How Robust are Electoral Institutions? An Agent-Based Test of Electoral Rules and Ideal Points

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Abstract

A broad literature explains many dimensions of politics as a function (at least partly) of electoral rules. Although much of this work is quite compelling and the evidence convincing, the theoretical underpinnings remain underexamined, especially for more complex and obscure electoral systems. In this paper, I propose an agent-based simulation as a tool to explore theories about electoral rules' impact on political systems. I illustrate by applying the simulation to three electoral systems, one whose incentives have faced extensive theoretical scrutiny, and two others whose workings are as yet under-examined.

1 Introduction

Electoral systems are perhaps the most important of all rules of the political game in modern democracies. Electoral institutions shape the behavior of nearly all important political actors. Voters' turnout, information levels, and balance between strategic and sincere behavior are all partially determined by the incentives of electoral systems. Candidate and incumbent emergence, policy positions, and campaign strategies also depend on various features of elections. Finally, parties' discipline, number, platforms are both tied directly to electoral rules in a broad literature. Some of this literature is based on empirical tests; other parts are based on either soft or formal rational choice models. Further, much of the literature is based on understandings of stylized electoral rules and social contexts.(Cox, 1997; Carey and Shugart, 1995; Morgenstern, 2000; Hallerberg and Marier, 2004; Hotelling, 1929; Black, 1958; Downs, 1957; Palfrey, 1984)

This paper seeks to address two challenges to additional growth in our understandings of electoral systems' impact on many facets of political systems. First, much of the formal modeling of electoral systems is limited to first-past-the post systems or simple proportional representation systems. Virtually unexamined are the nuances of more complex systems. Second, empirical testing of some of the second-tier or indirect effects of electoral rules is difficult. Many systems are country-specific, providing very limited variance for testing.

In this paper, I demonstrate one possible approach for building broader

and more robust theories of electoral systems: agent-based modeling (ABM). ABM is a promising and fast-growing part of the social sciences. It facilitates modeling of very complex, interactive processes. Effectively, it is a simulation where artificial actors within a program follow a set of preferences and decision rules, allowing us to manipulate both institutional rules and agents' preferences and constraints, and observe their impact on political outcomes.

My long-term goal is to build a simulation package that will allow scholars to study legislative elections. The simulation allows researchers to manipulate voters' preferences, information levels, and voting decision rules; politicians' campaign strategies, own preferences, and decision rules; and the electoral rules and other institutions under which all actors operate: ballot structure, aggregation rules, nomination proceedures, and other components of electoral systems.

The paper proceeds in three additional steps. In the next section, I describe the simulation's parameters and working in some detail. In Section 3, I illustrate by examining the campaign incentives provided by three electoral systems. In Section 4, I consider potential extensions and limitations of the method.

2 The Simulation

The simulation relies on a simple spatial understanding of politics. Candidates pick one-dimensional platforms, voters evaluate candidates and pick their most-preferred, then candidates may adjust their platforms for upcom-

ing elections or leave the game. The following paragraphs describe the primary actors in the model, their parameters, and the nature of their choices.

2.1 Agents

Voters have four characteristics: ideology, residency, partisanship, and information levels. Ideology is voters' prefered points in the one-dimensional policy space that ranges from zero to one. Voters' preferences are uniformly distributed across this space. Voters determine electoral outcomes by casting ballots for their most-preferred candidates. Voters' utility for supporting candidates is a function of ideological distance - voters cast sincere ballots for the candidates whose platforms are closest to their own ideal points. Distance functions can be simple linear, quadratic, or exponential.

Voters also have residency. Districts are comprised of subregions, and voters reside in equal proportions in each of the subdistricts. In some simulations, candidates may campaign in one region but not another, affecting voters' information levels and propensity to support them. Voters may also have partisanship - allegiance of varying strength to one party or another. None of these characteristics change in the course of the simulation, though that extension is coming. Finally, voters have information levels. Voters with high information observe all candidates' locations with no or minimal error. Voters with low information observe candidates' locations with significant error. Note that information levels are distinct from region.

