algorithm effectively ranks web pages based on their link authority.

> The concept is easy to understand but powerful in assessing the relative importance of web pages.

Herfindahl-Hirschman Index (HHI)

What is HHI?

The Herfindahl-Hirschman Index (HHI) is a measure of market concentration and is used to determine the market competitiveness, often pre and post merger and acquisition transactions. It is calculated by summing the squares of the market share percentages of all firms in the market.

Proponents

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

where: $S_1, S_2, \ldots, S_n$ are the market shares of firm 1, 2,...n in percentage terms.

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Range of HHI:

near 0 (perfectly competitive market) to 10,000 (monopoly).

Purpose

| Market Concentration | Antitrust Analysis | Concentration of Power |

HHI Calculation and Example

40%	**30%**	**20%**	**10%**
Firm A	Firm B	Firm C	Firm D

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To calculate the HHI

Square each firm's market share

Firm A
$40^2 = 1600$

Firm B
$30^2 = 900$

Firm C
$20^2 = 400$

Firm D
$10^2 = 100$

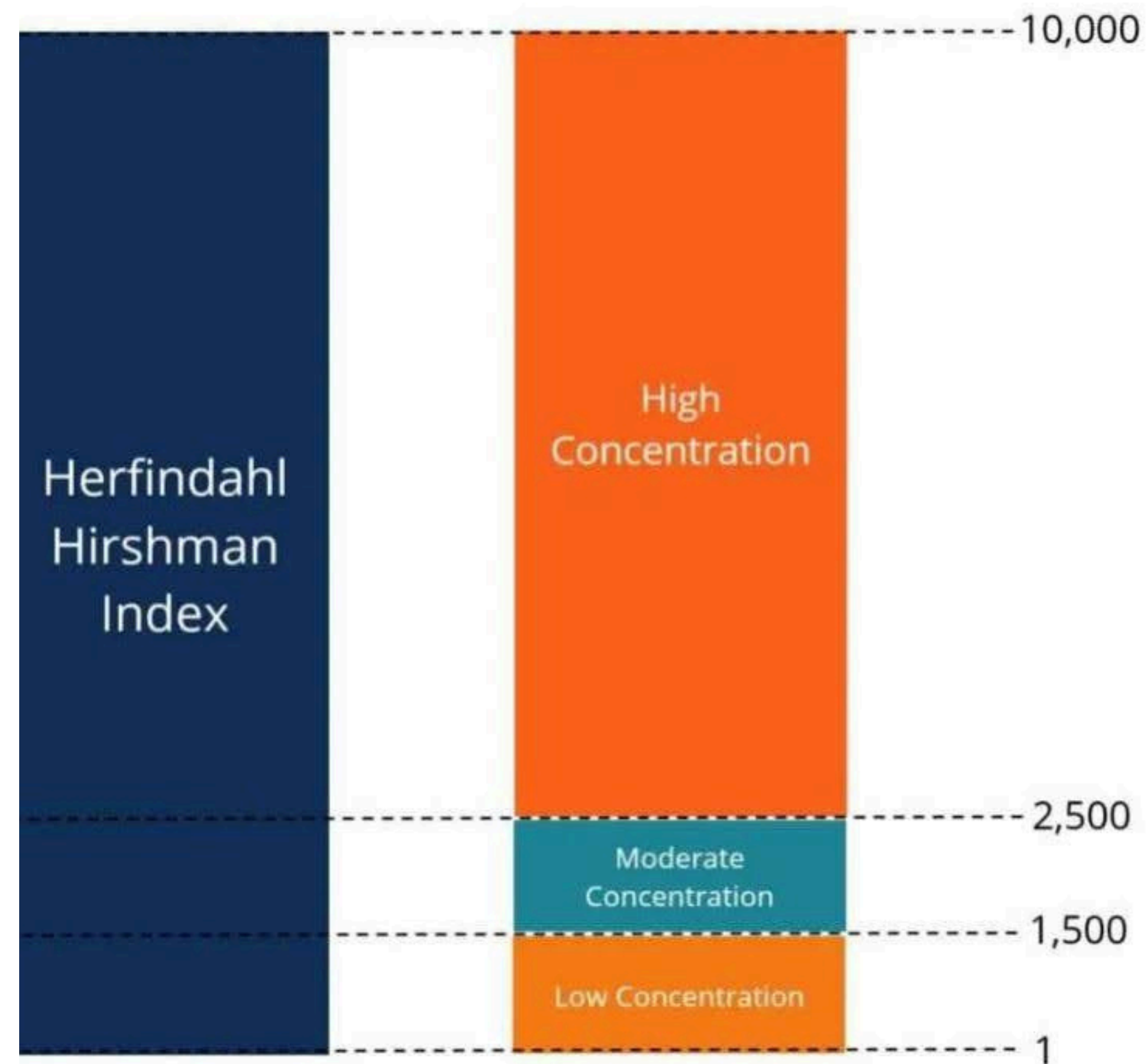### Sum these squared values

$HHI = 1600 + 900 + 400 + 100$

$HHI = 3000$

Interpreting the HHI

> **HHI < 1500**
>
> Low concentration, highly competitive market.

> **1500 ≤ HHI < 2500**
>
> Moderate concentration

> **HHI ≥ 2500**
>
> High concentration, less competitive market.

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Concentration of Power Index (CPI)

What is CPI?I

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.

Layered Structure of Optimism	Captures Complexities that traditional HHI misses	Measures power distribution accurately

