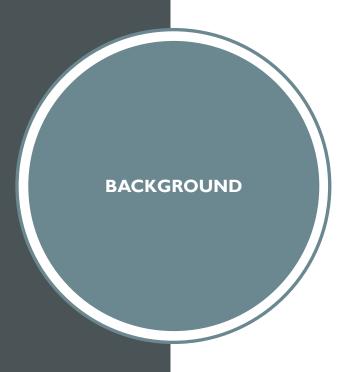
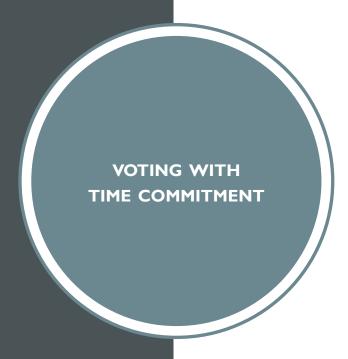
# VOTING WITH TIME COMMITMENT

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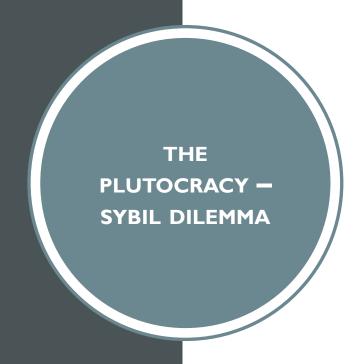


- Problems with pure token-based voting systems in a decentralized pseudonymous network:
  - **Plutocracy**: Wealth concentration in the hands of a few whales, which affects decision-making
  - **Sybil attacks**: Multiple fake identities created by pseudonymous accounts disrupt fair voting
  - **Vote buying**: Tokens are purchased before a vote and sold immediately after to sway voting outcomes
- Many DAOs adopt a voting mechanism (for example, one-token-one-vote or quadratic voting) only to be left facing these problems down the road.



Mohan, V., Khezr, P. and Berg, C. 2024. "Voting with Time Commitment for Decentralized Governance: Bond Voting as a Sybil-Resistant Mechanism", *Management Science*.

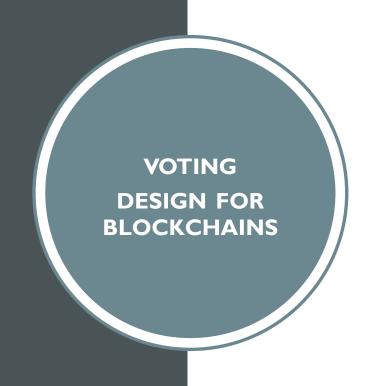
- There is a need for a holistic solution that recognizes how these problems are linked
- Provides theoretical background for trade-off between plutocracy and Sybil resistance.
- Proposes a new voting mechanism: bond voting
- Overall, emphasizes the value of time commitment in decentralized pseudonymous voting systems: time-based suffrage



• In a pure **token-based voting system**, the quantity of tokens, *q*, acts as a weight and the number of votes, *V*, is determined by:

$$V = v(q)$$

- Both plutocracy and Sybil attacks are related to how v(q) behaves with respect to q
- We show that under reasonable conditions, the only way to achieve Sybil resistance is by ensuring that v(q) is **linear** in q
- Plutocracy resistance requires that v(q) is **strictly** concave in q
- You cannot have both simultaneously!



- All blockchains using a token-based voting system are left with 2 options:
  - I. Use tokens to achieve plutocracy resistance, and find some other instrument to achieve Sybil resistance.
  - 2. Use tokens to achieve Sybil resistance, and use some other instrument to counter plutocracy.
- In other words, you need a voting function of the form v  $(r_1,r_2)$  where  $r_1$  and  $r_2$  are **voting** 'instruments' or 'resources'.
- This is well-known in economic policymaking: If you have two policy targets, you usually need two instruments to achieve both targets.



- **Time commitment** implies that tokens voters can lock tokens for a certain amount of time as part of the voting process.
- Adding time commitment, *t*, changes the voting function to:

$$V = v(q,t)$$

So, now votes are determined by quantity of tokens and the length of time the voter is willing to lock up the token.

Example: **vote escrow** used by Curve has V = qt, where t is a quarter of the number of years locked.



- Adding a time dimension in some form or the other can act as a **counter to vote-buying**.
  - Example: A 2-day 'timelock' after voting has ended before a proposal can be implemented.
  - Vote escrow, by construction, deters vote buying.
- So, time commitment has two **immediate benefits**:
  - Additional input for weighting votes to express intensity of preference
  - Protection against vote buying
- Moreover, you cannot launch a Sybil attack with time commitment alone.



