Assessing Variation in Mixed Electoral Rules Using Agent-Based Models

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The proliferation of mixed electoral systems across the globe has spawned a growing literature assessing how these rules affect the behavior of political actors at the micro-level and partisan competition at the macro-level. Scores of single-country studies have analyzed the effects of mixed electoral systems in established democracies[1] and transitional states.[2] A growing body of literature has investigated the broader implications of mixed systems cross-nationally, benefiting from the accumulated data from a decade and a half of mixed systems' popularity.

Despite our increased access to data from the expansion of mixed electoral systems and the conduct of multiple elections using these rules, our ability to draw inferences about their consequences is still constrained. Although Germany has held many elections under its mixed electoral rules, most other countries using mixed systems have conducted four or fewer elections. Moreover, institutional rules vary substantially across mixed systems and many countries have modified their rules over time. Thus, isolating the effects that mixed electoral rules exert, relative to other causal factors, is complicated by their relative newness, profound cross-national variation and longitudinal variability.

Our paper addresses both technical and substantive questions that emerge from the challenges presented by mixed systems. On the technical side, we introduce a simulation that allows us to assess consequences of mixed systems without limitations produced by small sample sizes or the peculiar choices of institutional designers. On the substantive side, the results of the simulation begin to provide insight into the effects of institutional features and the behavior of voters and parties on election outcomes.

The agent-based modeling approach strives to represent the substantively significant actors as self-contained objects that gather and receive information. Each citizen in our simulation is represented by an object that is faced with decisions about which party to join and how to vote on the party list and majoritarian ballots. The citizens exist within a larger political context that includes district-level election officials who keep the rolls and collect votes from the citizens, political parties that nominate candidates, and the national-level election officials who decide how many seats are allocated to each party in parliament.

The paper proceeds in four parts. First, we define mixed electoral systems and address institutional variation that characterizes these systems. Second, we outline different assumptions about voting behavior and their implications for outcomes under mixed electoral rules. Third, we introduce the simulation, describing its basic features. Fourth, we discuss some of the simulations preliminary findings and address potential directions for future applications.

Mixed Electoral Systems – Definitions and Forms

Mixed electoral systems, by definition, involve the *mixture* of election rules in a single election for a legislative assembly at the national or regional level. Extant definitions of mixed systems vary in their precise delineation of the combinations of election rules that qualify as "mixed" (see Reynolds and Reilly 1997; Massicotte and Blais 1999; Shugart and Wattenberg 2001; Ferrara, Herron and Nishikawa n.d.). Generally, scholars agree that mixed systems combine rules with varying incentives; that is, some form of majoritarian rule and some form of proportional rule is employed. The most common type of mixed electoral system marries a single-member district plurality system with a party-list ballot. While this variant of mixed systems may be "typical," mixed systems are characterized by substantial variation in their institutional rules.

Insert Table 1 about here

Table 1, from Ferrara, Herron and Nishikawa (n.d.), identifies forty mixed electoral systems in existence from 1990-2004 and classifies them by the major taxonomies in the literature. Each classification focuses on different institutional features that divide subtypes of mixed systems.

While we noted above that mixed systems combine at least two types of election rules into a single contest, the nature of that combination may vary. In the archetypal German mixed system, seat allocation in the proportional component is formally connected with seat allocation in the majoritarian races. The proportional tier determines the overall seat distribution of the whole system; seats acquired in the majoritarian component "count against" those acquired in PR. The PR tier thus compensates parties for poor performance in majoritarian races. This type of mixed system is often labeled "compensatory" for this reason.

As mixed systems proliferated across the globe in the 1990s, institutional designers modified the rules. Non-compensatory mixed systems emerged out of this experimentation. Unlike their compensatory counterparts, non-compensatory mixed systems do not formally link the majoritarian and proportional tiers. Rather, seat acquisition is de-coupled so that a party's majoritarian seats do not alter its seat total in PR. In principle, non-compensatory seat allocation could lead to more disproportional outcomes if the PR vote is seen as the primary indicator of a party's popularity.

In the classification schemes presented on Table 1, Mixed Member Proportional (MMP) systems in Reynolds and Reilly (1997) and Shugart and Wattenberg (2001), and Corrective systems in Massicotte and Blais (1999), are characterized by compensatory seat allocation mechanisms. Parallel (Reynolds and Reilly), Mixed Member Majoritarian (MMM) (Shugart and Wattenberg)[3] and Superposition (Massicotte and Blais)[4] correspond with non-compensatory seat allocation mechanisms.

While these distinctions do not cover all of the variation found among mixed electoral systems,[5] seat linkages are considered by many scholars to be the most important institutional feature for determining the strategic environment and party system (Moser 1999; Herron and Nishikawa 2001; Shugart and Wattenberg 2001; Ferrara 2004). While this proposition is plausible, it remains untested. We know that compensatory systems indeed produce proportional outcomes at the aggregate level more readily than non-compensatory systems, but we do not know if this institutional feature weighs more heavily than others in determining the size and shape of party systems.

