Sequential vs. Simultaneous Voting: Experimental Evidence

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Work in Progress

Introduction: Motivation I

- Elections as information aggregation mechanisms
  - "Condorcet Jury" Models
- Traditionally, assume simultaneous voting
- But many elections feature sequential voting
  - presidential primaries
  - roll-call voting in legislatures, boards, city councils
- How do these mechanisms differ?

Introduction: This Paper

- Experimentally test simultaneous and sequential voting
- Goals:
  1. History dependence vs. independence in seq. voting
  2. Comparisons, e.g. efficiency
  3. Fit of equilibrium theories
- Prior experimental literature
  - Simultaneous voting: Guarnaschelli, Mckelvey, Palfrey (2000)
  - Sequential voting: Hung and Plott (2000)
  - “Standard” cascades: Anderson and Holt (1997), ...

Model

- n voters ("the jury")
- True state, $\omega \in \{G, I\}$, prior $\Pr(\omega = I) = \pi \geq \frac{1}{2}$
- Each voter i receives a signal $s_i \in \{g, i\}$, private info., conditionally i.i.d. draws with precision $\gamma > \pi$
- Each voter casts a vote, $v_i \in \{C, A\}$
  - either simultaneously or
  - in roll-call sequence, observing history of prior votes
- Group decision, C or A, determined by some quota rule: C require a fraction $q \geq \frac{1}{2}$ or more of the vote
- Preferences: pure common values to "match" group decision with state

Equilibria: Simultaneous Voting

- Sincere or naive voting is generally not an equilibrium (ASB 1996)
  - pivot calculus
- Unique responsive symmetric equilibrium (FP 1998)
  - vote C with a g signal
  - generally mix between C and A with an i signal
  - mixture prob depends on all parameters
- There are also asymmetric equilibria

Equilibria: Sequential Voting

- The symmetric equilibrium of simultaneous game remains an equilibrium (DP 2000)
  - intuition: condition on being pivotal, *symmetric* strategies
  - history independent behavior
- But sincere or "posterior based" voting is also an equilibrium (AK 2007)
  - Bayes update based on past history and private signal, and "vote your posterior"
  - looks myopic, but is a b.r. for each voter
  - identical to standard cascades model behavior
  - behavior is not sensitive to voting rule, jury size, etc.
  - in some cases (e.g., unanimity rule) mimics asymmetric equilibria of simultaneous election, but in others (e.g. majority rule) there is no analog

Experimental Design

- 2 urns: R and B
  - R contains 2 red balls and 1 blue ball
  - B contains 1 red ball and 2 blue balls

$\implies \gamma = 2/3$

- Urn is selected randomly by computer, uniform prior ($\pi = 1/2$)

Experimental Design

- Subjects are put into groups of $n \in \{3, 6, 12\}$ players
  - Either simultaneous or sequential elections
  - Either unanimity (status quo B) or majority rule (random winner if tied)

- Each group plays 30 rounds, randomized voting order each time if sequential

- In each election, each subject observes 1 ball from urn with replacement ($s_i \in \{r, b\}$), and prior history of votes if any; then votes either R or B

- Payoffs: $1.00 if group guesses right urn, $0.10 otherwise

Experimental Parameters: Theory

For talk, only discuss $n = 6, 12$

- In the Simultaneous election, focus on the symmetric equilibrium (SME)
  - Majority rule: vote your signal
  - Unanimity rule:
    - if signal r, vote R with probability 1
    - if signal b, vote R with prob. 0.66 if $n = 6$ and prob. 0.83 if $n = 12$
- In the Sequential election
  - the above is an eqm
  - but also PBV: for either voting rule and jury size, in *undecided histories*,
    - vote your signal if vote lead (for R) is $-2 < \Delta < 2$
    - vote for R if $\Delta \geq 2$; vote for B if $\Delta \leq -2$

Data Overview

For the $n = 6$ elections

Timing	Rule	# Groups	# Rounds	All obs.	Und. hist.
Seq	Maj	6	30	1080	916
Sim	Maj	6	30	1080	n/a
Seq	Una	6	30	1080	549
Sim	Una	6	30	1080	n/a

For the $n = 12$ elections

Timing	Rule	# Groups	# Rounds	All obs.	Und. hist.
Seq	Maj	4	30	1440	1111
Sim	Maj	2	30	720	n/a
Seq	Una	6	30	2160	919
Sim	Una	6	30	2160	n/a

