Electoral Systems and Inequalities in Government Interventions

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Introduction

- **Government interventions** fraught with geographic **inequalities**
  - quantity and quality of public goods and services
    (Alesina et al. 99, WDR 2004, Barnerjee et al. 08)
  - taxation (Albouy 09, Troaino 17)
- Distributive politics literature: **political factors are key**
  (Ansolabehere et al. 02, Besley and Burgess 02, Stromberg 04, 08, Hodler and Raschky 08, Finan and Mazzocco 16)
  - many factors (e.g., apportionment, contestability, turnout, information, presence of core supporters/co-ethnics)
  - overall political distortions appear substantial
- **This paper:** focus on electoral systems (**MAJ vs. PR**)

Introduction

- **In MAJ systems**
  - multitude of electoral districts
  - each select a limited number of representative
  - winner-take-all method
- **In PR systems**
  - fewer electoral districts
  - each select at least 2 representatives
  - seats assigned in proportion to the vote shares of each party

Introduction

- **MAJ and PR are ubiquitous**
  - 82% of legislative elections held in the 2000s (Bormann and Golder 13)
- **Frequent debates about which system to use**
  - transition to democracies
  - older democracies (reforms relatively frequent)
    - ★ Colomer (2004): "82 major electoral system changes for assemblies [...] in 41 countries." between the early nineteenth century and 2002
      40 cases MAJ ⟶ PR, 13 cases PR ⟶ MAJ
- **Results relevant for Electoral College vs. NPV**
  - Whitaker and Neale (2004): "[...] more proposed constitutional amendments have been introduced in Congress regarding electoral college reform than on any other subject."
  - current initiative: National Popular Vote Interstate Compact

Introduction

- Conventional wisdom: **MAJ systems more conducive to inequality**
  - steeper incentives to target govt interventions to specific groups
- Based on **various theoretical arguments**

  (Persson&Tabellini 99, 00; Lizzeri&Persico 01, 05; Grossman&Helpman 05, Stromberg 08)
  - 50%-of-50% under MAJ, but 50% under PR
  - battleground states
  - tension between party leaders and "regional" legislators in MAJ
- This overlooks importance of **geographic distribution of voters**
  - MAJ: parties must win in different electoral districts in order to win multiple seats (*50%-of-at-least-50%*)
  - PR: no geographical constraint

This Paper

- Model of electoral competition where
  - government intervention **targetable** at finer level than electoral district
  - **heterogeneous localities**: population size, turnout, swingness
- Uncover a **relative electoral sensitivity effect** present only in MAJ
  - PR: more resources to localities with higher sensitivity
  - MAJ: more resources to localities with higher relative sensitivity
  - empirical evidence based on U.S. data (Stashko 20, Naddeo 20)
- Can lead to **lower inequalities in govt interventions in MAJ**
- **Numerical simulations** to assess **Electoral College reforms**

The Economy

- Continuum of voters of size 1
  - L localities: indexed by l, size n_l
  - each locality belongs to an electoral district $d \in \{1, 2, ..., D\}$
- Voters consume **locality-specific public resources**: $\mathbf{q} = \{q_1, ..., q_L\}$
  - q_l is amount per capita in locality l
- Preferences $u_l(\mathbf{q}) = u(q_l)$
  - $u' > 0 > u''$
  - no spillover across localities; no differences in utility functions

The Economy

- Government **allocates budget y to the different localities**
  - targeting at a finer level than the electoral district
    - ★ except in special case $L = D$
  - cost: $k_l\left(q_l\right) \equiv n_l^{\alpha} q_l$, with $\alpha \in [0, 1]$
    - ★ $\alpha = 1$: pure transfers ; $\alpha = 0$**:** pure local public good
  - budget constraint: $\sum_l n_l^{\alpha} q_l = y$

Optimal Allocation

- **Politics-free benchmark?**
- Social planner maximizes **utilitarian welfare function**:

$$\max_{\mathbf{q}} \mathcal{W}(\mathbf{q}) = \sum_l n_l u_l(\mathbf{q})$$
$$\text{s.t.} \sum_l n_l^{\alpha} q_l = y$$

- Socially optimal allocation:

$$\frac{\partial u_l(\mathbf{q})}{\partial q_l} = \lambda^{SW} n_l^{\alpha-1} \ , \ \forall l$$

  - socially optimal q_l increases in n_l $\longrightarrow$ only **vertical inequality**
  - no effect of electoral districts, nor of political characteristics

A Measure of Inequality

- To assess inequality in govt allocation: **welfare-based measure**
- We build upon Atkinson (1970, 1983)
  - assume CRRA utility:

$$u_l(\mathbf{q}) = \begin{cases} \ln(q_l) & \text{if } \rho = 1 \\ \frac{(q_l)^{1-\rho}}{1-\rho} & \text{if } \rho \neq 1 \end{cases}$$

