Voter Dynamics

A simple voter-politician attraction model

Philip Thomas K.   Wang Zi Yuan

Nanyang Technological University

April 17, 2024

Our Inspiration

Singapore's next General Election likely to be held in late 2024 at the earliest, analysts say

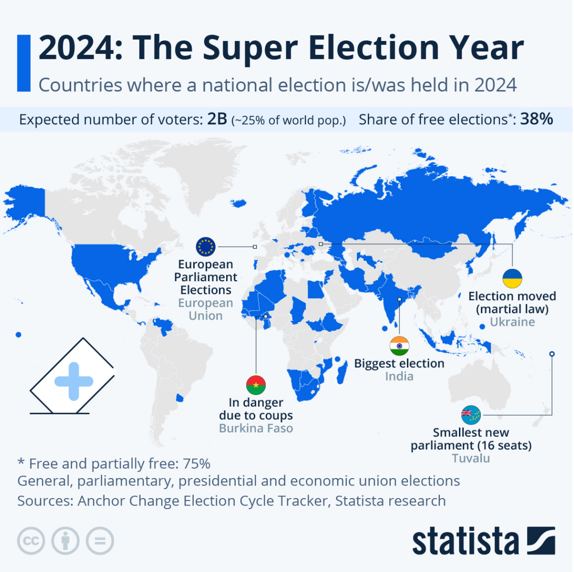
This comes after Prime Minister Lee Hsien Loong revealed he will hand the reins to Deputy Prime Minister Lawrence Wong before the next General Election, and by November 2024 "if all goes well".

Louisa Tang

Tang See Kit
@SeeKitCNA

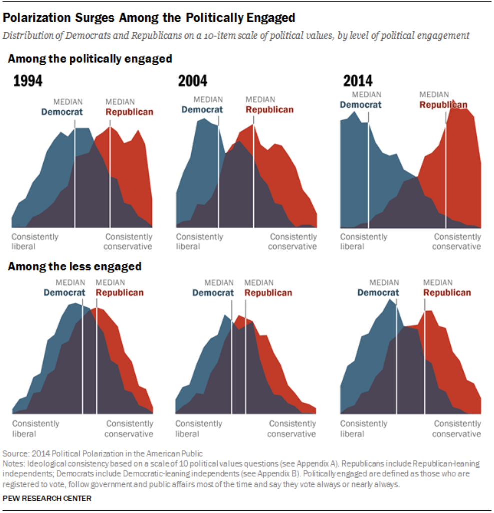
05 Nov 2023 07:59PM
(Updated: 06 Nov 2023 08:41AM)

Our Inspiration



Intuition behind our model

- Increasing political polarisation across democracies
- Confirmation bias
- Social Endorsement
- Budget:
  - Money inveseted in campaigning—social media, etc.
  - Political prowess

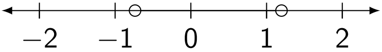


How can we model voters & politicians?

- We create numerically defined “issues/interests”:

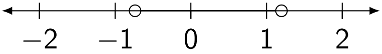
How can we model voters & politicians?

- We create numerically defined “issues/interests”:



How can we model voters & politicians?

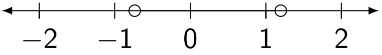
- We create numerically defined “issues/interests”:



- Allows us to assess whether voters are “aligned” with politicians

How can we model voters & politicians?

- We create numerically defined “issues/interests”:



- Allows us to assess whether voters are “aligned” with politicians
- Could foreseeably be used to encode real life data

Our Mathematical Model

$$\Delta v_i = (p_i - v_i)\rho_{v,p} B_p,$$

where:

Our Mathematical Model

$$\Delta v_i = (p_i - v_i)\rho_{v,p} B_p,$$

where:

- B_p is the budget of politician p,

Our Mathematical Model

$$\Delta v_i = (p_i - v_i)\rho_{v,p} B_p,$$

where:

- B_p is the budget of politician p,
- $\rho_{v,p}$ is the *correlation coefficient* on **all the issues** between voter v and politician p,

Our Mathematical Model

$$\Delta v_i = (p_i - v_i)\rho_{v,p}B_p,$$

where:

- B_p is the budget of politician p,
- $\rho_{v,p}$ is the *correlation coefficient* on **all the issues** between voter v and politician p,
- and $(p_i - v_i)$ is the difference between voter v and politician p on one specific issue.

Model Limitations

1. We don't know what the underlying distribution of these "issues" are.

Model Limitations

1. We don't know what the underlying distribution of these "issues" are.
2. We assume that each "issue" follows the same distribution.

Model Limitations

1. We don't know what the underlying distribution of these "issues" are.
2. We assume that each "issue" follows the same distribution.
3. We assume that politicians **don't change** during their campaign.