Simultaneous Elections: Fraction of votes for R

n=6

signal	Unanimity	Majority
b	.52 (323/616)	.05 (27/597)
r	.94 (437/464)	.96 (463/483)

- Recall SME in unanimity $Pr(R|b) = .66$
- Comparable numbers to GMP (APSR, 2000)

n=12

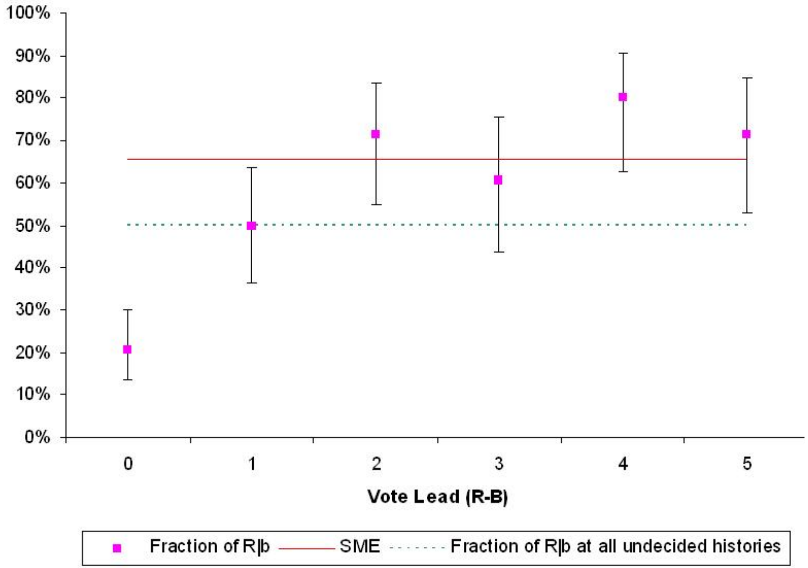
signal	Unanimity	Majority
b	.62 (761/1235)	.05 (20/398)
r	.95 (877/925)	.94 (304/322)

- Recall SME in unanimity $Pr(R|b) = .83$

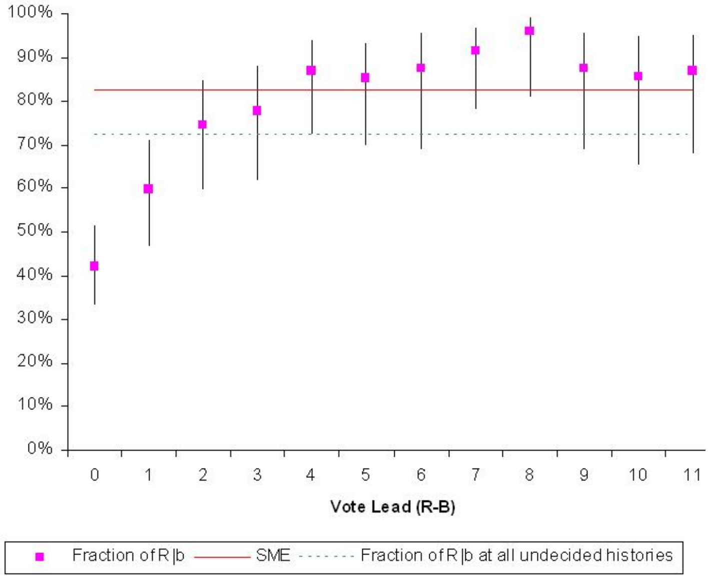
Sequential Elections

- Interested in behavior in **undecided histories**
- Under unanimity rule, $R|r$ is 98%, so interest is in $R|b$

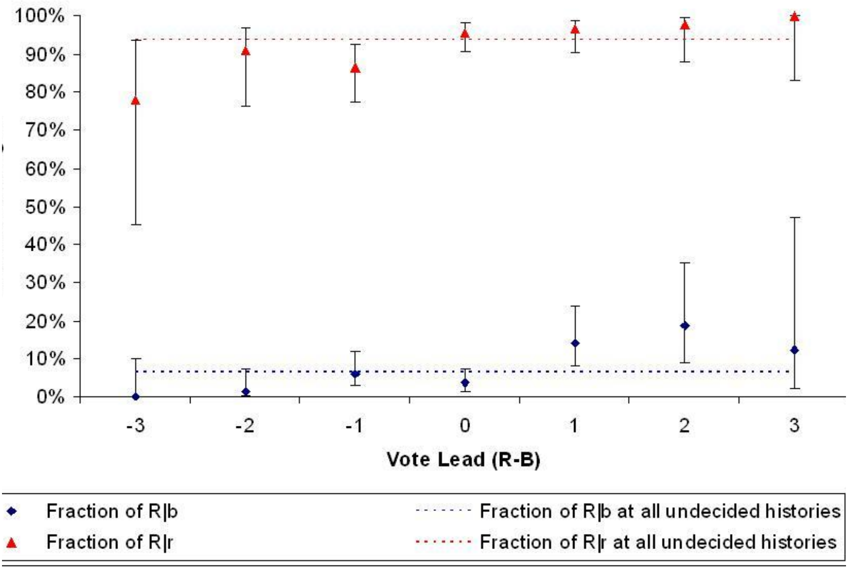
Sequential Elections: $n = 6$, unanimity rule