    - ★ ρ is individual risk aversion
  - define the equivalent budget: $y^E(\mathbf{q}) = \tilde{W}^{-1}(\mathcal{W}(\mathbf{q}))$
    - ★ were $\tilde{W}(y)$ is the indirect social utility function

A Measure of Inequality

- Our a la Atkinson inequality measure is:

$$A(\mathbf{q}) := 1 - \frac{y^E(\mathbf{q})}{y}$$

  - compares actual budget to minimum budget needed to achieve the same amount of welfare

- A is a measure of financial cost of political distortions
  - the smaller A, the more efficient the allocation

The Politics

A Model of Electoral Competition

- **Two parties**: A and B
  - make budget allocation proposals: $\mathbf{q}^A$ and $\mathbf{q}^B$
- **Objective**: maximize expected number of seats in national assembly
  - robust to maximizing proba of winning majority of seats
- **Electoral system**: maps votes into seats
  - *PR*: seats attributed proportionally to fraction of national votes
    - ★ as if one nationwide district
    - ★ extension: PR with districts
  - *MAJ*: seats are proportional to the fraction of districts won
    - ★ one seat per district
    - ★ districts won by FPTP

The Politics

A Model of Electoral Competition

- **Probabilistic voting model**

  (Enelow&Hinich 82, Lindbeck&Weibull 87; Dixit&Londregan 95; Persson&Tabellini 01, Stromberg 04,08)

- Turnout varies across localities: t_l

- When voting, individual i in locality l casts ballot for A iff:

$$\Delta u_l(\mathbf{q}) \geq \nu_{i,l} + \delta_d$$

  - $\nu_{i,l}$: individual's ideology, cdf $\Phi_l(\cdot)$
    - ★ $\Phi_l(-\infty) = 0$, $\Phi_l(\infty) = 1$, and $\frac{\partial \Phi_l(\nu)}{\partial \nu} = \phi_l(\nu) > 0 \; \forall v \in \mathbb{R}$
  - δ_d : district-level popularity shock, cdf $\Gamma_d(\cdot)$
    - ★ $\Gamma_d(-\infty) = 0$, $\Gamma_d(\infty) = 1$, and $\frac{\partial \Gamma_d(\delta)}{\partial \delta} = \gamma_d(\delta) > 0 \; \forall \delta \in \mathbb{R}$

Equilibrium under PR

- **Under PR**: parties maximize the country-wide expected vote share subject to the aggregate budget constraint
- If equilibrium exists: $\mathbf{q}^A = \mathbf{q}^B$, and implicitly defined by:

$$\frac{\partial u_l\left(\mathbf{q}^A\right)}{\partial q_l^A} s_l = n_l^{\alpha} \lambda^{PR} \ \forall l$$

  - $s_l = \bar{\phi}_l t_l n_l$ is the **electoral sensitivity** of locality l
    - ★ $\bar{\phi}_l = \int_{\delta_d} \phi_l\left(-\delta_d\right) d\Gamma_d\left(\delta_d\right) \rightarrow$ expected density of swing voters in l
  - λ^{PR} is the Lagrange multiplier of the budget constraint under PR

Equilibrium under PR

Proposition

In the PR system, $q_l > q_{l'}$ if and only if $s_l n_l^{-\alpha} > s_{l'} n_{l'}^{-\alpha}$.

- More sensitive localities receive a larger share of the budget
  - for $\alpha < 1$ (no pure transfers): localities with a large number of active voters and more swing voters
  - for $\alpha = 1$ (pure transfers): population size does not play a role, but turnout rate and swingness still play a role
- No effect of γ_d

Equilibrium under MAJ

- **Under MAJ**: parties maximize the number of districts won
  - winning a district requires $\pi_d(\cdot) \geq 1/2$
- If equilibrium exists: $\mathbf{q}^A = \mathbf{q}^B$, and implicitly defined by:

$$\hat{\gamma}_{d(l)} \frac{\hat{s}_l}{\hat{s}_{d(l)}} u_l' \left(\mathbf{q}^A\right) = n_l^{\alpha} \lambda^{MAJ} \ \forall l$$

  - $\hat{\gamma}_d$ is the **contestability** of district d
    - ★ intuitively: proba that parties end up close to a tie in d
    - ★ $\hat{\delta}_d$ is the value of δ s.t. district is tied when $\mathbf{q}^A = \mathbf{q}^B$
  - $\hat{\phi}_l = \phi_l\left(-\hat{\delta}_d\right)$ is the **swingness** of locality l
  - $\hat{s}_l = t_l n_l \hat{\phi}_l$ is the electoral sensitivity of locality l
  - $\hat{s}_d = \sum_{j \in d} t_j n_j \hat{\phi}_j$ is the aggregate sensitivity in district d