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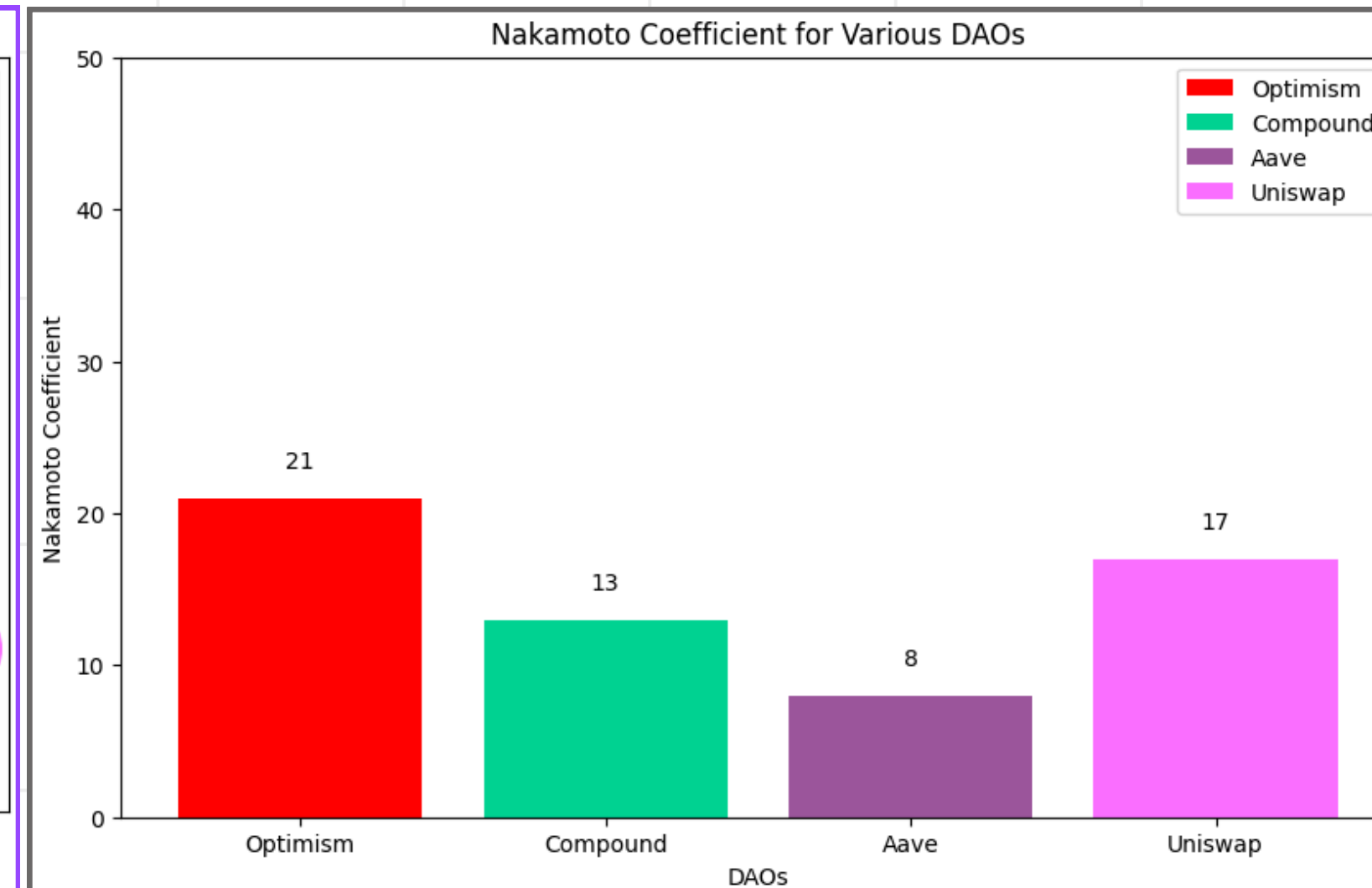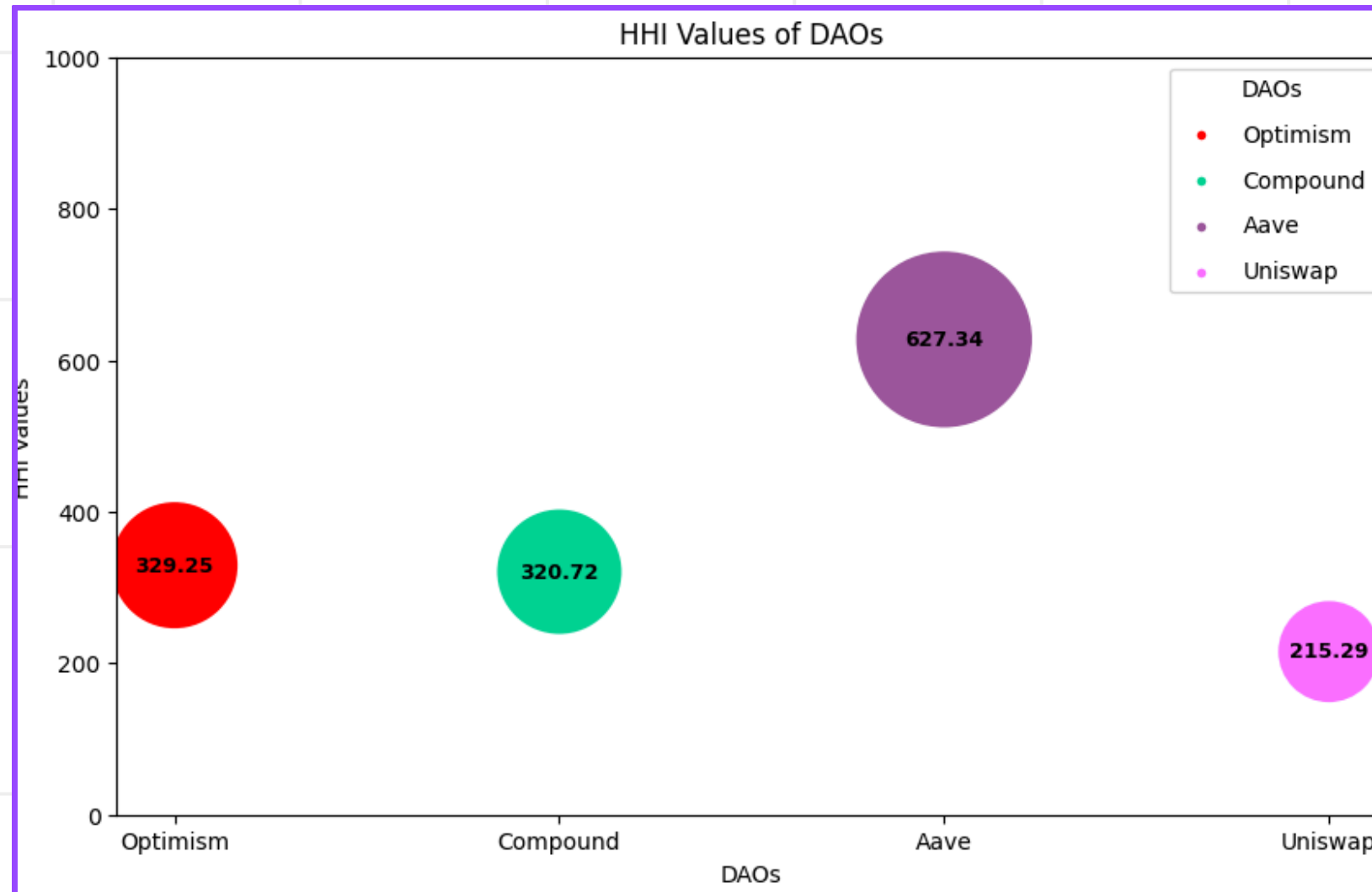| Tailored for Optimism's governance.	Includes additional factors.	Measures power distribution, not just market concentration.	Considers voting shares of delegates, unlike HHI which considers market shares of companies.	Specifically for governance, not just economic markets.

