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Centripetal and Centrifugal Incentives under Different Electoral Systems

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Abstract

In a seminal article, Cox (1990) suggested that electoral systems with larger district magnitudes provide incentives for parties to advocate more extreme policy positions. In this article we put this proposition to the test. Informed by recent advances in spatial models of party competition, we introduce a design that embeds the effect of electoral rules in the utility function of voters. We then estimate the equilibrium location of parties as the weight voters attach to the expected distribution of seats and votes changes. Our model predicts that electoral rules affect large and small parties in different ways. We find centripetal effects only for parties that are favorably biased by electoral rules. By contrast, smaller parties see their vote share decline and are pushed toward more extreme equilibrium positions. Evidence from thirteen parliamentary democracies supports model predictions. Along with testing the incentives provided by electoral rules, results carry implications for the strategies of vote-maximizing parties and for the role of small parties in multiparty competition.

1. Introduction[1]

Should parties change their policy goals under different electoral rules? Since Downs (1957) first proposed a model of centripetal incentives for a two-party system under plurality rule, scholars have worked to extend equilibrium models of voting to multiparty settings. Gary Cox's (1990) study marks the beginning of contemporary research on the topic and, in many ways, remains the most detailed exposition of the spatial incentives provided by electoral institutions. Considering an almost exhaustive set of factors determining electoral rules—including district magnitude, aggregation formula, and ballot structure—Cox made predictions linking electoral laws to parties' position-taking incentives expressed in terms of the dispersion of parties in policy space. *Centripetal* incentives (or "central clustering") are said to prevail when the number of votes per voter is high but partial abstention is prohibited and when district magnitude is low. *Centrifugal* incentives ("ideological dispersion") are encouraged by the inverse: few votes per voter, allowance of partial abstention, and high district magnitudes. Subsequent research on connections between electoral laws, party systems, and party positions has built on Cox's insights both formally (e.g., Lin et al. 1999; McGann 2002; Merrill and Adams 2007) and empirically (e.g., Dow 2001; Ezrow 2005; 2008).

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In this paper we advance this body of research by proposing a unified model which combines the insights of Cox and others on the mechanical properties of electoral rules with recent work on spatial models of party competition. Our model brings together, into a single utility function, the importance voters accord to their ideological proximity to parties and the weight they attach to parties being favorably or adversely affected by electoral rules. We show that the weight voters assign to mechanically-induced differences in parties' expected seat shares leads to clear predictions about the expected equilibrium location of parties.[2] More importantly, these predictions show that the centripetal and centrifugal effects of electoral rules affect large and small parties in very different ways.

The gains from our approach are both theoretical and substantive. Theoretically, our model offers a more explicit set of micro-foundations for how electoral rules are incorporated in voter utility and, in turn, in the policies vote-maximizing parties propose in competitive elections. The utility model is flexible enough to account for heterogeneity in the effect of electoral rules on party strategies across and within different contexts.

This flexibility has empirical payoffs: Consistent with what Downs and then Cox suggested, we find that the electoral system affects party equilibrium positions in unidimensional policy space. However, we show that the effect of electoral rules is contingent on party size. As in previous studies (e.g., Dow 2001), we find centripetal incentives for large parties that are favorably biased by electoral rules. But unlike previous work, we demonstrate *centrifugal* incentives for smaller parties that are penalized by electoral rules. Rules that reward large parties, lead not only to increases in vote shares but also to more moderate ideological positions. By

[2] By (Nash) *equilibrium* we mean a set of party positions from which vote-maximizing parties have no incentive to deviate.

contrast, rules that penalize smaller parties push their policy preferences toward more extreme equilibrium locations. In other words, *non-proportional* rules "crowd out" smaller parties, who vacate the center of the policy space while winning parties moderate their policy stances.

Because the utility function we adopt penalizes parties who win fewer seats than their vote share (Maurice Duverger's well known psychological effect), our model converges with prior research, generating predictions in which plurality-like rules reduce the effective number of electoral parties (Duverger 1954; Amorim Neto and Cox 1997; Ordeshook and Shvetzova 1994). Our predictions for the equilibrium *location* of parties, however, lead to very different conclusions.

We next present a model of voter utility and demonstrate how information about electoral rules updates this expected utility over *K* parties competing in the election. We then, in section 3, introduce the data to test our model empirically. Section 4 reports results for how electoral rules affect party equilibrium positions and electoral success. The conclusion discusses study implications for work on institutions and party strategies, on the role of small parties in multiparty competition party, and on the relationship between psychological and Duvergerian mechanical effects.

2. The Utility Function of Voters under Different Electoral Rules

In the last ten years considerable effort has been made to integrate empirical and formal models of political processes. Attempts to test micro-foundational theories of where parties locate in policy space—given constraints imposed by their competitors and by the electorate—have been particularly fruitful (Adams et. al. 2005; Kedar 2005; Schofield and Sened 2006). A prime example here is Adams, Merrill and Grofman's (AMG) *Unified Theory of Party*

Competition (2005) where the authors use survey data to estimate individual respondents' vote choice and then analytically derive each party's strategy. Their model uses an elegant conditional logit design to estimate the main choice parameters—policy positions and non-policy salience—which are then entered into an algorithm that computes equilibrium locations.

AMG's objective is to integrate spatial models of party competition with behavioral models of the vote. To AMG, parties' equilibrium positions in policy space are predicted to vary as a function of non-policy, or *valence*, considerations. As the authors recognize, however, their novel modeling strategy can be extended to a range of applications, from purely descriptive estimation of equilibrium strategies to more sophisticated applications.[3]

AMG single out electoral rules as a "potentially complicating" factor that might have implications for the validity of their unified model. In particular, they maintain that "a complete understanding of parties' or candidates' policy proposals in historical elections…must move beyond an exclusive focus on vote maximization to encompass…the electoral laws in effect in the real-world election of interest" (AMG 2005, 71).