Model Limitations

1. We don't know what the underlying distribution of these "issues" are.
2. We assume that each "issue" follows the same distribution.
3. We assume that politicians **don't change** during their campaign.
4. We assume that the only thing that varies among individuals is where they stand on these "issues".

Model Limitations

1. We don't know what the underlying distribution of these "issues" are.
2. We assume that each "issue" follows the same distribution.
3. We assume that politicians **don't change** during their campaign.
4. We assume that the only thing that varies among individuals is where they stand on these "issues".
5. We don't account for voter-voter interaction.

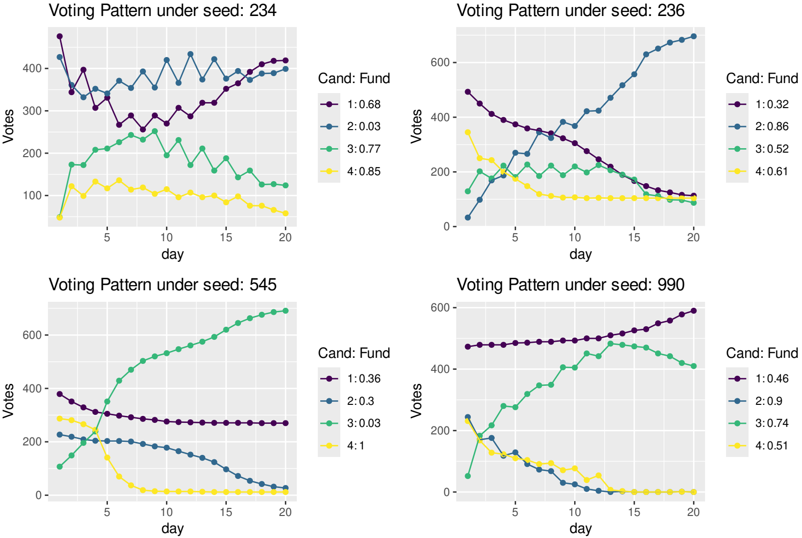
Model Implementation

For each voter, for each politician, determine how voters shift their stance:

```r
VI_data = rnorm(ni*nv)
PI_data = rnorm(ni*np)
b_data  = runif(np, min = 0, max = 1)
VI = matrix(data = VI_data, nrow = nv, ncol = ni)
PI = matrix(data = PI_data, nrow = np, ncol = ni, byrow = T)
b  = matrix(data =  b_data, ncol = np, nrow = nv, byrow = T)
for (day in 1:days) {
  rho <- cor(t(rbind(PI,VI)))[(np+1):(np+nv),1:np]
  ME  <- rho * b
  del_VI <- matrix(data = 0, nrow = nv, ncol = ni)
  for(v in 1:nv){
    for(p in 1:np){
      if (ME[v,p] > 0) {
        del_VI[v,] = del_VI[v,] + (PI[p,] - VI[v,])*ME[v,p]
      }
    }
  }
  VI <- VI + del_VI
}
```

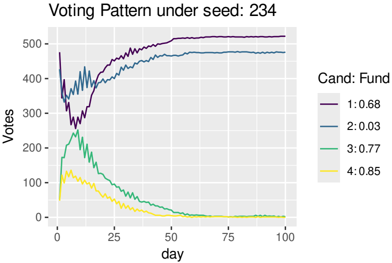
Initial Findings

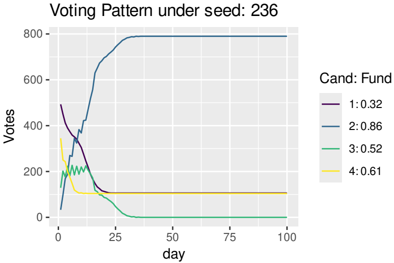
Process leads to varying outcomes w/ same parameters

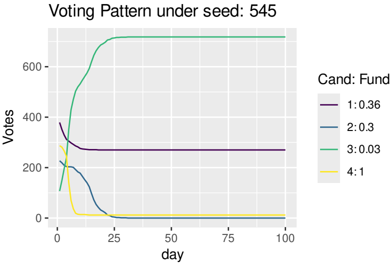


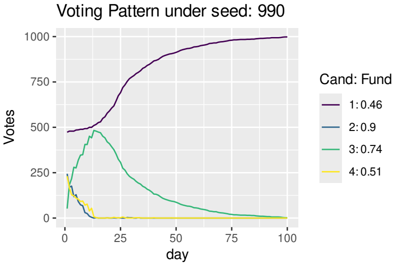
Initial Findings

Voters tend to converge towards a politician—stable points!