Voters in Mixed Electoral Systems

The literature on voting behavior, particularly in American politics, has been characterized by a division between those adopting a social/psychological approach and those favoring a rational choice approach.[6] In the former approach, voter beliefs and attitudes drive voting decisions. These beliefs may encompass inherited values from social and personal attachments, attachments to political parties, assessments of ideological proximity or other factors. In the latter approach, citizens' preferences for benefit maximization drive voting decisions. These preferences may result in voters selecting candidates based on issues as well as the candidates' or parties' likelihood of success in the election. We favor the rational choice approach in our analysis.

In pure majoritarian electoral systems where a plurality formula is used, decision-making that is based at least in part on the likelihood of success can lead to strategic voting in which sincere preferences are abandoned for more viable candidates (see Cox 1997). In proportional systems, strategic desertion of parties is less common as the effective threshold for representation is generally lower. Because a vote cast in a proportional election is less likely to be a "wasted vote," voters are more likely to choose sincerely.[7]

By presenting voters with two ballots,[8] mixed systems generate a more complicated decision-making calculus for voter choice. As Ferrara, Herron and Nishikawa (n.d.) note, if parties nominate candidates in all districts, three possible scenarios emerge:

- Voters select a party sincerely and the candidate who is nominated by the party, regardless of the candidate's likelihood of success;[9]
- Voters select a party sincerely and a candidate strategically; or
- Voters select a candidate strategically and the party that nominated the candidate, regardless of sincere preferences.

These scenarios require a voter to 1) know something about her preferences on important issues; 2) know something about party and candidate positions on those issues; 3) know something about the relative probabilities of success for candidates contesting a given district; and 4) be able to make decisions based on the accumulated information.

However, parties may not nominate candidates in all districts (Ferrara and Herron 2005), further complicating voter choice. Voters must not only have the desire to vote for a particular candidate, but the opportunity as well (Nishikawa 2002) for the above scenarios to fully function. Consequently, if parties do not always run candidates in every district, the following possibility emerges:

- Voters select a party sincerely and the candidate who is nominated by the party, *if a candidate is present in the district*. Otherwise, the voter selects strategically in the majoritarian race or chooses a candidate who is most proximate ideologically to the preferred party.

Further, a single voter type may not dominate the electoral landscape; some combination of the above scenarios may coexist simultaneously.

The Simulation[10]

The simulation is an agent-based model that represents elections under mixed electoral rules. When an election is held, the following actions occur:

1. The ideological stance of each party is announced to the voters;
2. Parties recruit members, who register in their districts;
3. Parties recruit candidates to run in SMD contests;
4. The voters in each district decide which party they prefer in the PR portion of the ballot and they select their favorite among the SMD candidates in their district; and
5. The parliament collects the votes from all of the districts, recognizing the SMD winners and allocating the PR seats.

A run of the model consists of a series of elections in which this algorithm is repeated. Different dynamic paths can be created, depending on whether the policy proposals of the parties are changed between elections, or the ideal points of the voters are changed. The details of each particular run of the model, of course, depend on the particular implementation of each of these stages. We have sought to keep the simulation simple by relying on the smallest possible number of exogenously specified parameters.

Institutions

Election Rules

The simulation's flexibility allows us to generate an assembly of any size using various combinations of institutional rules. For the simulations reported in this paper, we created a 200-member parliament. The parliament is evenly divided between single member districts using a plurality rule and a single national PR district determined by LR-Hare.

We include non-compensatory and compensatory PR allocation. The compensatory version of the system is based on the rules used in the Welsh and Scottish Assemblies. The essential idea is to award SMD seats to the winners in the districts, and then use PR to bring the under-represented parties closer to their national vote proportion. Each party's PR vote is divided by the total number of seats plus one. For the first allocation round, SMD seats (plus one) are used as the divisors. In each subsequent round, the divisors are modified by the number of PR seats received in earlier rounds. Seats are allocated successively until all have been distributed. Lastly, we employ a 5% and 10% PR threshold in our simulations.

Districts

Districts are numbered k=1,…,K. In our current models there are 100 majoritarian districts and 1 proportional district with 100 seats. One "electioneer" is created for each district. That agent keeps a record of all voters in the district, notifies voters that it is time to register for political parties, collects party registrations, maintains lists of voters registered with each party, notifies voters of the majoritarian candidates nominated in each district, notifies voters when it is time to vote, and collects votes.

Voters

A fixed number of voters populate every district. In the simulations we report here, there are 10,000 voters in each district (for a total of 1,000,000 voters nationwide). Voters make two decisions: casting a ballot in the majoritarian race for a candidate and casting a ballot in the proportional race for a party. No voters abstain from casting a ballot in either component and no voters make errors in marking their ballots.

Voter Preferences

Policy space in the model is one-dimensional (ranging from 0-100). Each party and candidate is positioned along this left-right policy dimension. When given a choice, the voter always selects the alternative closest to the personal ideal point, x_i^*.

A simulation that uses the same distribution of voters in all the districts is not very interesting because the same party tends to win every SMD race. We want voters to differ across districts, so that some districts have a modal ideal point that is on the left side of the spectrum, while some are in the middle, and some are on the left. That variety is achieved by creating a pair of district-level parameters, α_k and β_k. After those parameters are assigned, voter ideal points are drawn from a Beta distribution: $x_i^* \sim Beta(\alpha_k, \beta_k)$. The Beta distribution is convenient and extremely workable.

