Individual Strategy Choice in Electoral Decisions

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April 8, 2017

The Problem

- Suppose there is a population that makes decisions electorally - a simple majority wins
- Individuals know their own preferences over the possible selections
 - Simply voting for their favorite option may not be optimal
- The 2016 U.S. presidential election raised a question for many - Should I vote for my second or third favorite choice?

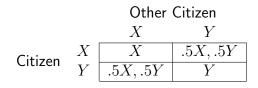
- University student government elections
- Small group dynamics choosing where to dine?
- Notation and jargon in academic fields

The Model's Assumptions

- Simple majority wins
- Citizens know their own preferences at the time of the election, and they are independent of how others vote
- Under campaigning allowance, there is probability zero of a tie
- Risk neutrality (optional)

Starting Simple - 2 Citizens, 2 Options

- Even number of citizens ties are possible
- Allow a draw to simply be counted as a half win for each option
- Thus we have outcome matrix:



Starting Simple - 2 Citizens, 2 Options

Consider Citizen's possible perspectives

- 1. Indifferent \Rightarrow zero matrix
- 2. Prefer $X \Rightarrow$ matrix below
- 3. Prefer $Y \Rightarrow$ analogous to X preference

$$\begin{array}{c|c} & \text{Other Citizen} \\ X & Y \\ \text{Citizen} & X & \hline 1 & .5 \\ Y & .5 & 0 \\ \end{array}$$

Clearly, picking X is a dominant strategy

Enough with the Obvious!

- With only two options, choosing the preferred option is always a dominant strategy
- The analysis with a population of n is simple, and assuming our Citizen prefers one option to the other, the utility of choosing that preferred option is always greater than or equal to choosing the alternative option

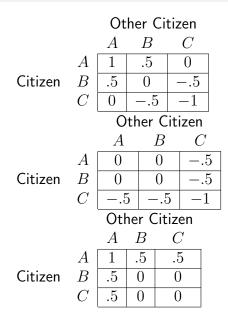
Three Options

- Our Citizen's preferences are now more complicated, but can be categorized into 13 bins:
 - (1) (6): ordered preferences (A > B > C)
 - (7) (9): aversion preferences (A = B > C
 - (10) (12): affinity preferences (A > B = C)
 - (13): indifference preference (A = B = C)
- Assume no fair weather fans (vote for popular choice) or counterculture (vote against popular choice)
- No need to analyze all 13 possibilities; instead consider one from each (nontrivial) bin

Using the same rules as before, we construct the new outcome matrix:

| | | Other Citizen | | | | | | |
|---------|---|---------------|----------|----------|--|--|--|--|
| | | A | B | C | | | | |
| | A | A | .5A, .5B | .5A, .5C | | | | |
| Citizen | B | .5A, .5B | В | .5B, .5C | | | | |
| | C | .5A, .5C | .5B, .5C | C | | | | |

Preferences and Payoffs



► A > B > C ⇒ Strategy A is dominant

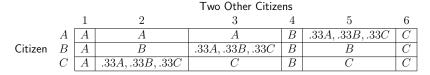
► A = B > C ⇒ Strategy C is dominated

• $A > B = C \Rightarrow$ Strategy A is dominant

Three Citizens

- The potential scenarios our Citizen will face grow quickly with the size of population - we will look at a population of 3 before jumping to n
- There are 6 possible scenarios
 - 1. Both pick A
 - 2. One picks A, one picks B
 - 3. One picks A, one picks C
 - 4. Both pick B
 - 5. One picks B, one picks C
 - 6. Both pick C

- The outcome matrix also becomes more involved
- Again, split the outcome for ties, as if the tie will be decided by a uniform random distribution (invoke risk neutrality)



- Same results as before:
 - (a) Ordered preferences: pick the favorite
 - (b) Aversion preferences: do not pick the averse option
 - (c) Affinity preferences: pick the favorite
- > Thus far: Citizen should always pick the favorite
- This machinery is consistent with intuition, and easy to extend

$n \, \operatorname{Citizens}$

- Sort the possible scenarios presented into 18 bins, based on how our Citizen's vote will affect the outcome
- The 18 bins can be summarized:
 - (a) Citizen's vote is meaningless
 - (b) Two or three options are tied, Citizen can potentially break the tie
 - (c) Citizen can potentially create a tie
- ► The outcome and payoff matrices are at an unwieldy 3 × 18 size

$n \, \operatorname{Citizens}$

- When considering a population of n, the results become more interesting:
 - (a) Ordered preferences: do not pick the least favorite
 - (b) Aversion preferences: do not pick the least favorite
 - (c) Affinity preferences: pick the favorite
- Contrary to the previous results, picking the favorite is not necessarily Pareto dominant anymore
- This feature arises because it may be best in some cases to vote for the second favorite option, in order to block the least favorite choice