Politicians have three parameters. First, they have one-dimensional policy platforms, whose value ranges from zero to one. The mechanisms for chosing these vary depending on the nature of the solution desired. Under random attrition, losing candidates retire, winners keep their policy platforms, and new challengers are drawn randomly from a uniform distribution. Alternatively, under stepwise convergence, candidates compare their retrospective vote share with what they would have received had they been to the left or the right of their chosen position. If they would have done better with a different policy platform, they move in the direction that offers the greatest improvements.

Politicians also have campaign strategies; they must choose where to allocate limited campaign resources. Specifically, they allocate campaign resources to specific geographic subconstituencies. They may allocate limited resources uniformly across all districts or concentrate their efforts in just one or two regions. In any event, allocating resources to a constituency reduces perceived ideological distances. Finally, politicians have partisanship, which is a fixed parameter. For certain electoral systems, partisanship determines initial platforms, which are allowed to change over time.

2.2 Electoral Cycles

The game begins with the creation of voters and establishment of candidates' initial policy platforms and campaign strategies. Voters allocate their votes to utility maximizing candidates. Votes are totalled and distributed to parties

and candidates following the electoral rules chosen for the simulation. After the election, the system may evolve in two ways. First, all candidates may update their positions and then run again. In this scenario, each candidate compares votes (or ranking) received with the number of votes she would have received in four alternative locations: one voter to the left, one voter to the right, one candidate to the left, or one candidate to the right. Both winners and losers are always comparing their vote share with the votes they could have received had they taken alternative positions, and update their strategies to improve their standing. A second evolutionary mechanism is simple attrition. Losers retire, and new challengers are drawn from a uniform distribution to replace them. Candidates never change strategies or policy locations - they simply drop out when defeated. Once candidates have adjusted their positions or been replaced by new challengers, the electoral cycle takes place again, with voters choosing between the new set of policy platforms put forth by candidates.

3 An Application and Preliminary Results

In this section I will illustrate several examples of electoral system simulations drawing on three systems: single-member districts and two versions of proportional representation. The first, single member districts, have well-known results against which we can develop baseline comparisons. The next two have been used in many countries and their effects on party systems the subject of some debalte, but they have face little theoretical scrutiny.

3.1 Plurality Elections

A large literature provides solid results for the nature of candidate dispersion in first-past-the-post electoral systems, where voters cast a single ballot for one candidate, and the top vote-getter receives a seat. The most well-known finding is that of the median voter - plurality rules with two candidates should lead to median voter results. Scholars have also found that two candidates will stave off challenges from a third by diverging from the median voter. Figure 1 shows results from 100 electoral cycles of plurality elections with two candidates and with three candidates. The two graphs in the first column use "stepwise" updating, the two graphs in the second column use attrition updating. All show relatively fast convergence to median results for both forms of succession. With stepwise succession, the two candidate case quickly converges to the median result. With attrition, where losers retire and are randomly replaced, convergence is even faster - within a few cycles.

Results with three candidates are mixed. For attrition succession, the results converge to the game theoretic predictions: two candidates diverge from the median to protect themselves from a third entrant. For stepwise convergence, the results are quite different - all three candidates remain at the median, jockeying each round to try and capture the most votes from that location.