In this article we address the effect of electoral rules explicitly, modifying the voters' utility function to include preferences about the future allocation of seats. We begin with a utility function that incorporates the expected distribution of seats into the voter's utility preference and

[3] Adams and Merrill (2009), for example, examine the effects of valence considerations on party equilibrium positions under proportional representation. Notably, their model produces a "centripetal valence effect" results in which predicts that parties moderate (radicalize) their positions when their valence images deteriorate (improve). The authors do not, however, consider the possible confounding effects of electoral rules. The model we advance below includes parameters for policy positions, valence considerations, and electoral rules.

then allows the equilibrium location of parties to be updated in response to the voter's utilities.[4] We then implement the proposed design by applying the Markov Chain Monte Carlo (MCMC) engine in WinBUGS 1.4 (Spiegelhalter et al. 2003) in a novel way, setting the model to follow a random walk over the equilibrium space of parties.

2.1. The Voters' Utility Model: The Mechanical and Psychological effect of electoral Rules

We begin, as do Adams, Merrill, and Grofman (2005), with a specification of the voter's utility where each voter's probability of voting for party *k* has both proximity and non-proximity components:

$$U_{ik} = -\propto (x_i - L_k)^2 + \beta T_{ik} + \varepsilon_i \quad (1)$$

In equation (1), x_i describes the self-reported ideological placement of voter *i*, L_k describes the ideological location of each party *k*, $\propto$ describes the weight, or salience, of the voter's proximity preference, and $(x_i - L_k)^2$ is a quadratic term measuring of the ideological proximity of voter *i* to party *k*. As with standard spatial models, electoral competition is assumed to take place along a single dimension of policy contestation (Cox 1990, 908). Including this probabilistic component in spatial models of the vote facilitates the identification of equilibrium strategies (Enelow and Hinich 1982; Erikson and Romero 1990). Accordingly, β describes the weight or salience that the voter gives to the non-spatial components of their vote choice, such as assessments about the expected quality of the candidate, T_{ik}. Finally, ε_i describes a stochastic error term. The choice model maximizes the random utility function in (1) to estimate the probability of a voter *i* will select party *k:*

[4] For a general introduction to multilevel designs see Gelman and Hill (2007).

$$y_{ik} = \begin{cases} \frac{e^{U_{ik}}}{\sum_{k=1}^{K} e^{U_{ik}}} \end{cases} \forall\, i, k \tag{2}$$

where U_{ik} replaces the random utility function defined in (1).

There are a number of alternative specifications for U_{ik} that may be used in place of the utility model defined in (1), including a valence model (Schofield and Sened 2006), a policy preference model (Kedar 2005), and a policy discounting model (Adams et al. 2005), among others. For our purpose, we modify the utility function of voters to describe the utility attached to the prior policy performance of the party (valence, as shown in Equation 1). Key to our inquiry, however, is to consider the utility attached to voting for a party given expectations over the transmission of votes into representation in government (seats). To do so, the model reported in Equation 1 can be re-expressed as:

$$U_{ik} = -\propto (x_i - L_k)^2 + \beta_1 T_{ik} + \beta_2 (S_k - V_k) + \varepsilon_i \tag{3}$$

where β_2 describes the utility that a voter attaches to the *seat premium* won by a party under the current electoral rules; that is, the utility that the voter attaches to the difference between seats and votes for party k, $(S_k - V_k)$. The seats-votes difference represents the mechanical effect of how electoral rules play a reductive role in the number of parties contesting an election. The parameter β_2, therefore, captures the psychological effect —e.g. how the voter anticipates the reductive effect of electoral rules.[5] It is important to notice that *seat premiums* need to be jointly

[5] In our model we consider the additive specification for the effect of seats and votes to be a reasonable decision, one which is consistent with previous extensions to probabilistic voting models (e.g., AMG 2005; Erikson and Romero 1990). It would also be possible to enter seats and votes as a multiplicative effect. In that case, the differences between seats and votes would amplify the existing spatial and non spatial components of the model. A multiplicative model

assessed for all parties. Our statistical strategy, therefore, will use a multinomial design that is not restricted to competing pairs of candidates (see Ordeshook and Zeng 1997).

To illustrate, imagine there are three parties, *A*, *B*, and *C*, competing under simple plurality rule, with *A* and *B* on the left of a unidimensional policy continuum, and *C* on the right. Further imagine that the ideal point of voter *i* is on the left and equidistant from Parties *A* and *B*. Moreover, the expected vote shares reported by the media show Party *A* gathering only 20% of the vote while Parties *B* and *C* are expected to receive close to 40% of the vote. If a voter's utility is a function of the electoral performance of a party, voter *i* should prefer to cast a vote for Party *B,* which has greater chances of defeating Party *C*. This example describes the underlying logic of Duverger's well-known psychological effect, where the *distance* between seats and votes is strictly a function of the mechanical effect of the electoral rules, but a reduction in the number of parties is influenced by the weight the voter attaches to such difference, as captured by the psychological effect parameter, β_2. By weighing the salience of electoral rules as they affect the utility attached to a party, β_2 captures the essence of the psychological effect as it pertains to "the shaping of party and voter strategies *in anticipation of* the electoral function's mechanical constraints" (Benoit 2002, 36, emphasis added).