Incorporating Campaigning

- Thus far, our population is entirely unrealistic: no one interacts, everyone just guesses what everyone else will do and votes accordingly
- Fix: introduce campaigning, so citizens can have a wider impact and share their ideas, and have unequal representation and costs
- Campaigning: any action through which an individual incurs a cost in an effort to promote their preferences in any way other than merely voting (pecuniary, non-pecuniary, or any combination)

Campaigning Scenarios and Outcomes

- Now only 10 scenarios exist, because this more realistic model eliminates ties, which are assumed to occur with probability zero:
 - (a) Campaigning is futile
 - (b) Campaigning may affect outcome
 - (c) Campaigning will affect outcome

| | | 1 | 2 | 3 | 4 | 5 | 6 | $\overline{7}$ | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|----------------|---|---|----|
| | A | A | A | B | C | A | A | A | B | A | C |
| n | B | B | A | B | C | B | A | B | B | C | В |
| | C | C | A | B | C | A | C | B | C | C | C |

n-1 Other Citizens

Citizer

Ordered Preferences: General Result

- Suppose A > B > C
- Choosing C is weakly dominated, but that is all that can be said without imposing further assumptions

Aversion Preferences: General Result

- Suppose A = B > C
- Choosing C is weakly dominated, but that is all that can be said without imposing further assumptions

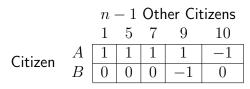
Affinity Preferences: General Result

- Suppose A > B = C
- Choosing A is weakly dominant, so we are finished analyzing this possibility!

Extending Assumptions

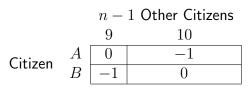
- Generality is the goal, so we minimize further assumptions that allow complete descriptions
- Recall that for ordered and aversion preferences optimal strategic behavior has not yet been fully prescribed
- Method: eliminate scenarios yielding indifferent outcomes, summarize results assuming:
 - (a) Some outcomes will not occur
 - (b) A mixed strategy may be employed
 - (c) The disparity between option utilities is constant

Ordered Preferences: A > B > C



- (1) Do not choose C
- (2) If 10 will not happen, choose A
- (3) If none of 1, 5, 7, or 9 will occur, choose B
- (4) If we assign relative probabilities p, q, r, and t, to scenarios 1, 5, 7, and 9, respectively, assign relative probability 1 p q r t to scenario 10, and Citizen estimates $p + q + r + t < \frac{1}{2}$, then Citizen should choose A with probability $\frac{-t}{2p+2q+2r+t-1}$

Aversion Preferences: A = B > C



- (1) Do not choose C
- (2) If 10 will not occur, choose A
- (3) If 9 will not occur, choose B
- (4) If the relative probabilities of scenarios 9 and 10 occurring are known, with probability of 9 occurring p, it is a weakly dominant strategy to choose A with probability p

Practical Application - Where to Eat?

- Steven and 4 friends are going out to dinner
- Steven is indifferent between Burgertown and Spaghettitopia, but has a strong distaste for Veggieville
- His friends are quite predictable: Cassidy and James usually choose Veggieville, and Oliver and Felicia usually choose Spaghettitopia
- Steven chooses Spaghettitopia

$$\begin{array}{c} & 4 \text{ Friends} \\ 9 & 10 \\ \\ \text{Steven} \quad \begin{array}{c} \text{Spaghettitopia} \\ \text{Burgertown} \end{array} \begin{array}{c} 0 & -1 \\ -1 & 0 \end{array}$$

Practical Applications - Deciding a Verdict

- A jury is deciding a case with multiple related charges (i.e. breaking and entering, theft, property damage, etc.)
- They realize they are almost a hung jury, so decide to take a vote: all will agree to the outcome for ruling
- The options are: guilty on all charges, guilty on some charges, or innocent
- One juror believes the accused is innocent, and the rest of the jury is split between some charges and all charges
- The sympathetic juror should vote guilty on some charges

11 Other Jurors

 $\begin{array}{c|c} 9\\ \text{Juror} & \text{Innocent} & -1\\ \text{Guilty on Some Charges} & 0 \end{array}$

Conclusions

- Largely achieved goal of constructing rigorous strategic voting optimization, though at the cost of stringent assumptions
- Many times, one would be able to apply real-world assumptions to this model and reach a simple strategy, but at other times, a lack of ability to estimate probabilities of scenarios would hinder the model's scope
- Plethora of other assumptions or concepts could be introduced, which might alter results

Thank You

- Abram, Chase. Individual Strategy Choice in Electoral Decisions With Up to Three Options. 2017.
- If you are interested in learning more or reading my paper, feel free to contact me at chabram@indiana.edu
- Special thanks to all who have provided invaluable feedback: James Walker, Derek Wenning, Carlos Carpizo, Jill Abram, Anna Guse