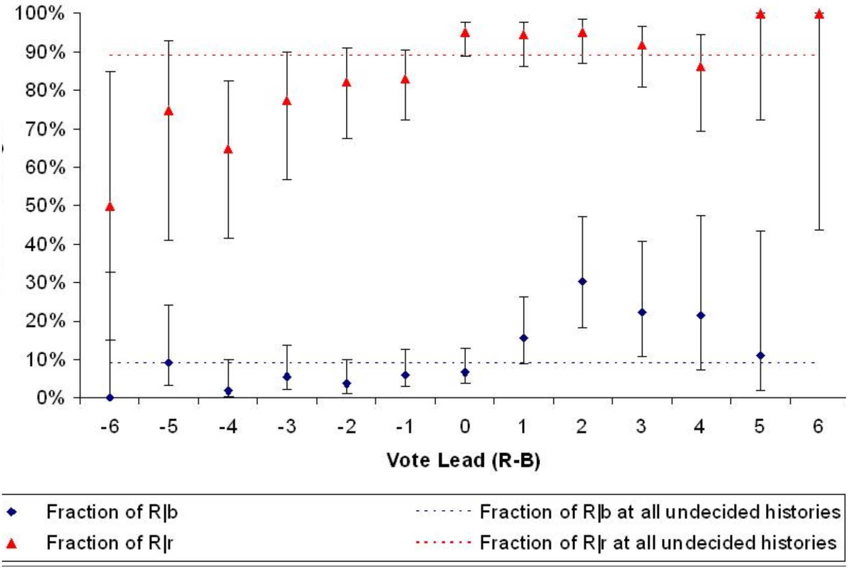
Sequential Elections: $n = 12$, unanimity rule



Sequential Elections: $n = 6$, majority rule



Sequential Elections: $n = 12$, majority rule



History Dependence: Test I

- p-values of Likelihood-ratio test of

$$H_0 : Pr(R|\cdot) \text{ is constant across positions}$$

	n=6	n=12
R|b in Una	0.00	0.00
R|b in Maj	0.00	0.00
R|r in Maj	0.02	0.00

- Above calculation assumes alternate hypothesis, H_a, is non-constancy, but the same point would hold if H_a is (weak) monotonicity

- History dependence under majority rule is especially striking since SME (informative voting) is efficient and simple there

History Dependence: Test II

Probit regression of voting R conditional on signal

Treatment	signal	Vote Lead coeff	Std Err	p-value	N
Una 6	b	0.312	0.0486	0.000	262
Una 12	b	0.158	0.0209	0.000	471
Maj 6	b	0.282	0.0726	0.000	507
Maj 6	r	0.263	0.0816	0.001	409
Maj 12	b	0.140	0.0316	0.000	630
Maj 12	r	0.137	0.0334	0.000	481

Sequential Elections: Fitting the Data

- Neither PBV nor SME can fit the data very well
  - e.g., in Seq Una, $\%R|b$ in pos. 1 is too high for PBV, too low for SME
- Note: because non-generic parameters, tie-breaking is relevant in PBV, but none of the variations fit well either
- Seems plausible that different subjects are playing different equilibrium strategies
- We plan to estimate mixture models and QRE

Group Decisions

Efficiency: Fraction of correct decisions

Jury size	Rule	Sim Eff	Seq Eff	Sig diff (5%)?
6	Una	0.66 (119/180)	0.57 (103/180)	No
12	Una	0.60 (108/180)	0.62 (112/180)	No
6	Maj	0.83 (149/180)	0.80 (144/180)	No
12	Maj	0.87 (52/60)	0.89 (107/120)	No

- Majority better than unanimity (as expected)
- No sig. differences between sim and seq
- Only sig. difference between jury sizes is in SeqMaj