A fundamental problem in estimating the utility model just described, however, is that the expected seats won by a party are not independent from the parties' policy choices (equilibrium locations). Because of this, voters anticipate the future distribution of seats and votes rather than

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should expand or contract the policy space forcing parties towards the center or the extreme of the policy space at different rates. A multiplicative model, consequently, could result in equilibrium locations for parties that would more closely follow the results derived in Cox (1990).

observing its actual realization. Such anticipations have been a recurring issue confronting research on electoral rules.[6] Our approach to this issue is to model it analytically using an estimation procedure to approximate the voter's decision problem by iteratively updating the expected difference between seats and votes into the equilibrium model, $(\hat{S}_k - \hat{V}_k)$. Expected seat-vote differences are anticipated by voters and parties, leading to strategic voting on the part of voters and, it follows, to new equilibrium adjustments by parties (Alvarez and Nagler 2000; Bawn 1999; Benoit et al. 2006; Cox 1997; Duverger 1954).

In the next section we described how we estimate the weight parameters of equation (3). The values of the parameters of interest $-\propto, \beta_1, \beta_2-$, can be estimated from survey data using maximum likelihood estimation. Our chief interest, however, is to provide a more general test of the relationship between electoral rules and equilibrium locations. Accordingly, we now describe the general algorithm used to estimate the salience assigned to the third term in equation (3), the seat-vote differential.

2.2. The Seat-Votes Model: Measuring the seat premium observed by voters

A major contribution of this article is to allow voters to update the expected vote and seat shares of each party. In turn, we can use this information to retrieve the equilibrium location of parties. The expected votes for each party, consequently, inform the updating process and have associated expectations about their future seat shares.

Characterizing an electoral system involves an almost infinite combination of rules and procedures, involving variations in district magnitude, the number of votes, formulae for transmitting votes to seats, and so on. Almost all the important features of an electoral system,

[6] Benoit (2002) identifies this issue of voter anticipation as the endogeneity problem in electoral studies.

however, can be summarized with two parameters: ρ, which describes the overall majoritarian properties[7] of electoral rules, and β_k, $k = (1,2,\ldots K)$. Majoritarian biases describe the extra seats that a party obtains by virtue of winning more votes than other parties in the race. Such biases reward or penalize a party strictly as a function of their relative vote share.[8]

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[7] In this section, we use the term "majoritarian" bias to describe the mechanical effect of electoral rules which provide winning parties with premium seats. A main determinant of the majoritarian bias ρ, as it has been shown since Downs (1957), Sartori (1986), and Taagepera (1986), is the district magnitude. Accordingly, most early models measuring the mechanical properties of electoral systems employed some transformation of the mean or median district magnitude as proxy for the majoritarian bias. However, a number of problems will affect how well district magnitude captures the majoritarian properties of electoral rules. For example, high within-country heterogeneity in district magnitude, differences in the number of parties, mixed member electoral rules with arenas of varying magnitude, or significant districting biases will significantly affect the majoritarian properties of the electoral rules even if mean district magnitudes appears unchanged. Consequently, a more general model capturing all mechanical properties of the electoral rules directly from seat-vote differences, such as Taagepera (1986) or King (1990), will include as a special case any model that only considers the effect of district magnitude. For a more general discussion of the relationship between district magnitude and the majoritarian bias parameter ρ, see Grofman (1983), Taagepera (1986), Taagapera and Shugart (1989), and King (1990).

[8] Partisan biases, by contrast, describe the seats that a particular party obtains above and beyond those expected by any other party with an equivalent vote share (King, 1990). Because we are only interested in how non-proportional electoral rules affect the equilibrium location of parties,

Early work by Laakso (1979), Taagepera (1986), Grofman (1983), and King (1990) provide the backbone of current seat-vote models, whose mechanical properties are well known. For our purposes, we begin with a multinomial design that allocates seats to multiple parties using a simplified multinomial design proposed by King (1990) of the form

$$S_k = \frac{e^{\rho \log(v_k)}}{\sum_{k=1}^{K} e^{\rho \log(v_k)}} \tag{4}$$

where the expected seats allocated to party $k = 1$ is a function of the party' vote share, v_k, and of the majoritarian properties of the electoral system, ρ. As ρ becomes larger, the difference between the share of seats and the share of votes won by parties increases. More importantly, winning parties will obtain more seats than their share of votes, $0 < (S_k - V_k)$, while losing parties will gather fewer seats than their share of votes, $0 > (S_k - V_k)$. Notice that the expected allocation of seats is solely determined by the party's vote share. Hence, knowing the value of ρ, we can substitute the expected seat share (4) into equation (3):

$$U_{ik} = -\propto (x_i - L_k)^2 + \beta_1 T_{ik} + \beta_2 \left[\frac{e^{\rho \log(\hat{v}_k)}}{\sum_{k=1}^{K} e^{\rho \log(\hat{v}_k)}} - \hat{v}_k\right] + \varepsilon_i \tag{5}$$

Equation (5) allows us to estimate changes in the equilibrium location of parties that are function of majoritarian parameter ρ. We can now model the mechanical effect into the voters' utility function in equation (3). As noted, ρ explains the majoritarian pull of the electoral rules (mechanical effect) while β_2 describes how much voters care about strategic incentives (psychological effect). Finally, since electoral rules are set exogenously to the voter's utility,

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we focus on the majoritarian properties of electoral rules. Still, because the findings of our research show centripetal effects for parties that are positively biased in seats, we expect partisan bias to enhance the effects described in this article.

note that we do not require any instrumental variable to model their effects (cf. Ordeshook and Shvetzova 1994).