Figure 1: Convergence in SMD Elections

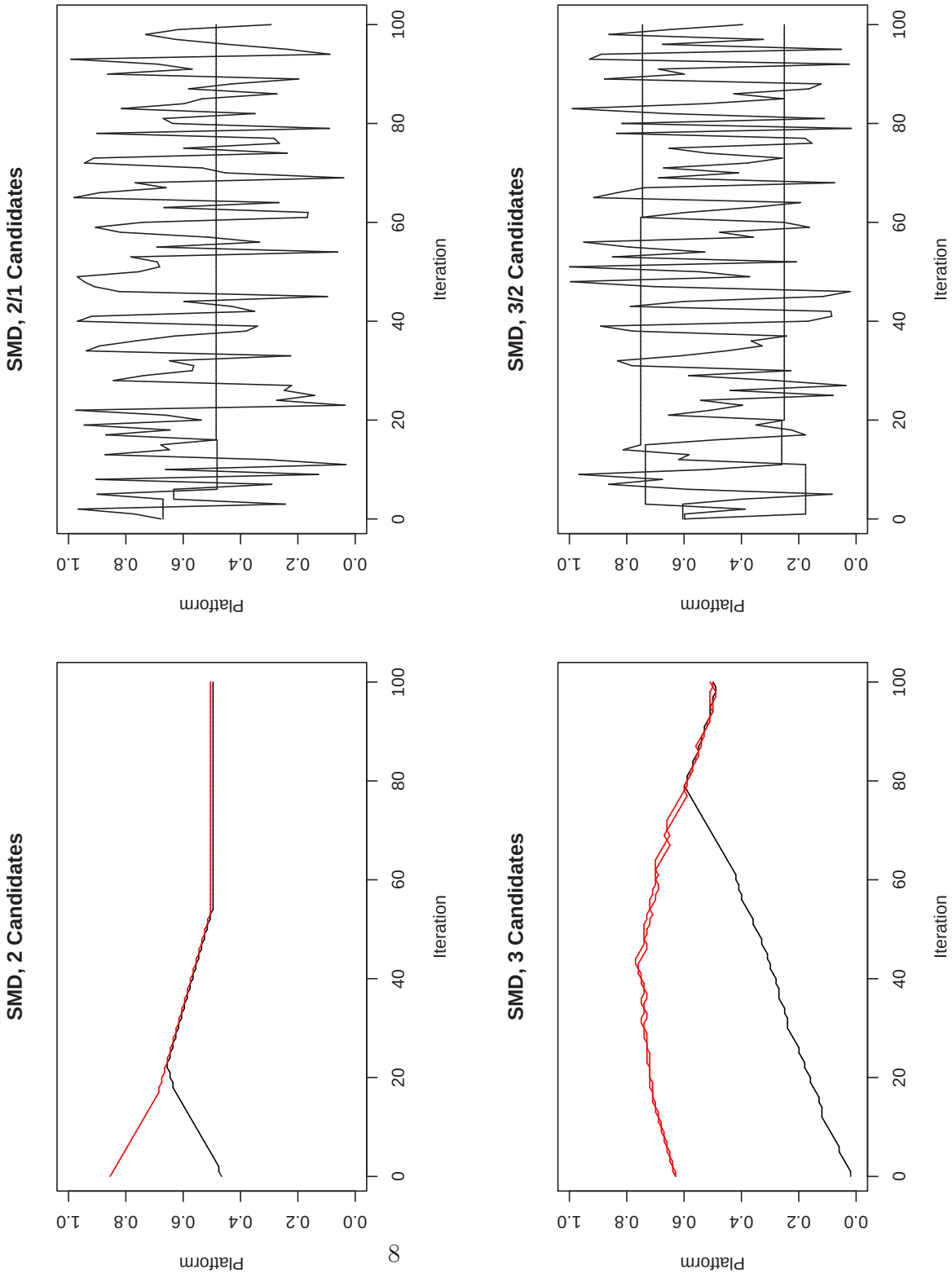


Table 1: Hypothetical Election Results - OLPR

	Party X		Party Y		Party Z	
Rank	Candidate	Votes	Candidate	Votes	Candidate	Votes
1	Miriam	7	Ruy	11	Cesar	18
2	João	6	Eudoro	9	Marta	8
3	Angelica	4	Jorge	7	Trinidade	7
4	Darcy	3	Udson	2	Ze	4
5	Carlos	2	Patricia	0	Walter	1
List votes	Party X	1	Party Y	8	Party Z	2
Total votes		23		37		40
Seats		1		1		2

Parameters: 4 seats, 3 parties, 15 candidates, and 100 voters.

3.2 Chile and Brazil: OLPR

My second example draws on the literature on Brazilian and Chilean politics.[1] Both countries use derivations of the open-list proportional representation (OLPR) electoral system.[2] The system is basically proportional representation, but with preference voting instead of party-defined lists.

Table 1 illustrates the system. Citizens each cast a single for their preferred candidate. Votes are aggregated by party and seats allocated to parties according to their proportion of the vote. Finally, seats are allocated to candidates within parties according to the number of votes each received - the top vote-getter receives the first seat, for example.