Equilibrium under MAJ

Proposition

In MAJ, $q_l > q_{l'}$ *if and only if* $\hat{\gamma}_{d(l)} \frac{\hat{s}_l n_l^{-\alpha}}{\hat{s}_{d(l)}} > \hat{\gamma}_{d(l')} \frac{\hat{s}_{l'} n_{l'}^{-\alpha}}{\hat{s}_{d(l')}}$.

- For given pop. size, share of budget of locality l increases with
  - contestability of district, $\hat{\gamma}_{d(l)}$
  - **relative electoral sensitivity,** $\frac{\hat{s}_l}{\hat{s}_{d(l)}}$
    - ★ resources allocated to a locality depend on characteristics of neighbors

Equilibrium under MAJ

Proposition

In MAJ, $q_l > q_{l'}$ if and only if $\hat{\gamma}_{d(l)} \frac{\hat{s}_l n_l^{-\alpha}}{\hat{s}_{d(l)}} > \hat{\gamma}_{d(l')} \frac{\hat{s}_{l'} n_{l'}^{-\alpha}}{\hat{s}_{d(l')}}$.

- Intuition:
  - increase in support of A in l affects winner of district iff *pivotal*
  - for given increase in support, there is a range of realizations of δ_d s.t. the change is pivotal
  - the more likely δ_d fall in pivotal range, the better the locality is treated
  - two factors determine the likelihood δ_d falls in pivotal range
    - ★ width and height

Equilibrium under MAJ

Proposition

In MAJ, $q_l > q_{l'}$ if and only if $\hat{\gamma}_{d(l)} \frac{\hat{s}_l n_l^{-\alpha}}{\hat{s}_{d(l)}} > \hat{\gamma}_{d(l')} \frac{\hat{s}_{l'} n_{l'}^{-\alpha}}{\hat{s}_{d(l')}}$.

- **Width of pivotal range** determined by **relative sensitivity**
  - higher $\hat{s}_l$ $\rightarrow$ voters in l more responsive to increase in utility

    $\rightarrow$ change in the winning party for a wider range of shocks

    $\rightarrow$ **increases width of pivotal range**
  - higher $\hat{s}_{d(l)}$ $\rightarrow$ voters in d more responsive to the shock δ_d

    $\rightarrow$ aggregate vote share in d more unstable

    $\rightarrow$ **reduces width of pivotal range**

Equilibrium under MAJ

Proposition

In MAJ, $q_l > q_{l'}$ *if and only if* $\hat{\gamma}_{d(l)} \frac{\hat{s}_l n_l^{-\alpha}}{\hat{s}_{d(l)}} > \hat{\gamma}_{d(l')} \frac{\hat{s}_{l'} n_{l'}^{-\alpha}}{\hat{s}_{d(l')}}$.

- **Width of pivotal range** determined by **relative sensitivity**
- **Height of pivotal range** determined by **district contestability**
  - likelihood that the shock takes any of the values in the pivotal range

Equilibrium under MAJ

Proposition

In MAJ, $q_l > q_{l'}$ if and only if $\hat{\gamma}_{d(l)} \frac{\hat{s}_l n_l^{-\alpha}}{\hat{s}_{d(l)}} > \hat{\gamma}_{d(l')} \frac{\hat{s}_{l'} n_{l'}^{-\alpha}}{\hat{s}_{d(l')}}$.

- **Special case:** one locality per district
  - typical in the literature (Persson and Tabellini 00, Stromberg 04, 08)
- $\hat{s}_l = \hat{s}_{d(l)} \rightarrow$ all localities have the same relative sensitivity
- Differences in allocations exclusively driven by differences in contestability across district
  - trade-off MAJ vs. PR: contestability vs. sensitivity
  - overlooks role of relative sensitivity

Comparing the Systems

- Comparison of government interventions under MAJ and PR systems
  - PR: electoral sensitivity
  - MAJ: relative electoral sensitivity and contestability
- Simplifying assumptions
  - $\alpha = 0$ (pure public good)
  - individual and district shocks are uniformly distributed
    - ★ individual specific shock: $\nu_{i,l} \sim U[\frac{-1}{2\phi_l}, \frac{1}{2\phi_l}]$

      ($\bar{\phi}_l = \hat{\phi}_l = \phi_l =$ **swingness**)
    - ★ district specific shock: $\delta_d \sim U[\beta_d - \frac{1}{2\gamma_d}, \beta_d + \frac{1}{2\gamma_d}]$