For the models discussed here, we have chosen parameters so that the frequency distribution of ideal points in every district is unimodal, but there are differences across districts. The district modes range from 30 to 70. We have sorted the districts so that the left-leaning ones, the ones with smaller means and modes, are assigned lower index values. We can, of course, re-draw voters from the same distribution for each election, representing the idea that the characteristics of a district are fixed, but the particular people who decide to vote in any particular election is unpredictable. In contrast, between elections we can keep the ideal points of the voters fixed. That allows us to focus on other changes in the model. Detailed comments on the design of the voter ideal point distribution are available from the authors.

The simulation includes three types of voters:

- *Pure Partisan*. The voter selects a party that is closest to its ideal point and votes for a candidate affiliated with the party. If the party offers no candidate, the voter chooses among candidates by Euclidean distance;
- *Independent Partisan*. The voter selects the party that is closest to its ideal point and the candidate closest to the ideal point (regardless of party affiliation);
- *Reverse Partisan*. The voter selects the candidate closest to its ideal point and the party closest to the ideal point (regardless of the candidate's affiliation).

The composition of the electorate varies across our simulations. We run three sets of simulations with each voter type set at 100% of the electorate. In a fourth set of iterations, we divide the electorate evenly among the three voter types.

In simulations where parties nominate majoritarian candidates in every district, Pure Partisan and Reverse Partisan voters are functionally equivalent as they do not split tickets. However, in simulations where parties do not nominate candidates in every district, this result may not obtain.

Political Parties

The number of parties is a run-time variable. Parties can be dropped, added, or merged between elections, but we have not investigated this capability to a great extent. In the runs reported here, we have left the number of parties fixed throughout each run. The parties are bootstrapped according to the following algorithm.

Suppose there are *P* political parties. *P* voters are randomly selected from the entire nation. The ideal points of those voters serve as the "founding" policy positions of the parties. The parties' positions are broadcast to the voters who choose their favorite and register with that party in the district. Each party collects its membership information from the district electioneers. We create parties in this manner because we assume that political organizations are founded by individuals with particular entrepreneurial ambitions whose distribution is not correlated with ideology. That is, ideology itself does not determine who might choose to form a party.

Each party is able to nominate a certain number of candidates in majoritarian contests. We have considered two possibilities. First, a party may be able to run candidates in all districts. Second, parties may not nominate candidates in all districts because they are resource constrained or they choose to restrict nominations for strategic reasons. We focus on the former decision-making calculus in this simulation. We use the number of party members as a proxy for resources, determining the number of candidates that a party can offer. The largest party can nominate candidates in all districts, but the smaller parties are not able to do so. The fraction of districts in which a party can field candidates is equal to the ratio of its membership level to that of the largest party. The party prioritizes districts, nominating candidates in the districts where it has the highest membership levels. For each district in which the party intends to offer a candidate, the party selects a candidate whose policy preference is at the median of registered party members in the district.[11]

Parameter Combinations

In order to explore the various causes of changes in election outcomes, we have divided model parameters into two categories. Some parameters are fixed throughout a run.

Insert Figure 1 about here

As a starting point, consider the diagnostic information that is displayed when the model is run interactively. A snapshot of the parameter panel is illustrated in Figure 1. One can set the initial number of parties, voters per district, the required threshold for the PR component, whether the parties run candidates in all districts (that variable is called "allInAll"), and so forth. Of central importance in the interactive analysis of the model are the parameters "randomizeVoters," "randomizeParties," and "adaptiveParties." If randomizeVoters is set to 1 (representing the Boolean value YES), then the timestep begins with a fresh draw of voter ideal points from the stochastic model. Otherwise, the ideal points remain fixed between timesteps. If randomizeParties is set to 1, then the ideological positions of the party leaders are drawn at random. Whether or not the voter ideal points were re-randomized, the parties proceed to collect member lists and nominate SMD candidates. If adaptiveParties is set to 1, then the party's ideological position is adjusted to equal the median of its SMD candidates in the previous election. If one ran the model over-and-over with all of these parameters set to 0, the *exact same* election results would be obtained over-and-over. By setting these parameters in various combinations, we can explore the various sources of variety in the observed election results.

For the sake of completeness, we have explored various combinations of these parameters.

- *Phase 1 (randomizeVoters =1; randomizeParties=0; adaptiveParties=0)*
  In this phase, the ideological positions of the parties are fixed. In each iteration, we randomly assign voter ideal points, based on the ideological distribution assigned to each district. The parties recruit members and select SMD candidates from this distribution of voters. We conduct 30 elections in this way, hoping to detect the amount of variation in electoral outcomes that is driven by randomness in the behavior of individual voters *while all other conditions are fixed.*
- *Phase 2 (randomizeVoters =1; randomizeParties=0; adaptiveParties=1)*
  As we will illustrate shortly, the positioning of the parties plays a key role in the eventual electoral outcomes. As a first-cut at the problem of adaptation in party positions, we have taken an organizational approach similar to the one used in models of voluntary organizations (Johnson 1991; 1996). Suppose that the party position is not fixed, but rather it adjusts to reflect the opinions of the candidates that a party fields in SMD contests. As the party position changes, the member lists and candidate lists change, and the electoral system undergoes a general repositioning. This model tends to produce parties that are evenly spaced along the ideological continuum. Once the party system

reaches equilibrium (the party positions stop changing), we run 30 elections with randomly drawn voters. The party positions continue to adjust. The aim of this phase of the analysis is to find out if the properties of competition between parties "in equilibrium" (in some sense, anyway) is different from the out-of-equilibrium competition depicted in phase 1.