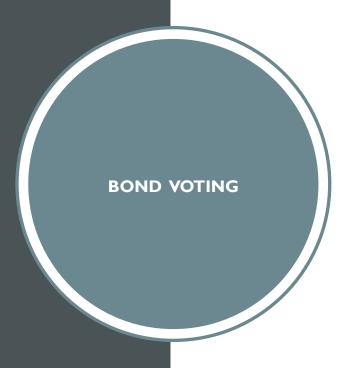
- Vote escrow can be circumvented using by selling ownership of locked tokens through an OTC trade, which is expensive and opaque, or by adding another layer that offers flexibility, which can lead to its own problems.
- Vote escrow locks tokens for a certain amount of time, and an agent can vote across multiple proposals using escrowed tokens.
  - So, agents don't need to think carefully about a specific proposal
  - Agents can extend the power of wealth across multiple voting proposals
- The vote function v = qt is linear in both quantity and time, so limited rewards for time commitment.



- Resistance to a Sybil attack
- It has an instrument that can counter plutocracy
- Counters vote buying

#### **Plus**

- Accelerate voting power for long-term commitment to the blockchain
- Time commitment takes-place on a proposal-by-proposal basis
- Voters can get out of time commitment in a simple, transparent manner
- There is some mechanism for information to be generated from the voting process about how the community views the future of the blockchain

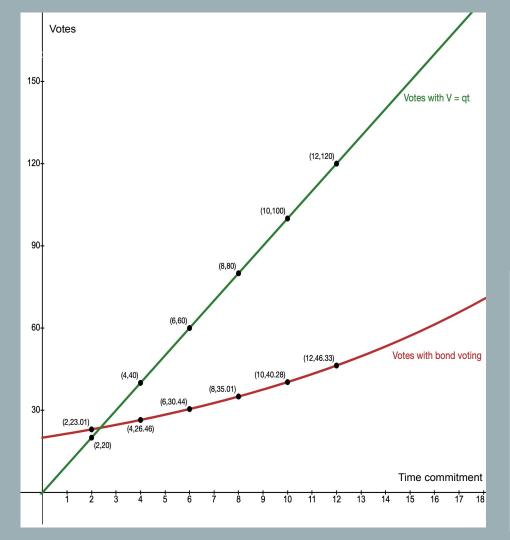


• The **number of votes** cast by the user (*V*) is calculated based on the bond voting formula:

$$V = qe^{rt}$$

Here r is a parameter fixed by the blockchain.

- Think of the blockchain as issuing **voting bonds**: An instrument that represents a commitment by the voter to lock a particular quantity of tokens (q) for a particular period of time (t). For example, an NFT recording (q,t) is issued.
- The reason for thinking of it as an instrument is that claims on the locked funds can be traded in a secondary market. Secondary market trades carry information



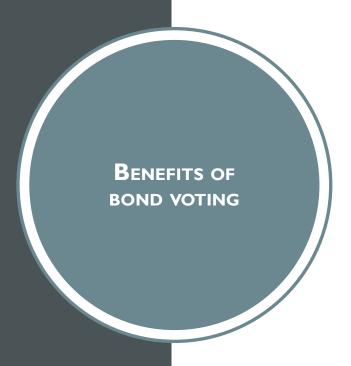
#### **Bond Voting**

- $V = qe^{rt}$
- q=10
- r = .07

#### Vote escrow

- V = qt
- q = 10

Time (months)		Bond Voting
1	10	21.45
2	20	23.01
4	40	26.46
6	60	30.44
8	80	35.01
10	100	40.28
12	120	46.33



#### • Sybil resistance

- The bond voting formula is linear in tokens

#### Plutocracy alleviation

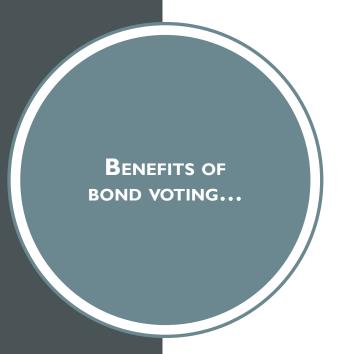
- Time commitment in bond voting acts as an instrument to counter plutocracy

#### Vote buying

- Time commitment reduces occurrence of vote buying

## Reward for long-term commitment

- The power of time commitment increases at an increasing rate



### Voting on a proposal-by-proposal basis

- Staking with flexibility
  - The secondary market allows a voter to relinquish time commitment and exit positions in a transparent manner, as opposed to OTC measures
- Informational properties
  - The secondary market provides information about market sentiment, which enhances long-term decision-making



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