      ($\hat{\gamma}_d = \gamma_d =$ **contestability**)

Comparing the Systems

Winners and Losers

- Locality wins or loses following a PR-to-MAJ reform?
- Numerical example with 4 localities and 2 districts
  - CRRA: $u(q_l) = 2\sqrt{q_l}$
  - $\gamma_A/\gamma_B = 1$ or $\gamma_A/\gamma_B = 6$

District	Locality	Sensitivity (s_l)	q_l^{PR}	q_l^{MAJ} $(\gamma_A/\gamma_B = 1)$	q_l^{MAJ} $(\gamma_A/\gamma_B = 6)$
A	1	1	2.9%	9.7%	19.4%
A	2	2	11.8%	38.7%	77.7%
B	3	2	11.8%	7.1%	0.4%
B	4	5	73.5%	44.5%	2.5%

Comparing the Systems

Inequality

- Which system generates more inequalities in govt interventions?
- We use our Atkinson measure of inequality $A(\mathbf{q})$
  - increases as political forces distort allocation away from social optimum
  - PR *Atkinson-dominates* MAJ if $A\left(\mathbf{q}^{PR}\right) < A\left(\mathbf{q}^{MAJ}\right)$
- Back to previous numerical example:
  - if the 4 localities have identical turnout and swingness

    $\rightarrow$ sensitivity only varies because of differences in pop. sizes

    - ★ PR: social optimum $A\left(\mathbf{q}^{PR}\right) = 0$
    - ★ MAJ: distortions $A\left(\mathbf{q}^{MAJ}\right) = 0.14$ for $\gamma_A/\gamma_B = 1$

      $A\left(\mathbf{q}^{MAJ}\right) = 0.71$ for $\gamma_A/\gamma_B = 6$

Comparing the Systems

Inequality

- Which system generates more inequalities in govt interventions?
- We use Atkinson measure of inequality $A(\mathbf{q})$
  - increases as political forces distort allocation away from social optimum
  - PR *Atkinson-dominates* MAJ if $A\left(\mathbf{q}^{PR}\right) < A\left(\mathbf{q}^{MAJ}\right)$
- Back to previous numerical example:
  - if the 4 localities have identical turnout and swingness
  - if the 4 localities have identical pop. size $(n_l = 1/4)$
    - ★ MAJ Atkinson-dominates PR when $\gamma_A/\gamma_B = 1$

      $A\left(\mathbf{q}^{MAJ}\right) = 0.13 < A\left(\mathbf{q}^{PR}\right) = 0.26$
    - ★ PR Atkinson-dominates MAJ when $\gamma_A/\gamma_B = 6$

      $A\left(\mathbf{q}^{MAJ}\right) = 0.41 > A\left(\mathbf{q}^{PR}\right) = 0.26$

Comparing the Systems

Inequality

- Which system generates more inequalities in govt interventions?
- **General comparison?** Complex

Proposition

PR Atkinson-dominates MAJ if $\frac{\gamma_d}{\sum_{d'=1}^{D}\gamma_{d'}}$ *is a mean preserving-spread of* $\frac{s_d}{\sum_{d'=1}^{D}s_{d'}}$ *(and conversely) when either*

1. $\rho \neq 1$, *there is one locality per district, and* $n_d = 1/D \ \forall d$, *or*

2. $\rho = 1$, *and* $n_d = 1/D \ \forall d$.

- For those specific cases, comparison boils down to comparing
  - spread in contestabilities
  - spread in electoral sensitivities

Comparing the Systems

Inequality

- Which system generates more inequalities in govt interventions?
- **General comparison:** complex

Proposition

PR Atkinson-dominates MAJ if $\frac{\gamma_d}{\sum_{d'=1}^{D} \gamma_{d'}}$ *is a mean preserving-spread of* $\frac{s_d}{\sum_{d'=1}^{D} s_{d'}}$ *(and conversely) when either*
1. $\rho \neq 1$, *there is one locality per district, and* $n_d = 1/D \ \forall d$, *or*
2. $\rho = 1$, *and* $n_d = 1/D \ \forall d$.