- *Phase 3 (randomizeVoters =0; randomizeParties=1; adaptiveParties=0)*
  Finally, consider the possibility that the ideal points of the voters are fixed characteristics of an electoral system. The parties, however, are assigned at random at the beginning of an electoral campaign. The party positions are, of course, drawn from the electorate, representing the idea that some people become politically active and form parties. They then recruit members and select SMD candidates. The variation that we observe during this phase of the model is strictly due to the way that party leaders are selected. We conducted 100 elections under these conditions.

Insert Table 2 about here

Table 2 summarizes the parameters which govern the behavior of parties and voters in the batch of simulations that we are reporting here. We produced results for compensatory and non-compensatory mixed systems and those with a 5% and 10% PR thresholds. We ran three series of simulations with each voter type at 100% of the electorate and one with the voter types evenly balanced. In some simulations, all parties nominate candidates in every majoritarian race. In other iterations, parties nominate candidates in a limited number of districts.

Operating the Simulation

The simulation model can be run either in an interactive graphical mode or in a batch mode. The graphical mode is used for testing and debugging. In the graphical mode, one uses a "control panel" to start and stop the simulation. The parameter values (Figure 1) can be adjusted interactively. In addition, there is a series of graphs that summarize the state of the model. For each election, the screen redraws a histogram of the distribution of voter ideal points. The user can designate whether the national distribution (Figure 2A) or a particular district (Figure 2B) is presented. In addition to that histogram, there are time plots of several variables. Two of the graphs track indicators of the state of the national-level party system. These national-level indicators represent the number of effective parties and the level of disproportionality in the PR, SMD, and compensated SMD components. In addition, there are three graphs which track the state of the parties. For each party, we track the median position of the party's candidates in single member districts, the SMD seats, the PR seats (one graph for the compensated PR allocation, one for the noncompensated formula).

Insert Figures 2A and 2B about here

The analysis of individual runs of the model can lead to insights, but the large majority of the analysis is based on the model run in batch mode. For each combination of parameters, 100 runs were conducted. Output files describing the state of the districts, the voters, the parties, and the parliament were created and subjected to analysis. The model generates information at several levels of aggregation. At the national level, we observe the distribution of voter preferences, the effective number of parties and least squares index of proportionality. For each party, we collect information on ideological positions, membership, and votes. For each district, we observe the ideological positions of the SMD candidates, vote totals for each party in each ballot and, of course, the SMD winner. We report findings based on data from all levels.[12]

Preliminary Results

The simulation model can be used to investigate patterns that are expected on the basis of previous research, and it also can be used to generate new hypotheses about the way in which mixed electoral systems translate the tastes of the voters into parliamentary representation. The model has several fundamental properties that lead us to believe we are in the right "ball park," but the model requires modifications for future iterations.

Thresholds

Thresholds affect the results as anticipated. The mean effective number of parties for scenarios with 5% thresholds is 7.4 in non-compensatory PR and 6.2 in compensatory PR. By contrast, with a 10% threshold, the effective number of parties is 4.4 in non-compensatory PR and 3.7 in compensatory PR. The effective number of parties in SMD is also higher in systems with 5% thresholds (4.1) than in systems with 10% thresholds (3.3). Variability is also, not surprisingly, higher in runs with a 5% threshold. As parties adapt to the spatial distribution of voters, they often evenly space themselves out. As a consequence, with higher numbers of parties, many parties fail to pass the 10% threshold, reducing the overall competitiveness of the system.[13]

Party Positions and Election Outcomes

One of the most important insights from the graphical display is that the positioning of the parties plays a vital role in electoral outcomes. Due to the "luck of the draw," the party system may be more or less obviously "representative." Consider run 65 of the 5-party model in which all voters are partisans who support their party's candidate in SMD. In this instance, the ideological positions of the party founders are 15.9, 34.7, 53.03, 71.60, and 88.14. The PR allocation of seats, 20, 23, 24, 20, and 13, is quite a bit different from the SMD allocation, which is 0, 4, 62, 17, and 17. The number of effective parties under PR is 4.8, while under SMD it is 2.25. Considering the variation across 100 runs, the number of effective parties under SMD is not usually so high. The general pattern is for the SMD system to exclude some parties altogether. It is not necessarily the case that the center parties obtain SMD seats. They are often positioned so close to each other that the extremist parties (on either side) control all of the seats.