2.3. The Analytic Model: Equilibrium Strategies in a Multiparty Setting

Having presented our model of voter utility, we now provide an algorithm to estimate the equilibrium location of parties as we change the mechanical properties of the electoral rules. Adams, Merrill, and Grofman (2005) show that the random utility model in equations (1) and (2) can be used to search for the equilibrium location; that is, the combination of strategies used such that party *k* will not unilaterally increase its vote share by choosing a different policy location. Starting with the model in (5), the expected vote share for party *k* is

$$EV_k(\mathbb{L}, \propto) = \sum_j P_{ik}\,(\mathbb{L}, \propto) \qquad (6)$$

where the expected vote share, EV_k, is the sum of the probabilities of voting for party *k* given all parties locations, $L_k \subseteq \mathbb{L}$. After replacing equation (1) into (6), AMG differentiate for the location of each party L_k when $\propto = 0$, solving for the last occurrence of L_k to find the location at which party *k* maximizes its vote share:

$$L_k = \frac{\sum_i P_{ik}(\mathbb{L},\mathbf{0})[1-P_{ik}(\mathbb{L},\mathbf{0})]x_i}{\sum_j P_{jk}(\mathbb{L},\mathbf{0})[1-P_{jk}(\mathbb{L},\mathbf{0})]} \qquad (7)$$

By iteratively solving for each party preferred location, *max(L_k)*, AMG provide an algorithm to find each party's equilibrium. They also provide a proof of the conditions that guarantee the existence and uniqueness of Nash equilibria for each party *k*.[9]

Notice that estimating the equilibrium strategy of party *k* does not require information about the actual vote choice of the respondents as in equation (2). The algorithm also has no stochastic component and mechanically updates the spatial location of each party in response to

[9] See AMG (2005) Appendix 4.1 for a proof of (7).

changes in the location of all other parties, with fixed proximity and non-proximity parameters $\propto$ and $\beta_{1,2}$. While L_k appears "implicitly in both sides of [equation (7)], we may use [equation (7)] as the basis of an iterative algorithm" (AMG 2005, 260). Because (7) is not a statistical model, all parameters of interest have to be fed into the algorithm, which AMG do using the *maximum likelihood* estimates from equation (1) and (2).

We use WinBUGS 1.4.2 (Spiegelhalter et al. 2003) and R 2.8 to estimate the conditional choice models and to retrieve the equilibrium location of parties. This implementation provides some advantages, such as the possibility of estimating simultaneously the conditional logit model proposed by AMG, the equilibrium algorithm, and provide confidence intervals around the equilibrium estimates.

3. Testing the Theoretical Implications of Electoral Rules

To test for the effect of the electoral rules on the equilibrium location of parties we examine post-election survey data collected by Module 2 of the Comparative Study of Electoral Systems, which contains post-election surveys from elections occurring between 2001 and 2006 (CSES 2007). The model and the predictions it yields pertain to systems in which governments are formed as a result of party strength in national legislatures. We thus examine all parliamentary elections for which data available from the CSES module: Australia, Denmark, Finland, Germany, Great Britain, Ireland, Israel, the Netherlands, New Zealand, Norway, Spain, Sweden, and Switzerland.[10] These cases capture a wide range of electoral rules, from single

[10] We omitted parliamentary elections in Belgium, France, and Italy due to missing data for key measures. We also leave out democracies which lack established party systems such as Albania, Bulgaria, Czech Republic, and Hungary. We also omit the 2004 Canadian federal election due to

member district plurality, to mixed designs, to various proportional formulae. The number of credible competitors on the national stage also varies widely, from three in Britain and Spain to nine in the Netherlands, for 79 parties in all (See Supporting Information). This variation is key: Since the non-proportional properties of electoral rules become stronger as the effective number of parties gets larger (Calvo 2009), seat-vote differences will be more pronounced for countries having many parties vying for seats in the legislature.

Our strategy is to first estimate a model of voter choice and then use the initial parameter estimates to inform a series of simulations designed to assess the sensitivity of voter utility to changes in the electoral rules. As per equation (3), the analyses pool individual-level measures of vote choice, ideological proximity, and performance assessment with information about the differences between all parties' seat-vote shares. The dependent variable is the respondent's self-reported party vote. Independent variables include self-reported ideological location of the voter, x_i, the reported location of each party, L_k, valence variables describing other non-policy factors, T_{ik}, and an aggregate variable measuring the difference between the seats and votes of each party k, $(S_k - V_k)$. To estimate the ideological proximity of voters to parties, $(x_i - L_k)$, we take advantage of the CSES survey design, which asks respondents to provide a location for themselves and each party on a left-right ideological scale from 0 to 10. To measure non-policy factors, T_{ik} , we use 10 point thermometer scales for each party.[11]

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the strength of regional parties, particularly in the large province of Quebec. Analyses performed with the Canadian case do not alter results reported below.

[11] The general form of the question for self- and party policy positions is "In politics sometimes people talk of left and right. Where would you place [yourself/PARTY NAME] on a scale from 0 to 10 where 0 means the left and 10 means the right?" The valence measure uses the question

Following AMG (2005), we estimate the vote choice model using conditional logit (CL). Table 1 reports the results, first with a model which pools the 79 parties and then disaggregated by country. Results of the pooled model show that each of the parameters of interest—the ideological proximity parameter (standard in spatial models), the valence parameter, and the majoritarian bias parameter—are estimated precisely and signed in the expected directions. The proximity weight ($\propto$) is negative, indicating that the utility of selecting party k increases as the distance between the voter and the party's placement becomes smaller. The valence weight (β_1) is positive, indicating that parties that receive higher performance marks by voters also win more votes. And the seats-votes weight (β_2) is also positive, conveying that voters prefer to vote for winning parties which receive more seats than votes. In summary, voters prefer a party which is ideologically closer, has a valence advantage, and it is projected to benefit from the country's electoral rules.