- Useful to interpret findings in the empirical literature
  - Stromberg (2008): replacing Electoral College with NPV $\rightarrow$ decrease in cross-states inequalities in campaign resources

    (for elections studied: cross-state differences in contestability >> differences in sensitivity)
- **What if we allow for targeting at sub-district level?**

Comparing the Systems

Importance of Sub-District Targeting

Affects comparison in terms of inequalities

- Numerical example: same as before (with $\gamma_A/\gamma_B = 6$)
  - new columns with targeting at district level

District	Locality	s_l	n_l	q_l^{PR}	q_l^{MAJ}	q_l^{PR-d}	q_l^{MAJ-d}
A	1	1	17%	2.9%	19.4%	7.8%	48.6%
A	2	2	33%	11.8%	77.7%	7.8%	48.6%
B	3	2	33%	11.8%	1.2%	42.2%	1.4%
B	4	5	17%	73.5%	2.5%	42.2%	1.4%
Atkinson index:				**0.42**	**0.38**	**0.22**	**0.40**

- Comparison of Atkinson measures flips $\rightarrow$ misleading conclusion
  - targeting creates within district inequality under both systems
  - what matters is the share of resources that flow to each district (weight put on new distortions)

Affects gains and loses of districts

- Different numerical example:
  - same utility function
  - 3 districts (A, B, and C)
    - ★ each composed of two localities
    - ★ different contestabilities: $\gamma_A = 0.2$, $\gamma_B = 1$, and $\gamma_C = 1.5$

District	s_l		q_d^{PR}	q_d^{MAJ}	q_d^{PR-d}	q_d^{MAJ-d}
A	1	1	15.1 %	1%	16.7 %	1.2%
B	0.2	1.8	24.7%	41.7%	16.6 %	30.4%
C	2	2	60.2%	57.3%	66.7 %	68.4%

- A and C receive more resources with district targeting, B less
- MAJ-to-PR reform:
  - C wins under locality targeting (+3 p.p.)
  - C loses under district targeting (-1.7 p.p.)

Reforms: the U.S. Presidential Electoral System

- Study possible reforms of the Electoral College
- Extension of the model to other versions of MAJ and PR
- Calibration of theoretical results to U.S. data

Reforms: the U.S. Presidential Electoral System

- **Electoral College**:
  - each state has a #Electors = #representatives + #senators
  - candidate with most electors wins
  - MAJ but with different weight for the districts
- **Potential reforms:**
  - National Popular Vote (NPV)
    - ★ equivalent to PR
  - PR version of the Electoral College (PR-EC)
    - ★ allocation of electors proportional to vote shares in each state

Reforms: the U.S. Presidential Electoral System

Theory

- Electoral College in our model

  $\simeq$ MAJ system with district weight ω_d

$$\frac{\partial u_l\left(\mathbf{q}^A\right)}{\partial q_l^A} = \frac{1}{\omega_{d(l)}} \frac{\lambda^{\textbf{College}}}{\gamma_{d(l)}} \; \frac{\sum_{k \in d(l)} s_k}{s_l}, \; \forall l$$

- Comparison with MAJ:
  - tilts the allocation of resources towards districts with higher ω_d
  - same role of contestability and relative sensitivity

Reforms: the U.S. Presidential Electoral System

Theory

- PR version of the Electoral College in our model

$$\frac{\partial u_l\left(\mathbf{q}^A\right)}{\partial q_l^A} = \frac{n_d t_d}{\omega_d}\frac{1}{s_l}\lambda^{PR-EC}, \ \forall l$$

  - $t_d := \sum_{l \in d} t_l \frac{n_l}{n_d}$ is the average turnout in d
  - $n_d := \sum_{l \in d} n_l$

- Comparison with nationwide PR or NPV:
  - new term: $\frac{n_d t_d}{\omega_d}$ was de facto equal to 1 under PR
    - ★ allocation as if each district received a share of seats equal to its realized number of votes
    - ★ high-turnout districts tend to receive less under PR-EC than PR
  - still no effect of contestability

Reforms: the U.S. Presidential Electoral System

Numerical Simulations

- Application of results to U.S. presidential election data
- Goal: assess numerically the implications of possible reforms of the U.S. Electoral College
- Focus on the insights that sub-district targeting brings to the question

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Data

- Match model and US political and administrative structure
  - states are the districts (48 in our dataset)
  - counties are the localities (3106 in our dataset)
- Our dataset covers 10 presidential elections (1980-2016)
- We need proxies for key variables

Reforms: the U.S. Presidential Electoral System

Proxies for key variables

- n_l: decennial census information from IPUMS-NHGIS
  - post-2010, supplemented with American Community Survey
- t_l: number of votes cast (from Congressional Quarterly Press Voting and Elections Collection) divided by total county population
- ϕ_l: standard deviation in the democratic vote share in previous elections (i.e., between 1980 and the election under consideration)
- γ_d: two measures
  - $\gamma_{d,e} = 1 - VM_{d,e}$ where $VM_{d,e} = |rep\_share_{d,e} - dem\_share_{d,e}|$
    - Berry et al. (2010)
  - $\gamma_{d,e}^{Str}$ relies on the work and data from Stromberg (2008)
    - roughly, we fit Stromberg's predictions, find relationship between fitted values and $\gamma_{d,e}$, and then extrapolate for other years