Efficiency of PR and SMD

The graphical display has led us to an observation about the relative efficiency, in a statistical sense, of PR and SMD components of mixed systems. By efficiency, we mean low variance in results that are observed when elections are held repeatedly under fixed conditions. Consider run 65 that was discussed above. If we draw another sample of voters and keep the same party positions, the PR result is exactly the same, but the SMD results are different: 0, 6, 59, 23, 12. The result of repeating this process 30 times -- the same parties, with new voters -- is illustrated in Figure 3. Simply put, there is much more variability in SMD results.

Insert Figure 3 about here

As a summary indicator of the relatively higher variance of the SMD component, calculate the standard deviation for each party in each electoral system, and then average those estimates to obtain an overall indicator of "stability" for the system. In this example, the PR outcome never changes, so its aggregated stability indicator is 0, while that for SMD is 2.45. Considering 100 runs conducted under these conditions (parties=5, threshold=5%, candidates in all districts), we find that PR outcomes are not always so stable (the average stability indicator for PR seats is 0.08), while the SMD results are not so unstable (the average stability indicator for SMD is 0.64). The compensated PR system inherits the instability of SMD component (the average is 0.52).

The stability that is observed in some SMD outcomes is, however, purchased at a heavy price. In 12 runs, the instability index of SMD is 0, meaning that, across 30 elections, there is no change in SMD representation. In all 12 of those runs, the number of effective parties is 1.0. That is to say, when SMD is stable, only one party is winning seats. The contrast in the two electoral systems is displayed in Figure 4. The two scatterplots show the relationship between the stability index and the effective number of parties for the PR and SMD systems. Note that in the PR system, the number of effective parties is unrelated to the stability observed across time, while in the SMD system the two appear to be tightly linked.

Insert Figures 4A and 4B about here

Best of Both Worlds or Contamination?

An important question in the study of mixed electoral systems has been the how much interaction between the tiers of mixed systems affects substantive outcomes. One school of thought suggests that mixed systems are the "best of both worlds," producing outcomes in majoritarian and proportional races that approximate the expectations of Duverger (1954) (see Shugart and Wattenberg 2001 and Moser and Scheiner 2004). Another school of thought suggests that interaction between the tiers in mixed systems creates incentives that undermine Duvergerian equilibrium in majoritarian races (see Herron and Nishikawa 2001; Cox and Schoppa 2002). That is, both PR and SMD should be characterized by multiparty competition.

Some evidence suggests that the "best of both worlds" approach might obtain in some mixed systems. In 56 of 120 cases (each case being a summary of thirty iterations), the effective number of parties in SMD is close to 2 (ranging from 1.56 to 2.07) while PR produces multiparty competition (above 3 effective parties). This result is what one would anticipate from the "best of both worlds" approach.

However, this result was not produced under all combinations of voter/party features. Most of these cases (40) occurred in simulations where parties nominated candidates in all districts (i.e., there was no strategic withdrawal of nominations). Moreover, most of the cases were in Phase 1 simulations, with some in Phase 3 simulations. This result was not evidenced in the summary statistics from Phase 2 simulations.

This question about the "best of both worlds" approach is difficult to answer for two reasons. First, it is difficult to know for sure when the SMD component is fulfilling its "part of the bargain." Second, we do not have a clear theoretical understanding of the process that goes on in the selection of party positions. Consider the first problem. As illustrated in Figure 4B, the effective number of parties varies quite a bit from one run to another. These numbers are themselves averages (averages across 30 draws of voter ideal points), and if we average those averages, we can say the number of effective parties is 1.65. Compared to the PR system, where there are many more effective parties, the SMD component appears to be a success. However, this conclusion is somewhat doubtful because we have not clearly specified a criterion of representation. The SMD system may award seats only to one party, or divide seats between two extreme parties. In other words, it may not produce two party competition at the district level, but rather an effective number of parties that appears to reflect robust two-party competition.

The second problem is that the "best of both worlds" approach is faced with a serious challenge by the results obtained in phase 2 of these simulations. Faced with the findings in the previous paragraph, an advocate of the "best of both worlds" thesis might contend that the party positions are driving the results, and that once the parties adjust to better represent the electorate, then the SMD elections will behave as expected. Unfortunately, the findings in phase 2 point in the opposite direction. When the parties spread themselves across the ideological spectrum, the number of effective parties in SMD jumps dramatically. When each party runs a candidate in every district, the number of effective parties rises to 3.65 when there are 5 parties, and 5.60 when there are 10.

The conclusions that we reach about the "best of both worlds" thesis is quite confounded when the parties are resource constrained and do not offer candidates in all SMD elections. When nominations are limited, the effective number of parties is 3.52 with 5 parties and 7.55 with 10 parties, respectively. As we see. the number of effective parties is also above two in these contests, but the parties that gain representation also tend to be closer to the overall median. Phase 2 results are generally inconsistent with the "best of both worlds" argument.

Conclusion

Our paper addresses how simulations can aid our understanding of mixed electoral systems and their consequences. Because of real-world variation in the types of mixed electoral systems in use cross-nationally and over time, the relatively small number of elections held in any given country under mixed rules, and potential variation in voter approaches to casting ballots in these systems, our ability to make causal inferences about the effects of these rules has been constrained. Simulations provide one avenue to address these problems by allowing the operator to control critical features while repeating the electoral process and addressing sample size problems.