<Table 1 about here>

Table 1 also reports CL results disaggregated by country. The magnitude and sign attached to parameters is generally similar across the country surveys. In all instances parameters are signed in the expected directions, though in four cases estimates do not attain statistical significance (the proximity weight for Great Britain, Israel, and Sweden, and the seats-votes weight for Denmark). Results from the pooled model provide strong support for the overall

wording: "After I read the name of a political party, please rate it on a scale from 0 to 10, where 0 means you strongly dislike that party and 10 means that you strongly like that party." Additional details are available at www.cses.org.

effect of electoral rules. We still present single-country models to show the different effect across cases, which provide a range of feasible values for the simulations in next section.[12]

The CL parameters provide us with starting points to map the effect of electoral rules on party equilibrium locations. We can now examine the sensitivity of the model to changes in the electoral rules, analyzing changes in the equilibrium location of parties and, by extension, on the parties' electoral success. Our approach is to hold constant the weight that voters attach to the first two parameters of interest—ideology and valence—while varying the degree of majoritarian bias of the electoral rules as well as the weight voters attach to the seat-vote differences. That is, we hold constant the first two terms of the utility function, $-\propto (x_i - L_k)^2$ and $\beta_1 T_{ik}$, and let the two key parameters of the seat-vote term, β_2 and ρ, to vary. This is done by allowing the algorithm described in equations (6) and (7) to map the location of parties at five different values of $\beta_2 \equiv \{0.2,0.4,0.6,0.8,1.0\}$ and six different values of $\rho \equiv \{1.5, 2, 2.5, 3, 3.5, 4\}$.[13] We then gauge the effects of these parameters on parties' equilibria and on expected vote shares (as depicted in equation (3)) against a baseline provided by a restricted model with no seat-vote effect (as in equation 1).

4. Results

For illustrative purposes we first demonstrate the basic properties of the model with results from the 2002 Swedish election. We then pool the equilibrium estimates for all 79 parties

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[12] The Supporting Information file reports estimates from unpooled models with individual-specific demographic variables, including gender, age, education, income, union membership, and urban/rural residence. Inclusion of these variables has little effect on parameters of interest.

[13] These values are informed by the estimates from Table 1 (for β_2) and by the properties of seats-votes models as developed by King (1990) and others (for ρ).

in the thirteen elections across all values of β_2 and ρ to measure the response to mechanical differences in the electoral rules.

4.1. The 2002 Swedish Election

In the 2002 Swedish general election votes were contested by six main political parties, the Left Party (with a position of 1.3 on the 0-10 left-right scale), the Social Democrats (3.5), the Center Party (5.7), the Liberal People's Party (6.5), the Christian Democrats (7.1), and the Moderates (8.9). These six parties obtained vote percentages in the election of 8.4, 39.9, 6.2, 13.4, 9.1, and 15.3 percent, respectively. How do electoral rules affect the positioning in policy space under the assumption of vote-maximizing behavior? In turn, how do these positions affect party vote totals? We can address these questions by varying the mechanical properties of the electoral rules to examine how seats-votes differentials matter for the parties' positions and vote shares.

First we consider how less permissive electoral rules affect the Nash location of each party. Figure 1 displays model results for each of the six Swedish parties. Solid lines describe party equilibrium strategies under strictly proportional rules (ρ= 1). Dashed lines describe party equilibrium strategies under plurality-like rules (ρ = 3). To facilitate comparison, the weight voters accord to the seats-votes differences, β_2 (the psychological effect), is fixed at 0.6.[14] Differences between the posterior distributions of both specifications thus capture the effect of electoral rules for party equilibrium locations.

<Figure 1 about here>

[14] The other model parameters are also fixed. The proximity weight, $\propto$, is set to -.05, and the valence weight, β_1, is set to 1.0.

The solid lines show that under proportional rules the Left Party and the Social Democrats have well defined equilibrium locations to the left of the political spectrum (less than 5 on the 0-10 point scale), while the Center Party, the Liberal People's Party, the Christian Democrats, and Moderates—all members of the 1991-1994 and 2006-present coalition governments—have equilibrium locations to the right of center. Electoral system effects on these Nash positions can be observed by comparing the solid lines (ρ = 1) to the posterior distributions reported by the dashed lines (ρ = 3). These movements capture the effect of imposing majoritarian biases on parties and voters. Results show that, with the important exception of the Social Democrats, this manipulation of electoral rules induces *centrifugal* effects: the vote-maximizing prescription for the Left Party is to become more extreme on the left side of the policy spectrum, while conservative parties move further to the right. Cox's (1990) Downsian claim that majoritarian rules exert centripetal incentives is supported for only one—and by far the largest—of the six parties, the Social Democrats.

Figure 2 plots the mean equilibrium location of each party with the ideological distribution of voters on the left-right dimension. Here, we again see that the position-taking incentives provided by electoral rules are party-specific. A shift from $\rho = 1$ to $\rho = 3$ yields moderation for the Social Democrats but extremism for the smaller parties. Figure 2 shows the effect of electoral rules on *party electoral success*, as expressed by expected vote share and shown on the y-axis. Again, the effects are party-specific. A change from proportional to majoritarian rules is estimated to increase vote share for the largest party in the system, the Social Democrats, by about eight percent (compare height of solid and dashed lines). All other parties, however, lose votes when the system becomes less proportional. That is, consistent with our model's predictions, the mechanical rules induce more voters to chose the Social Democrats giving this party a larger seat premium.