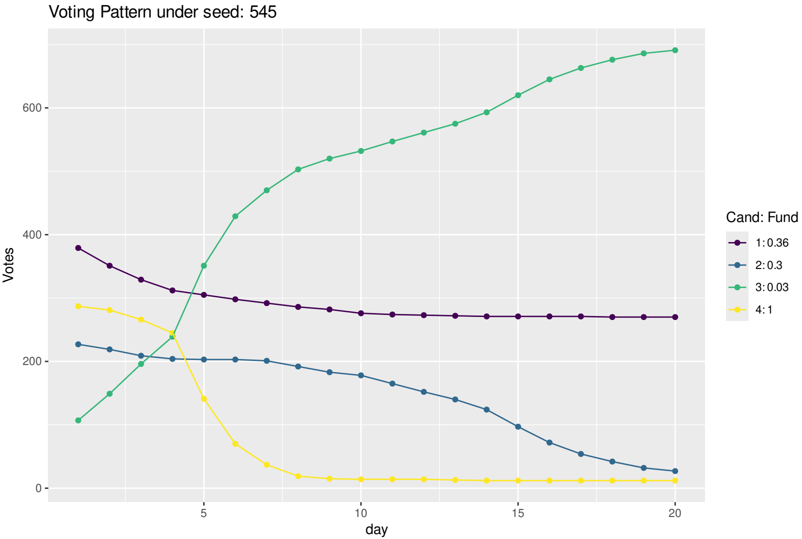






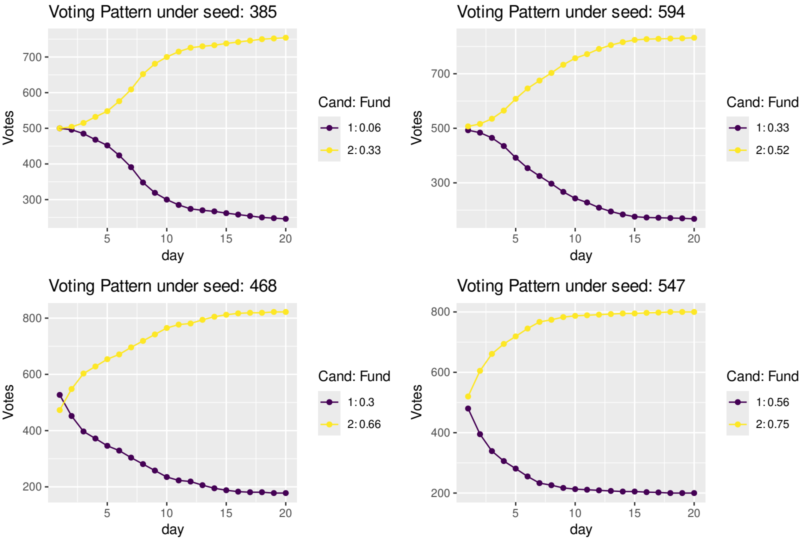
Initial Findings

Higher budget $\neq$ winning



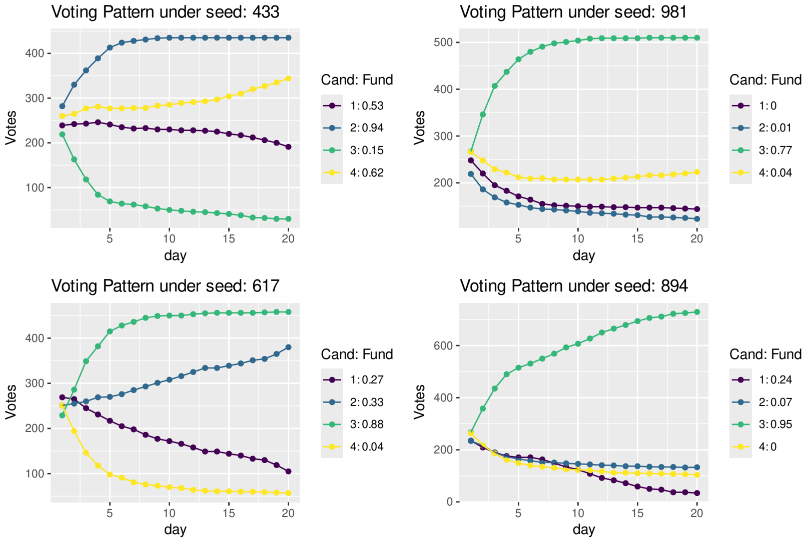
Interesting Findings

Higher budget ≈ winning for low number of politicians



Interesting Findings

Higher budget ≈ winning for high number of politicians for large no. of issues



The End.