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Data

Table 4: Descriptive Statistics

Statistics	Mean	Median	Std. Dev	Min	Max	N	R^2 on FE
ϕ_l	0.073	0.067	0.027	0.019	0.222	9314	0.334
t_l	0.43	0.431	0.076	0.119	0.896	9314	0.377
n_l (*)	100	26	321	0	10121	9314	0.119
s_l (*)	3	1	10	0	357	9314	0.116
s_l/s_d	0.015	0.005	0.04	0	0.713	9314	0.206
s_d (*)	190	123	206	17	1209	144	1.000
γ_d	0.83	0.841	0.111	0.486	0.999	144	1.000
γ_d^{Str}	0.83	0.719	0.412	0.248	2.54	144	1.000
ω_d	11	8.5	9.706	3	55	144	1.000

Notes: Averages for years 2008-2016. (*) in thousands.

- Variations both across counties and across states
  - particularly important for the absolute and relative sensitivity
- R^2 of regressions of each variable on state-year fixed effects
  - substantial within-state variation in the variables of interest

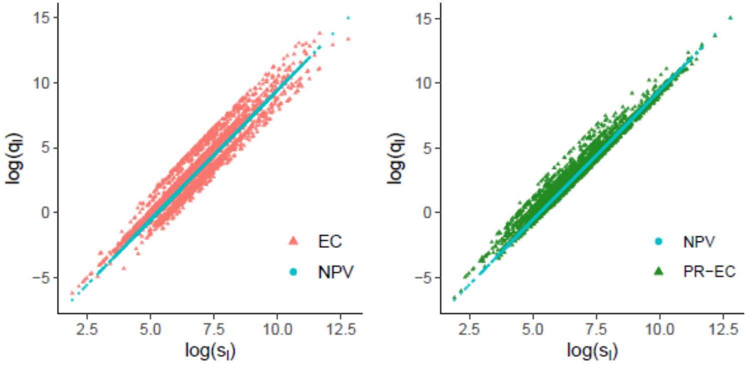
Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Predicted Allocations

- We can compute the predicted allocation for
  - CRRA utility ($\rho = 0.5$)
  - uniform shocks
  - total budget of \$10 million
- Three systems: EC, NPV, and PR-EC

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Predicted Allocations



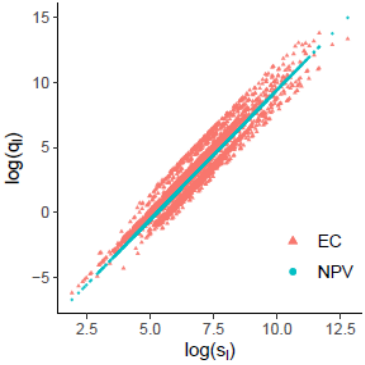
Notes: Year 2016. Strömberg-like measure of contestability.

Figure 1: COUNTY ALLOCATIONS AS A FUNCTION OF THEIR ELECTORAL SENSITIVITY

- Relationship is log-linear in s_l (drives most of variations in allocations)

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Predicted Allocations



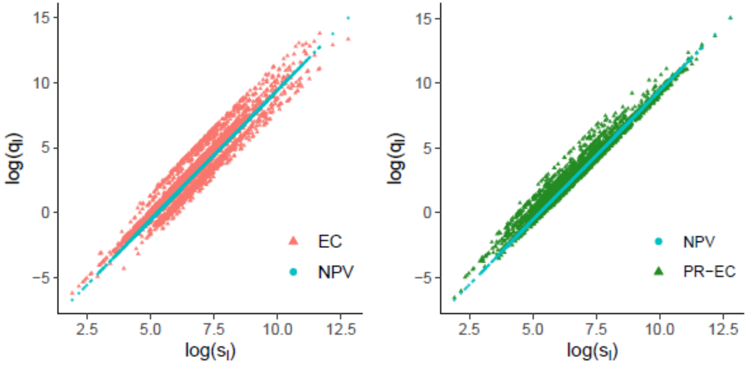
Notes: Year 2016. Strömberg-like measure of contestability.

Figure 1: County allocations as a function of their electoral sensitivity

- Variations not only due to differences in n_l, also t_l and ϕ_l

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Predicted Allocations



Notes: Year 2016. Strömberg-like measure of contestability.