This electoral system has been characterized as encouraging within-party competition and fragmenting parties. The basic logic is that candidates are rewarded for taking each others' votes. For example, João in the illustration above, was not elected. He could earn a seat in two ways - by increasing his party's vote share by 17, enough to earn a second seat, or by taking just 1 vote from the front-runner in his own party! The implication is that within-party competition is more likely than without party competition, and this should encourage party fragmentation. The basic mechanisms that encourage party fragmentation have been well-documented and are well-known to many scholars of electoral instititutions.(Ames, 2001, 1995; Mainwaring, 1991) Further, additional work has suggested that these party-fragmenting effects should only increase with district magnitude.(Carey and Shugart, 1995)

These perverse incentives of OLPR are contrasted with those of close-list proportional representation, where party leaders order lists. Voters only choose between lists - not between individuals. This system is considered to promote strong, cohesive, and disciplined parties; discouraging within-party competition for votes. Because candidates are not rewarded for competing for votes, the logic goes, they should not attack their copartisans, reducing party fragmentation and increasing party cohesion.

A series of simulations offers some additional information about the way each of these systems works. Figures 2 and 3 show the patterns of platforms for each party under each of the two electoral systems. As before, the first column of graphs is stepwise succession; the second column is random attri-

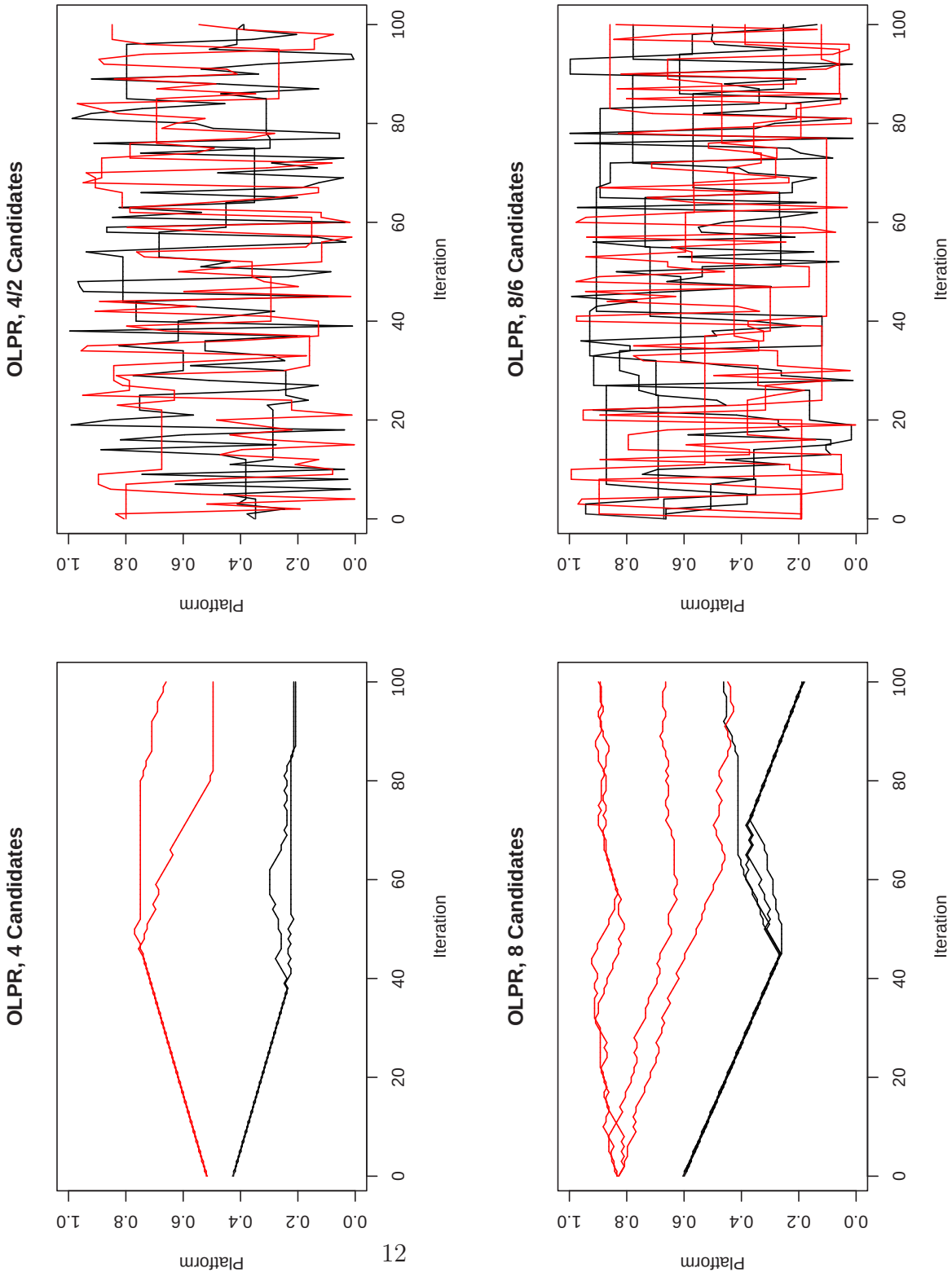
tion succession. There are two parties nominating candidates, distinguished by color - red and black.