<Figure 2 about here>

4.2. The Effects of Electoral Rules in Thirteen Parliamentary Elections: Implications for Party Locations

Evidence reported for party competitors in the 2002 Swedish election suggests that non-proportional rules generate centripetal incentives for large parties (the Social Democrats) and centrifugal incentives for smaller parties (all others, none receiving more than 16% of the vote). We now report results using the full set of 2370 observations, first looking at party locations and then party vote shares.[15]

Figure 3 offers a visual comparison of the equilibrium locations of all parties as the electoral rules display larger majoritarian biases. The horizontal axis displays baseline equilibrium locations in a strictly proportional system, when $\hat{S}_k - \hat{V}_k = 0$. This model estimates only the effect of the proximity and valence components of the vote choice, as in AMG's (2005) workhorse model described in equation (1). Equilibrium positions charted on the horizontal axis are produced from a model which incorporates information about the seat premium resulting from the use of different electoral rules, including all observations where $\hat{S}_k - \hat{V}_k \neq 0$. The diagonal line thus represents no change in party equilibrium positions after accounting for electoral rules. In Figure 3 parties are characterized as either favorably biased or unfavorably biased in seats.

<Figure 3 about here>

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[15] The number of observations analyzed is equal to the number of parties in the data set (79) multiplied by the five values of β_2 multiplied by the six values of ρ.

The results are consistent: those parties which are favorably biased in seats have incentives to cluster in the center of the policy continuum. That is, parties with *positive seat premiums* ($\hat{S}_k - \hat{V}_k > 0$) have centripetal incentives. This is just as previous research suggests, and the Swedish Social Democrats serve as a good example. Most parties, however, tend to be biased against in terms of seats and votes. Majoritarian biases mean the party receives fewer seats in the assembly than they would if rules were strictly proportional. For these parties, the reductive effects of majoritarian rules exert centrifugal pressures, pushing them to the extremes.

Figure 4 uses the same information as in Figure 3 but displays separate estimates for each country.[16] Horizontal axes report the difference in party seat share and vote share as we vary the majoritarian bias parameter such that higher values indicate greater seat premiums. Vertical axes display the party's difference in Nash locations based on a utility model without consideration of seats and votes ($\beta_2 = 0$ in equation 5) compared to one which includes a seats-votes component ($\beta_2 > 0$). On the vertical axes all position differences are standardized so that, regardless of whether a given party is located on the left or right, positive values connote centrifugal movements and negative values indicate centripetal movements.

<Figure 4 about here>

Figure 4 graphs provide a picture for all cases analyzed consistent with that shown for Sweden. As majoritarian biases favoring party *k* increase, *k* displays stronger incentives to move towards the median voter in the sample.[17] In the Swedish example, we saw that one of six

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[16] For economy of presentation, one of the thirteen country cases (New Zealand) is displayed in the Supporting Information available on-line.

[17] Recall that the influence of majoritarian bias, ρ, for party *k*'s seat share, S_k, is given by equation (4).

parties fit this scenario. Overall, one third (33%) of our observations exhibit center-clustering tendencies. Of these, the simulations show that a change in electoral rules would have the strongest center-clustering pressure on the Norwegian Conservatives, with a difference in equilibrium location of 1.0 points along the 11-point left-right scale (for $\rho = 3.5$ and $\beta_2 = 1$). However, the remaining two-thirds of the party observations face unfavorable seats-votes differential. As shown in the southwest quadrants of the graphs, non-proportional rules produce centrifugal incentives for these parties.[18] The strongest such incentive is for the Danish Christian People's Party (a centrifugal shift of .63 when $\rho = 4$ and $\beta_2 = 1$).

4.3. The Effects of Electoral Rules in Thirteen Parliamentary Elections: Implications for Electoral Success

As with the Swedish example, pooled analyses reported above showed that majoritarian biases "crowd out" smaller parties and cause them to *move to more extreme policy locations*.

[18] As an example, consider the case where ρ is set to 3 (and $\beta_2 = 0.6$). In this case 54 of the 79 parties analyzed have incentives to move to more extreme values in search of maximizing their voter share. Under these parameters, majoritarian rules--produced by comparing simulated party Nash locations using equation (1) and equation (5)--provide centripetal incentives for only 25 parties (these parties are in italics in the Appendix). Many though not all of these rank among the largest parties in their systems. We also note that a small minority of parties behave in an anomalous way in that being biased against in seats produces centripetal incentives. In our simulations this behavior is exhibited by three very small parties: the One Nation Party in Australia, the Christian People's Party in Denmark, and the Christian People's Party in Norway (see Figure 4 graphs, northwest quadrants). Possible contingencies linking party size to policy incentives are necessarily left for future research.

Moreover, as Figure 2 showed, the voter's decision to incorporate electoral rules in her utility function *reduces the expected vote share* for smaller parties. The implications of our analyses in terms of vote shares is shown in Figure 5 for the pooled sample. The figure plots estimated party vote shares from the baseline model (equation 1, horizontal axis) and the seats-votes augmented model (equation 5, vertical axis). Parties located on the diagonal are those for which electoral rules produce no change in their vote totals.[19] Parties located below and to the right of the diagonal experience a decline in vote shares. In the absence of partisan bias, this sample includes only smaller parties. Parties located above and to the left of the line gain in votes, such as the Swedish Social Democrats, Dutch Christian Democrats, or British Labour, which frequently head up governments.