Our substantive findings suggest that the simulation is evolving properly. Thresholds have the expected effect on results. The positions that parties stake out directly affects their likelihood of success. We witness greater variability in results from SMD elections than in PR elections. The mix of voter types substantially affects the election outcomes. Finally, while mixed systems seem to produce some results that conform with the "best of both worlds" approach, these results are highly problematic.

Our preliminary analysis points to future improvements for the simulation. First, we will explore modifying party decision-making so that parties can withdraw from competition if they perform poorly. We may also explore how to automate the creation of new political parties. Second, we will vary the institutional features of mixed systems: altering the proportion of seats allocated to PR and SMD (it is currently balanced) and introducing different thresholds. Third, we will address voters, potentially adding measures of candidate quality and viability to better approximate voter decision-making.

Figure 1: Parameter Display

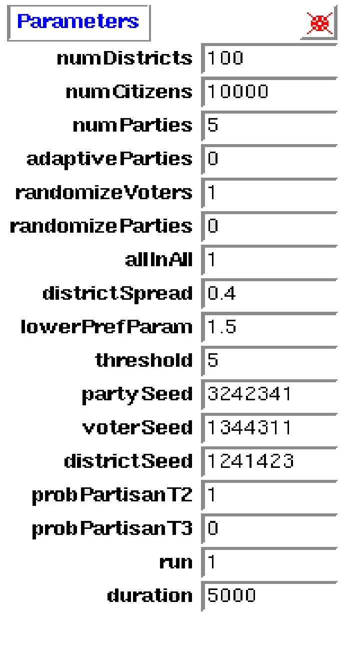
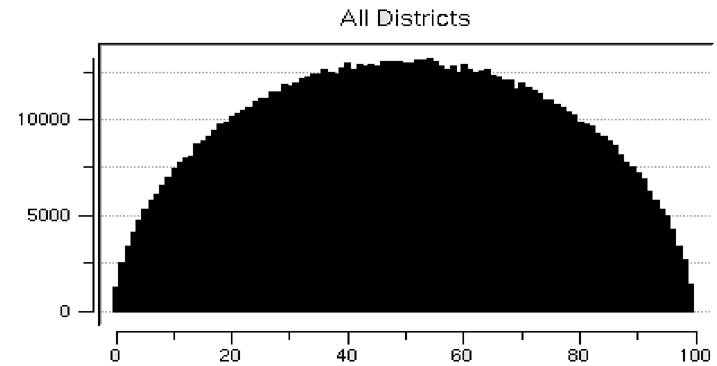


Figure 2: Histogram Displaying Voter Ideal Points

A.



B.

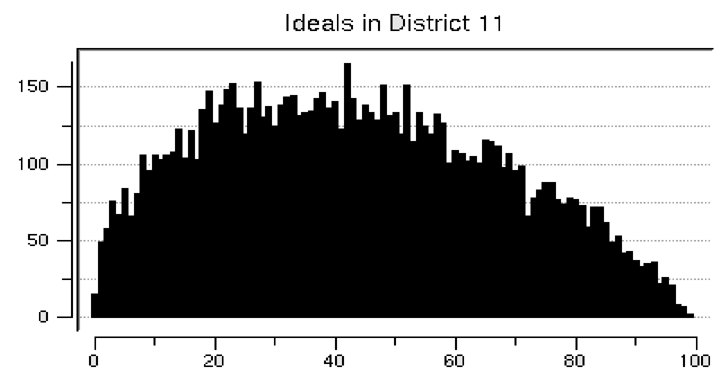


Figure 3: SMD and PR Results (5 Parties)