The simulation suggests a very surprising result: the closed-list system is just as variant as the open-list system. This results run contrary to the literature's predictions. CLPR should produce more cohesive parties, but it is consistently electing less cohesive parties! Under OLPR and stepwise results, the candidates rarely venture into the ideological space of other parties - they stick to "their side" of the ideological spectrum. Under CLPR, the candidates from each party intermingle significantly, with no distinct parts of the political spectrum dominated by one party or another.

With some thought, the explanation becomes clear. Under OLPR, it is easier to win by stealing votes from copartisans than from competitors. This encourages candidates from the same party to stick together - competing for the same part of the ideological spectrum. For example, under OLPR, a legislator that moves *closer* to a copartisan, takes votes from that legislator and increases her chance of election.

Under CLPR, taking votes from copartisans only reduces one's owh chances of winning; taking votes from other parties is the optimal strategy. Moving closer to a copartisans cannot improve electoral prospects. Instead, candidates ought to spread out across the ideological spectrum to maximize their party's vote share and avoid overlap as much as possible. In other words, in this simple example, intra party competition in OLPR actually reduces ideological variance within parties while the lack of party competition in CLPR

Figure 2: Convergence in OLPR Elections



increases ideological variance.

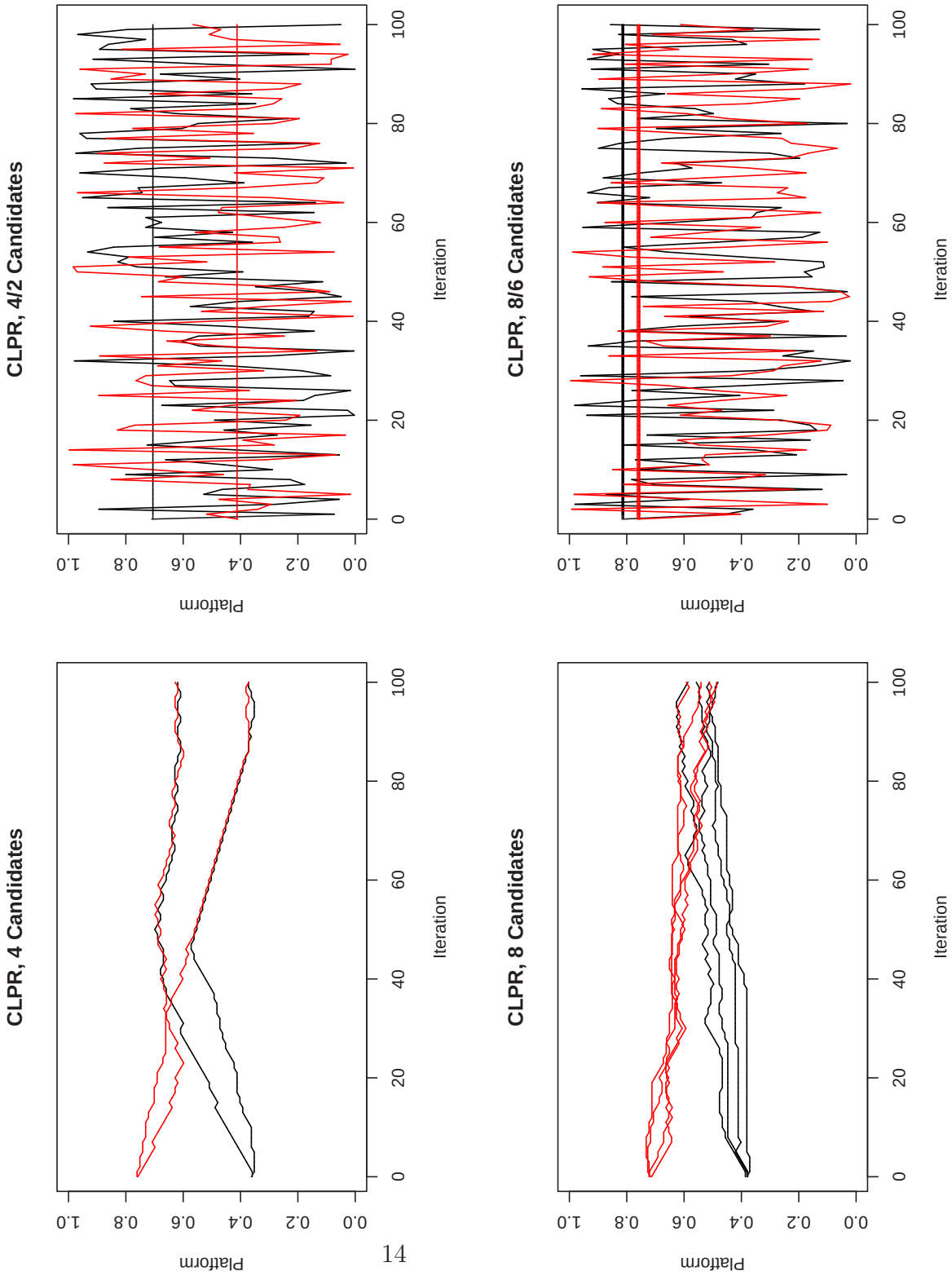
I expect that any reader is at this point eager to point out the numerous oversimplifications of the model: voters have no partisanship and cast sincere votes, party leaders do not impose discipline on members that diverge from the party line, and there is no strict control of nominations, and voters pick party lists based on candidates' positions, not party platforms.