Figure 1: COUNTY ALLOCATIONS AS A FUNCTION OF THEIR ELECTORAL SENSITIVITY

- EC and PR-EC: counties with same s_l typically be treated differently

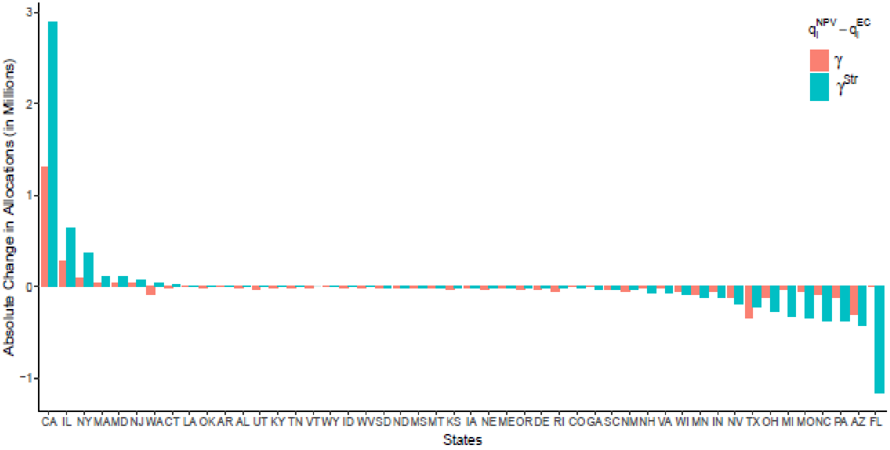
Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Winners and Losers of the Reform

- A reform of the EC towards NPV would generate winners and losers
- Counties in a given state win more (or lose less) when the state has
  - a high aggregate sensitivity s_d
  - a small number of electoral votes ω_d
  - a low contestability γ_d or γ_d^{Str}

Reforms: the U.S. Presidential Electoral System

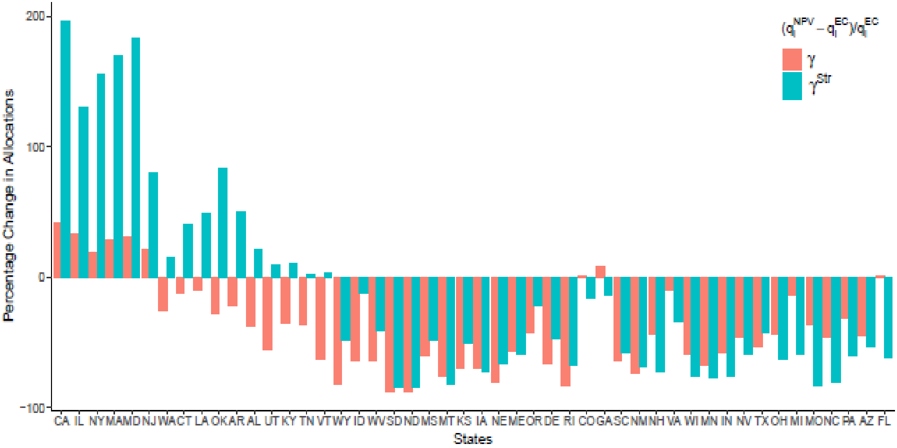
Numerical Simulations: Winners and Losers of the Reform



(a) Absolute gain.

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Winners and Losers of the Reform



(b) Percentage gain.

Several interesting patterns emerge

1. A majority of states lose from the reform in favor of a few
2. Common wisdom: winners and losers depends on γ and ω
    - many of biggest losers (FL, PA, AZ, NC, MI) battleground states
    - many of biggest winners have low ω and γ (CA, IL, NY, MA)
    - importance of contestability is magnified under γ^{Str}
        - ★ FL: magnitude of loss is fundamentally different under γ and γ^{Str}
        - ★ some states (AR, LA, OK, KY, AL, TN, CT, UT, WA) win only for γ^{Str}

Reforms: the U.S. Presidential Electoral System

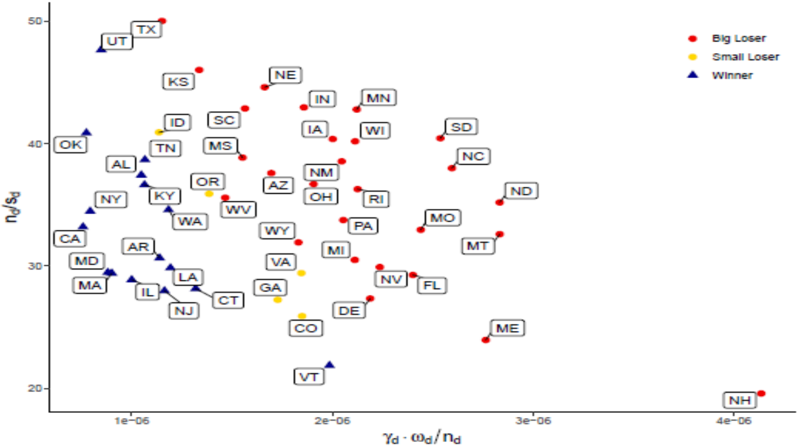
Numerical Simulations: Winners and Losers of the Reform