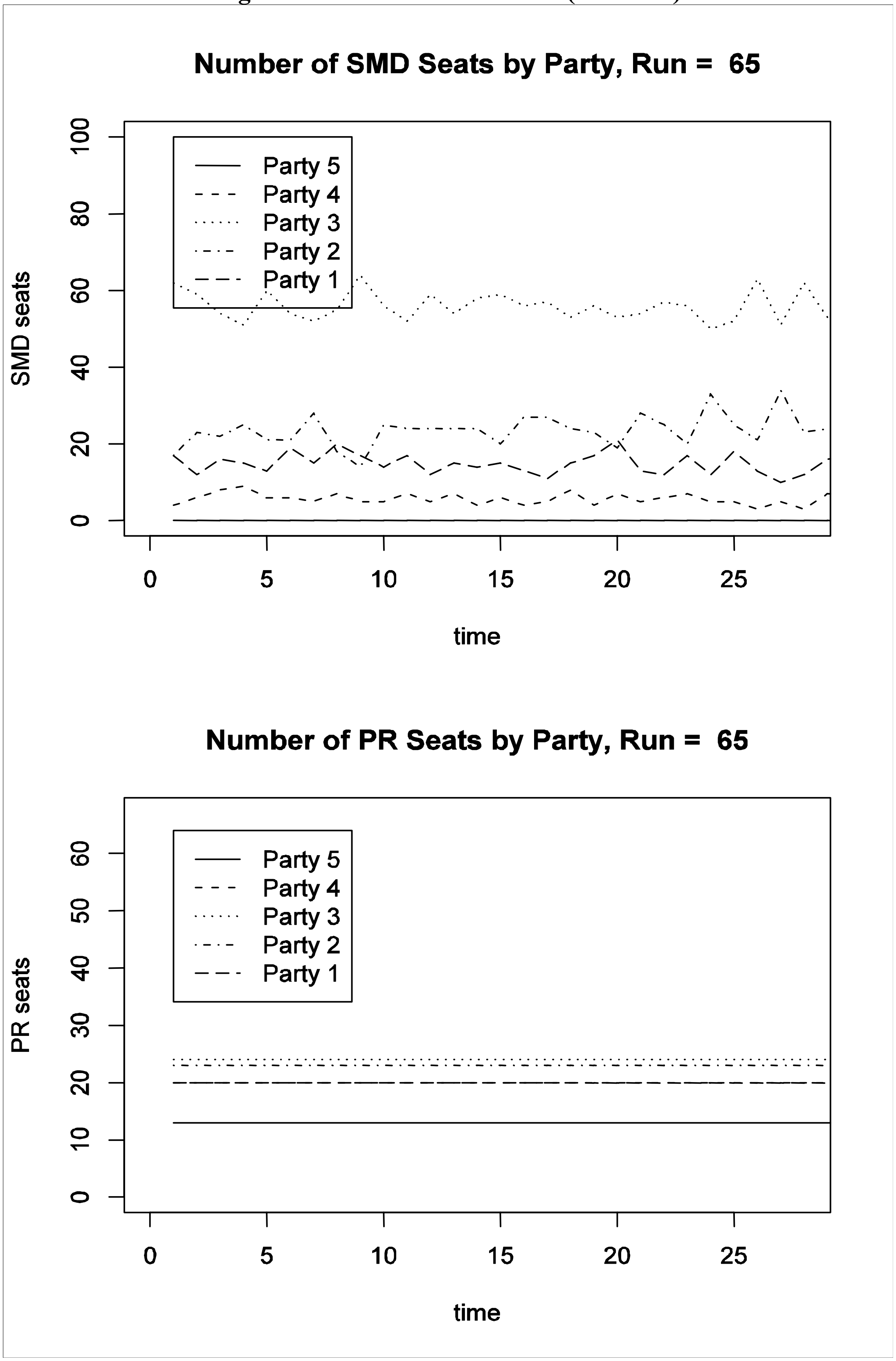
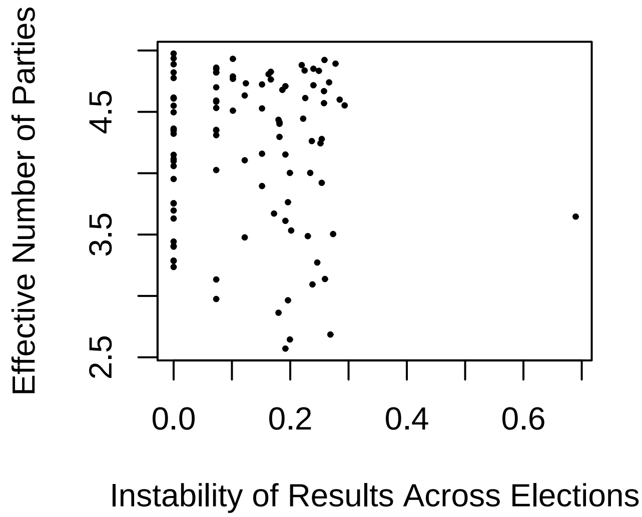


Figure 4: Stability and the Number of Effective Parties (5 parties)

A. Proportional Representation



B. Single Member Districts

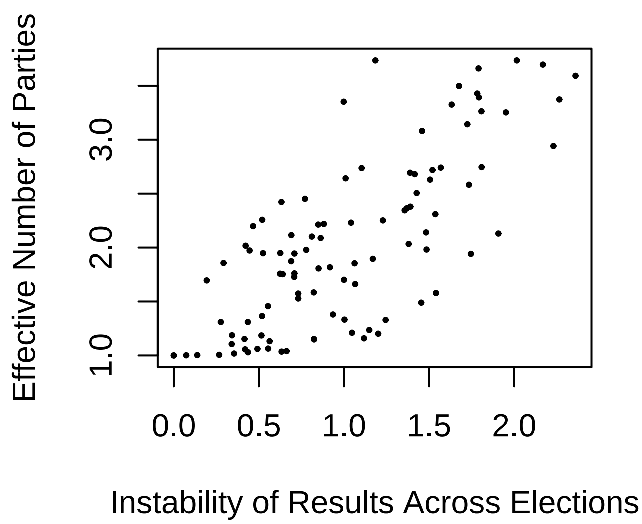


Table 1: List of Mixed Systems (1990-2004)