<Figure 5 about here>

Finally, Figure 6 plots the parties' seat-vote differentials (produced as in Figure 4) against their difference in expected vote shares attributed to including the seats-votes parameter in the voter's utility function. Results are displayed by country. Differences in vote probabilities are compared to the gain or loss incurred by considering the effect of electoral rules on party electoral success. Values greater than zero along the vertical axis indicate that majoritarian bias increases party electoral success while values less than zero mean a loss of vote shares. Again we see that electoral rules affect different parties differently. The story is one of asymmetric gains: a minority of the party cases gain votes—and gain considerably, upwards of 15%. The majority of party competitors, however, would be harmed by a majoritarian electoral reform. For most cases, however, the model predicts this loss to be on order of less five percentage points.

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[19] Most of these "no change" cases are very small "niche" parties for which voters may cast ballots based purely on their policy appeals (captured by α in equations (1) and (5)).

<Figure 6 about here>

Figure 6 displays the relationship between majoritarian bias and the absolute vote shares received by each party such that parties lying above (below) 0 on the vertical axis are absolutely advantaged (disadvantaged) by non-proportional rules. An alternative approach would be to examine the relationship between electoral rules and parties' relative gains. It is plausible that a party gains votes under non-proportional rules but does not gain *to the same degree* as another party in the election. Such a party would be absolutely advantaged but relatively disadvantaged. Indeed, additional results, included as part of the Supporting Information to this article, show that in a small minority of cases (81 of 2370, or 3.4% observations) majoritarian rules cause some parties to fall into this category.[20]

4.4. Isolating Mechanical and Psychological Effects: Multivariate Analyses

We have shown that electoral rules that reward large parties also drive them to take more moderate positions. Conversely, smaller parties typically see their vote share decline and are pushed toward more extreme equilibrium positions. For further insight, we can perform multivariate analysis on the simulated data to isolate the contributions of the mechanical and

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[20] At times (for different combinations of ρ and β_2) this characterizes the Finnish Center and National Coalition Parties, the German Christian Democrats, Meretz in Israel, the Norwegian Christian People's Party, and the People's Party and Green Party in Switzerland. However, our results indicate that the distinction between being absolutely as opposed to relatively disadvantaged by electoral rules does not fundamentally affect model predictions for most parties. We leave for future research the question of whether the electoral system's absolute or relative (party-specific) effects are more critical for determining voter behavior and, by extension, party Nash locations. We thank an anonymous reviewer for this suggestion.

psychological effects. We first examine shifts in party Nash positions as produced by taking electoral rules into account (equation 5) relative to not doing so (equation 1). As per the previous section, we expect that party incentives to cluster in the center in search of votes will become greater as majoritarian biases increase (that is, as ρ increases) and as the voter's psychological anticipation of this effect gets stronger (as β_2 increases). Centripetal tendencies will not be uniform, however. The effects should work in the opposite direction for adversely biased parties—such parties should move toward the extremes.

Model 1 in Table 2 tests this prediction. The dependent variable is the difference in party Nash locations, *ΔNash*, coded so higher values indicate centripetal movements. This measure is regressed on the mechanical for (ρ) and psychological (β_2) parameters of electoral rules, their interaction with a dummy variable scoring 1 for biased against parties and 0 for favorably biased parties, and a control for the initial effective number of competing parties (ENCP) as produced by equation (1).[21] Results show estimates for ρ and β_2 are positive and statistically significant, meaning that non-proportional rules provide center-clustering incentives. The interactive term, however, shows these parameters only affects parties which are favorably biased in terms seats and votes. Most parties (80% in our sample) are biased against in seats. For these parties, increases in the mechanical and psychological properties of majoritarian rules produce centrifugal effects. Specifically, for biased against parties the coefficients on ρ and β_2 are -0.03 and -0.22, respectively.[22] For biased against parties, increases in the *mechanical* majoritarian properties of the electoral system leads to small but statistically significant centrifugal

[21] Table 2 models include country fixed effects, as prescribed by *F*-tests.

[22] These are the coefficients for ρ and β_2 when *Biased Against Party* = 1. Both conditional coefficients are statistically significant at $p < .01$.

movement. Increase in the *psychological* majoritarian properties of the electoral system also creates incentives for dispersion for the small biased-against parties.[23]

<Table 2 about here>

The second model in Table 2 assesses the reductive effect of majoritarian biases for party systems, isolating the impact exerted by mechanical and psychological factors as posited by Duverger. The dependent variable is the ENCP as calculated for each observation in the data using the vote shares for each party produced from applying the analytic model to equation (5). Results of the regression analysis show, as Duverger proposed, that this reductive effect works through both the mechanical effect of electoral rules and, by way of voter anticipation of this effect, through the psychological effect. Further, the reduction in the number of competing parties is attributable to declines in votes received for both large (favorably-biased) and small (biased-against) parties. Calculation of conditional effects shows that the influence of the latter on the party system is somewhat larger.[24] This variation squares with intuition: large mainstream parties are less likely to be susceptible to changes in electoral rules than the smaller parties.

5. Conclusion

Researchers have done much to specify how and under what conditions electoral rules matter for party position-taking. Deservedly influential is Cox (1990), where he formally derives an exhaustive set of predictions for the conditions under which parties converge in policy space

[23] When assessing the relative influences of mechanical and psychological properties, it is instructive to recall the in-sample ranges: 1.5 to 4 for ρ and 0.2 to 1 for β_2.

[24] For favorably biased parties coefficients on ρ and β_2 are -0.23 and -1.65. For biased against parties these estimates are -0.25 and 1.95. All of these are statistically significant.

under a set of factors characterizing a given electoral system. Following Downs and Cox, theoretic work to date has focused on institutional incentives while treating all party actors similarly. In this article we build on recent work on spatial models, and formally account for the effect of electoral rules on vote choice, party competition, and the policy preferences of different types of parties.