These are all true - this model is an oversimplification. But it clarifies and helps us understand the mechanisms of the two systems. There is a strong consensus in the literature that OLPR systems have weak, undisciplined parties and CLPR have strong, cohesive parties. The simulation does not disprove that result. But the findings suggest that the vote aggregation rules, specifically the incentives for within party competition are not responsible for the differences in party systems. Instead, scholars should focus on nomination proceedures and voter characteristics.

4 Extentions and Future Directions

In this paper I have sought to explain the methods and usefullness of agent based models for understanding the impact of electoral institutions on legislative politics. I illustrated with two applications, one to first past the post institutions, a second with proportional representation rules. The agent-based model reproduced the essence of well-known features of these electoral rules: median voter convergence for two candidates, and increasing variance in ideal points as the number of candidates increases.

Figure 3: Convergence in CLPR Elections



The second example compared the incentives of two versions of proportional representation: open-list and closed-list systems. The conventional wisdom is that the former reduces party cohesion and discipline while the latter strengthens parties and increases cohesion. My simulation showed how under a simple set of assumptions, the opposite is true - CLPR, not OLPR, decreases cohesion. Regardless, both examples support two conclusions. First, the basic method leads to robust and interesting results and confirms findings from the formal literature. Second, when formal analysis becomes difficult, the ABM approach allows us to explore the impact of various assumptions on politics by relaxing them one at a time and simulating in their absence.

The basic program is very incomplete and awaits several important extentions. Four additional routines are planned for the near future:

- Increase candidate's own preferred platforms. Candidates have to balance electoral opportunity and their own preferences for specific platforms.

- Party ideal points. Give parties stable ideal points and mechanisms for punishing those that stray too far from the party line.

- Voter information levels. As discussed previously, this is already part of the basic siumulation, but I did not incorporate it into the examples I presented. I expect voter information to have a significant and important effect on voting behavior and candidate strategy.

- Campaign strategies. Candidates should also be able to vary the nature of their campaign messages, sending messages to voters that either self promote or attack opponents - "going negative".

Agent-based models have grown enormously in recent years. In this short paper, I introduced a simulation program for exploring the impact of electoral rules on party systems and legislative behavior. The models are very simple, but still reproduce existing empirical and theoretical research. Several examples showed robust findings and revealed several unanticipated dimensions to our understandings of electoral systems and essential assumptions.

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