Countries[14]	*Reynolds and Reilly (1997/2002)*[15]	*Massicotte and Blais (1999)*	*Shugart and Wattenberg (2001)*
Albania	Parallel - TRS	Corrective	-----
Andorra	Parallel - Block	Superposition	-----
Armenia	Parallel - FPTP	Superposition	MMM
Azerbaijan	Parallel - TRS	Superposition	-----
Bolivia	MMP	Corrective	MMP
Bulgaria	-----	-----	-----
Cameroon	Parallel - FPTP	Supermixed	-----
Chad	TRS	Supermixed	-----
Croatia	Parallel - FPTP	Superposition	-----
Ecuador	Parallel - PB	Supermixed	-----
France[16]	-----	Coexistence	-----
Georgia	Parallel - TRS	Superposition	MMM
Germany	MMP	Corrective	MMP
Guatemala	Parallel - FPTP	-----	-----
Guinea	Parallel - FPTP	Superposition	-----
Hungary	MMP	Supermixed	MMM/Partial Compensation
Israel	PR	-----	Direct PM
Italy	MMP	Corrective	MMM/Partial Compensation
Japan	Parallel - FPTP	Superposition	MMM
Kazakhstan	-----	-----	-----
Kyrgyzstan	-----	-----	-----
Lesotho	-----	-----	-----
Lithuania	Parallel - TRS	Superposition	MMM
Macedonia	TRS	Superposition	MMM
Mexico	MMP	Corrective	Limited MMM
New Zealand	MMP	Corrective	MMP
Niger	List PR and FPTP	Coexistence	-----
Panama	List PR and FPTP	Coexistence	-----
Philippines	Parallel - FPTP	Corrective	MMM
Russia	Parallel - FPTP	Superposition	MMM
Senegal	Parallel - PB	Superposition	-----
Seychelles	Parallel - FPTP	Superposition	-----
Somalia	Parallel - FPTP	-----	-----
South Korea	Parallel - FPTP	Superposition	MMM
Taiwan	Parallel - SNTV	Superposition	-----
Tajikistan	-----	-----	-----
Thailand	Parallel - FPTP	-----	MMM
Tunisia	Parallel - PB	Corrective	-----
Ukraine	Parallel - FPTP	Superposition	MMM
Venezuela	MMP	Corrective	MMP

Note: PB = Party Block Vote (voters choose parties and not candidates); TRS = Two round system (or majority-runoff).
Source: Ferrara, Herron and Nishikawa (n.d.)

Table 2: Parameters in the Simulation

Characteristics	*Values*
Number of Parties	5/10/15
Threshold in PR	5%/10%
Linkage Mechanism	Compensatory
	Non-Compensatory
Nomination Strategy	Parties Nominate in all SMDs
	Parties Nominate in Some SMDs
Voter Types	100% Pure Partisan
	100% Independent Partisan
	100% Reverse Partisan
	33% Each Partisan Type

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Endnotes

[1] See, for example, Bawn (1993; 1999), Cox and Schoppa (2002), Ferrara (2002), Karp et al. (2002), Lancaster and Patterson (1990), Navarra and Sobbrio (2001), Reed (1999; 2001); Stratmann and Baur (2001).
[2] See, for example, Benoit and Schiemann (2001), Herron (2002), Kostadinova (2002), McAllister and White (2000), Moser (2001), Shvetsova (2002), Smith and Remington (2001), and Thames (2001).
[3] Shugart and Wattenberg (2001) further qualify compensatory mechanisms based on vote transfers (such as those found in Hungary and Italy) as partially compensatory.
[4] Massicotte and Blais (1999) divide systems into "dependent" (compensatory) and "independent" (non-compensatory) categories and identify additional subtypes. Coexistence systems apply two rules in different geographic regions of a country. Supermixed systems combine compensatory and non-compensatory features.
[5] Other variation in mixed systems may also influence party system evolution. Mixed systems vary in the proportion of seats allocated to PR and SMD, the ability of candidates to contest in both tiers, level of thresholds employed, formulas used in SMD and PR, and other features.
[6] For a review, see Niemi and Weisberg (1993).
[7] Though strategic voting in proportional systems is not unheard of (Cox 1997).
[8] Some mixed systems use a single ballot, but most are dual ballot.
[9] In principle, this selection mechanism should be equivalent to voters who select a candidate sincerely and a party closest to the candidate's ideological position.
[10] The code for the MixedElection model uses the libraries provided by the Swarm Simulation System (http://www.swarm.org), a free and open programming toolkit which is available under the GNU Greater Public License (this model requires Swarm version 2.150 or better). The code is freely available from the authors upon request.
[11] The following procedure is used to determine the number of candidates a party may offer. First, calculate the smallest number of candidates that a party may offer: minCandidatesSp = N*(membership of party p/membership of largest party). Second, select the number of candidates allocated to party P by choosing a random integer in {minCandidatesSp,…, number if districts}.
[12] The raw data is available from the authors. It is approximately 28 gigabytes!
[13] In scenarios with 15 parties in competition, party adaptation drove all parties to fail to pass the threshold. This is a feature of the simulation that we will modify in the next iteration.
[14] Azerbaijan, Bulgaria, Croatia, Macedonia, Kyrgyzstan and Ukraine adopted and later abandoned mixed electoral systems.
[15] The classification is based upon Reynolds and Reilly's book (1997) and the modified manuscript (2002) found on the International IDEA website at: http://www.idea.int/esd/data/world.cfm.
[16] Coexistence applies to the Senate. Municipal elections are categorized as Fusion systems in which multiple allocation rules are applied at the district level.