HHI and Nakamoto Coefficient in different DAOs

HHI Values of DAOs

DAOs
- Optimism
- Compound
- Aave
- Uniswap

Aave: 627.34
Optimism: 329.25
Compound: 320.72
Uniswap: 215.29

Nakamoto Coefficient for Various DAOs

- Optimism
- Compound
- Aave
- Uniswap

Optimism: 21
Compound: 13
Aave: 8
Uniswap: 17

The chart represents the HHI values for each DAO, highlighting the differences in power concentration. *Only Token House is considered for Optimism.

The Nakamoto Coefficient indicates the number of delegates required to collectively control more than 51% of the total voting supply.

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HHI in individual Houses, Councils & Committees in Optimism

HCC	HHI
Token House	318.78
Citizen House Round 2	270.27
Citizen House Round 3	161.29
Grants Council Season 3	1111.11
Grants Council Season 4	1111.11
Grants Council Season 5 (w/o M&M)	909.09
Grants Council Season 5	5000.0
Developer Advisory Board Season 5	10000.0
Code of Conduct Council Season 5	2500.0

CPI in Optimism Collective over time

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CPI Values of Optimism
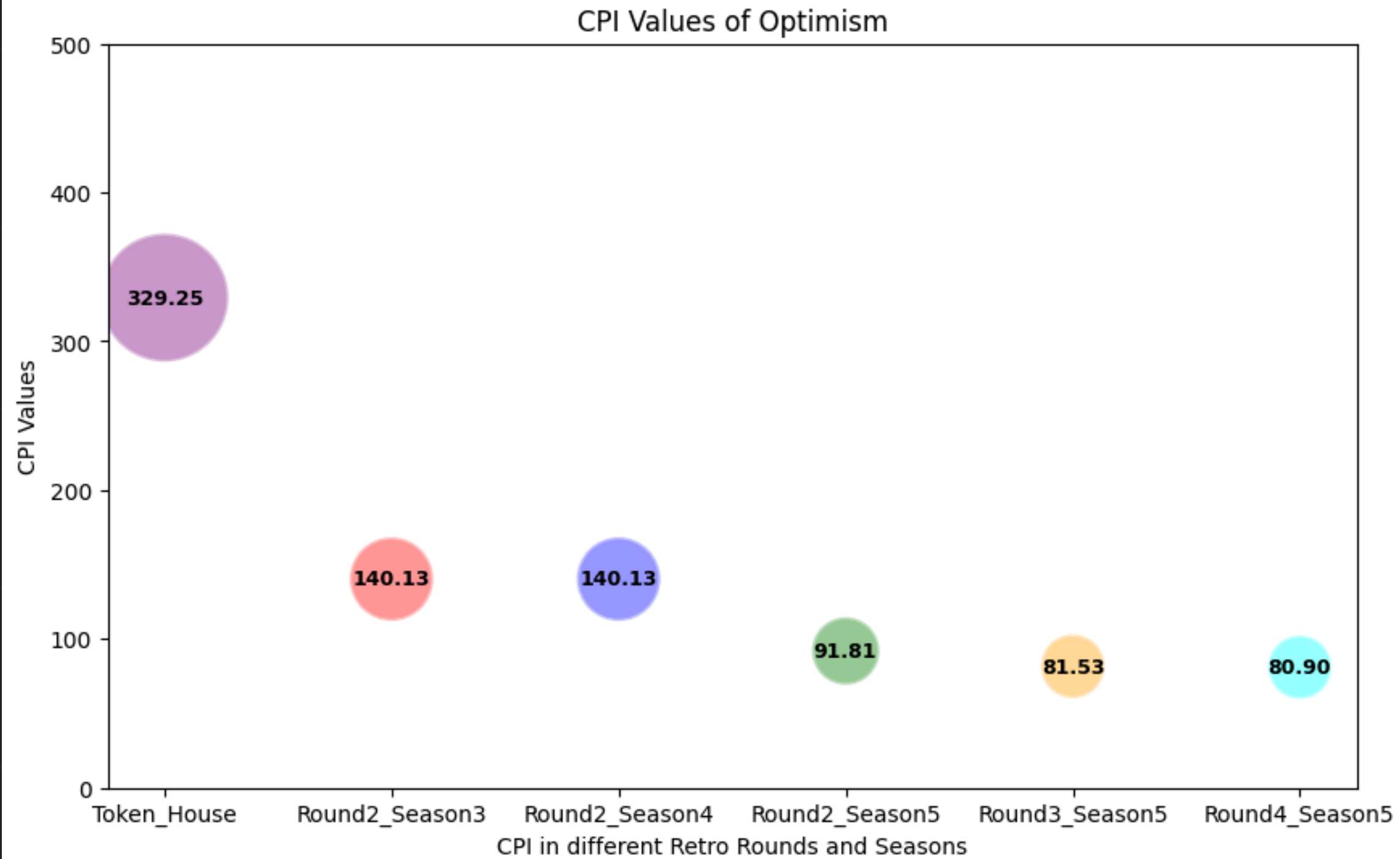
The overall CPI vof the Optimism Collective has decreased with new retro rounds and seasons, showing reduced power concentration compared to individual HHI values of specific HCCs.

Challenges in Defining Parameters to Measure Influence

Quantification of Roles

Translating theoretical roles and responsibilities into quantitative values.

Parameter Standardization

Creating common parameters to compare councils with varying powers.

Weight Assignment