Several interesting patterns emerge

1. A majority of states lose from the reform in favor of a few
2. Common wisdom: winners and losers depends on γ and ω
3. Overlooks the role of the aggregate sensitivity of the state
    - new figure to highlight the importance of that component
    - IL vs. TX: similar contestability and malapportionment
    - yet, IL among biggest winners, TX among biggest losers
        - ★ TX has relatively low s_d, due to low t_d and ϕ_d

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Winners and Losers of the Reform



Notes: Big Loser / Small Loser / Winner if percentage gain $\in (-\infty, -0.5]$ / $(-0.5, 0]$ / $[0, \infty)$. Average for 2008-2016. Strömberg-like contestability.

Figure 3: Decomposition of State's Characteristics

Several interesting patterns emerge

1. A majority of states lose from the reform in favor of a few
2. Common wisdom: winners and losers depends on γ and ω
3. Overlooks the role of the aggregate sensitivity of the state
4. Winners and losers in absolute value vs. percentage terms
    - largest winners in absolute value, also among those in percentage terms
    - largest losers in percentage also small states (MT, ND, RI, SD)
        - over-represented in the EC

Several interesting patterns emerge

1. A majority of states lose from the reform in favor of a few
2. Common wisdom: winners and losers depends on γ and ω
3. Overlooks the role of the aggregate sensitivity of the state
4. Winners and losers in absolute value vs. percentage terms
5. Similar results for reform to PR-EC
    - but, states with low turnout gain more (or lose less) than with NPV
    - e.g., CA and TX lower than average t_d, FL higher

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: Inequality

- Comparison electoral systems based on inequality in allocation
- Two measures:
  - Gini of inequality across individuals: includes all inequalities
  - Atkinson measure: socially inefficient inequality
- Results:

	$EC\ (\gamma^{Str})$	$EC\ (\gamma)$	NPV	PR-EC
Gini	0.842	0.875	0.909	0.912
Atkinson	0.316	0.089	0.072	0.071

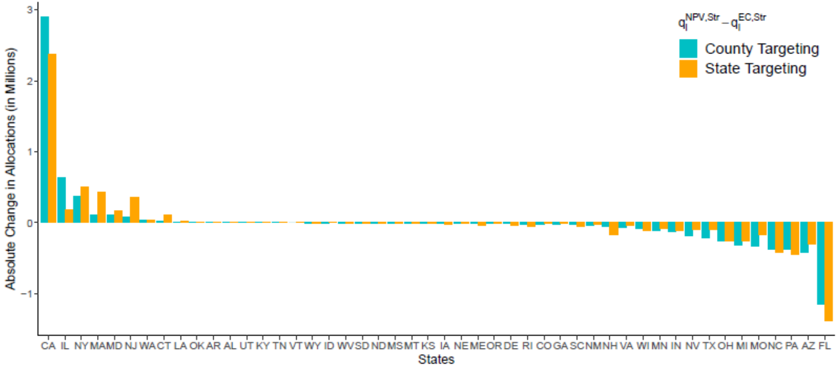
Table 5: INEQUALITY MEASURES 2016

  - Gini: both reforms slightly **increase** inequality for 2008-2016
  - Atkinson: both reforms slightly **decrease** inequality for 2008-2016

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: State-Level vs. County-Level Allocations

What if no county targeting?



Notes: Average for 2008-2016.

Figure 6: Winners and losers of a reform for County and State Targeting

Reforms: the U.S. Presidential Electoral System

Numerical Simulations: State-Level vs. County-Level Allocations

What if no county targeting?

- IL and CA gain less, while NJ and MA gain more
- AZ and TX lose less, while FL and NH lose more
- Key factor: within-state heterogeneity
  - IL and CA composed of counties with considerably different s_l
  - highly sensitive counties gain more under county-level targeting, especially when other counties in the state are low sensitivity

Conclusions

- **Effects of electoral systems on inequality in govt interventions**
  - focus on **PR vs. MAJ**
- **Main novelty:** sub-district targeting and heterogeneity
- **Main result:** *relative electoral sensitivity effect* only in MAJ
  - can reverse common wisdom that inequalities higher in MAJ
- **Implications** for reforms of U.S. Electoral College
  - not only contestability and apportionment of the states
  - also, aggregate sensitivity of the states
  - relevance confirmed by numerical simulations