Determining appropriate weights for each parameter.

Dynamic Governance

Adapting to changes in roles and responsibilities over time.

Subjectivity

Ensuring consistent and objective scoring of parameters.

Complex Interactions

Reflecting the influence of councils while considering their interdependencies.

Parameter Coverage

Ensuring all critical aspects of influence are included.

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Base Parameters for Measuring Influence

Level of decision-making power.	Range and extent of influence.	Level of engagement with the community.
Degree of operational independence.	Amount of voting power.	Authority to veto proposals or decisions.

CPI Formula for Optimism Collective

$$CPI = \sum_{i \in D} V_i^2 \text{ where } V_i = \sum_{j \in HCC} (V_j * I_j)$$

Where

- > V_j is the voting power of delegate i in HCC j.

- > I_j is the influence factor of HCC j in the overall Optimism Collective.

- > V_i is the weighted voting power of delegate i.

Set Definitions

- > D is the set of Delegates. $D = \{d_1, d_2, d_3, ... , d_n\}$

- > HCC represents the set of Houses, Councils & Committees which includes $HCC = \{Th, Ch, Gc, Sc, CoC, DAB\}$

Explanation

- > The CPI is the sum of the squares of the weighted voting power of each delegate.

- > The weighted voting power V_i for each delegate i is calculated by summing the products of the voting power V_j and the influence I_j for each house and council in the Optimism Collective.

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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

OP THANK YOU

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