At the heart of our story lies the relationship between electoral rules and vote choice in competitive elections. Strategic voting influences party platforms, generating simultaneously centripetal and centrifugal tendencies, based on the party's particular characteristics.[25] The voter utility function developed here, which accounts for the seat-vote properties of electoral rules, allows us to model the strategic behavior of voters. More importantly, our results provide evidence supporting a centripetal effect of plurality-like electoral rules *on favorably-biased parties*, e.g., parties positively biased in seats by the electoral rules. By contrast, non-proportional rules *crowd-out* smaller parties into more extreme policy positions, as voters defect from parties that expect fewer seats than their vote share.

These findings have several implications. For one, the insight that different parties have different incentives clarifies anomalous findings in recent research on the behavioral consequences of electoral rules. For example, Blais and Bodet (2006, 1250-55) find that proportional rules produce less centrist parties and a greater diversity of policy positions, an empirical finding which consistent with Cox's 1990 predictions that parties tend toward the

[25] Future work should be devoted to learning more about what drives certain parties to cluster in the middle while others move to the extremes in seek of votes. A promising direction is this regard might be to relax the assumptions of our model to allow electoral rules to affect the strategic entry/exit of parties from competition.

extremes under proportional rules. However, using different data, Ezrow (2008) finds no evidence that the system's "average party policy extremism" is affected by electoral rules: PR systems are no more likely to exhibit high levels of party policy dispersion than countries selecting members to the assembly with simple plurality rule. Others have suggested that the answer to the absence of this relationship can be found by examining non-policy, or "valence" considerations (Erikson and Romero 1990; Schofield and Sened 2006) or by considering the role of party activists (Aldrich 1983).

Our research, however, implies that the heterogeneous effects of mechanical and psychological rules at the individual party level ought to cancel out any observed aggregate level relationship between the electoral system and party equilibrium locations. Future research should aim to disentangle the *relative* importance of valence, competence, proximity, the electoral environment, and other factors on the policy strategies of competing parties.

Second, our findings are relevant to recent interest in how small parties shape the overall policy space of political competition. Adams and Merrill (2006), for example, show that the centrist strategies of third parties is not just of passing interest but has implications for the positions taken by the main parties, moving them to the extremes. Meguid (2008) also assigns a key role to small parties. An implication of these studies is that *all* party competitors can sway election results and, in turn, where parties choose to locate on policy. As with these studies, our findings highlight points of difference (heterogeneity) across party competitors. However, rather than arguing that party strategies are due to party system effects, our account differs from other entrants in this research agenda by showing how the directions and opportunities for party policy shifts depends in part on the electoral system. Competitor behavior matters for explaining policy shifts (Adams and Somer-Topcu forthcoming); our work, however, shows that the degree to which this matters is a function of the rules of the electoral game.

Finally, our model of voter utility and the party Nash equilibria it produces offers a new means for isolating the mechanical and psychological processes through which electoral rules shape party competition. While the effects of formal institutions on party systems are widely recognized, political scientists too often have placed the mechanism connecting rules to outcomes in a black box. Many recognize, however, that "the operation of electoral systems on the number of parties winning seats operates twice, both on the conversion of votes to seats but also on the composition of votes itself" (Benoit 2002, 44). By proposing a means to isolate these effects within the voter's utility function, we offer a way to connect this fundamental insight into our empirical models.

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Table 1. McFadden Conditional Logit Models, Individual-Level Estimates

	Pooled Model	Australia	Denmark	Finland	Germany	Great Britain	Ireland
Proximity $\propto$	-0.040	-0.037	-0.047	-0.027	-0.022	-0.004	-0.021
	(0.008)	(0.009)	(0.009)	(0.011)	(0.005)	(0.022)	(0.007)
Valence β_1	1.120	1.030	1.302	1.403	0.691	1.096	0.860
	(0.128)	(0.051)	(0.045)	(0.069)	(0.024)	(0.105)	(0.039)
Seats-Votes β_2	0.301	0.725	0.017	0.318	0.290	0.199	0.250
	(0.060)	(0.052)	(0.044)	(0.058)	(0.044)	(0.086)	(0.041)
LogLik	-7638.1	-614.7	-942.0	-487.6	-1133.0	-132.8	-752.4
AIC	15282.1	1235.5	1889.9	981.2	2272.0	271.6	1510.8
N	11756	1002	1420	700	1520	378	855

	Israel	The Netherlands	New Zealand	Norway	Spain	Sweden	Switzerland
Proximity $\propto$	-0.007	-0.124	-0.026	-0.039	-0.079	-0.031	-0.032
	(0.008)	(0.012)	(0.009)	(0.008)	(0.012)	(0.020)	(0.009)
Valence β_1	1.083	1.850	0.895	1.535	0.855	2.099	0.845
	(0.067)	(0.073)	(0.052)	(0.053)	(0.069)	(0.129)	(0.049)
Seats-Votes β_2	0.380	0.235	0.530	0.194	0.852	0.142	0.394
	(0.067)	(0.053)	(0.083)	(0.063)	(0.109)	(0.068)	(0.046)
LogLik	-328.0	-734.2	-415.6	-790.1	-152.1	-239.0	-421.3
AIC	662.0	1474.3	837.3	1586.1	310.3	483.9	848.7
N	544	1155	527	1460	758	733	704

Notes: Cells report conditional logit model coefficients with standard errors in parentheses. The first model reports a pooled specification which combines data from all thirteen election studies. All models are estimated without party-specific intercepts. Models with party-specific intercepts produce equivalent results and are available upon request.

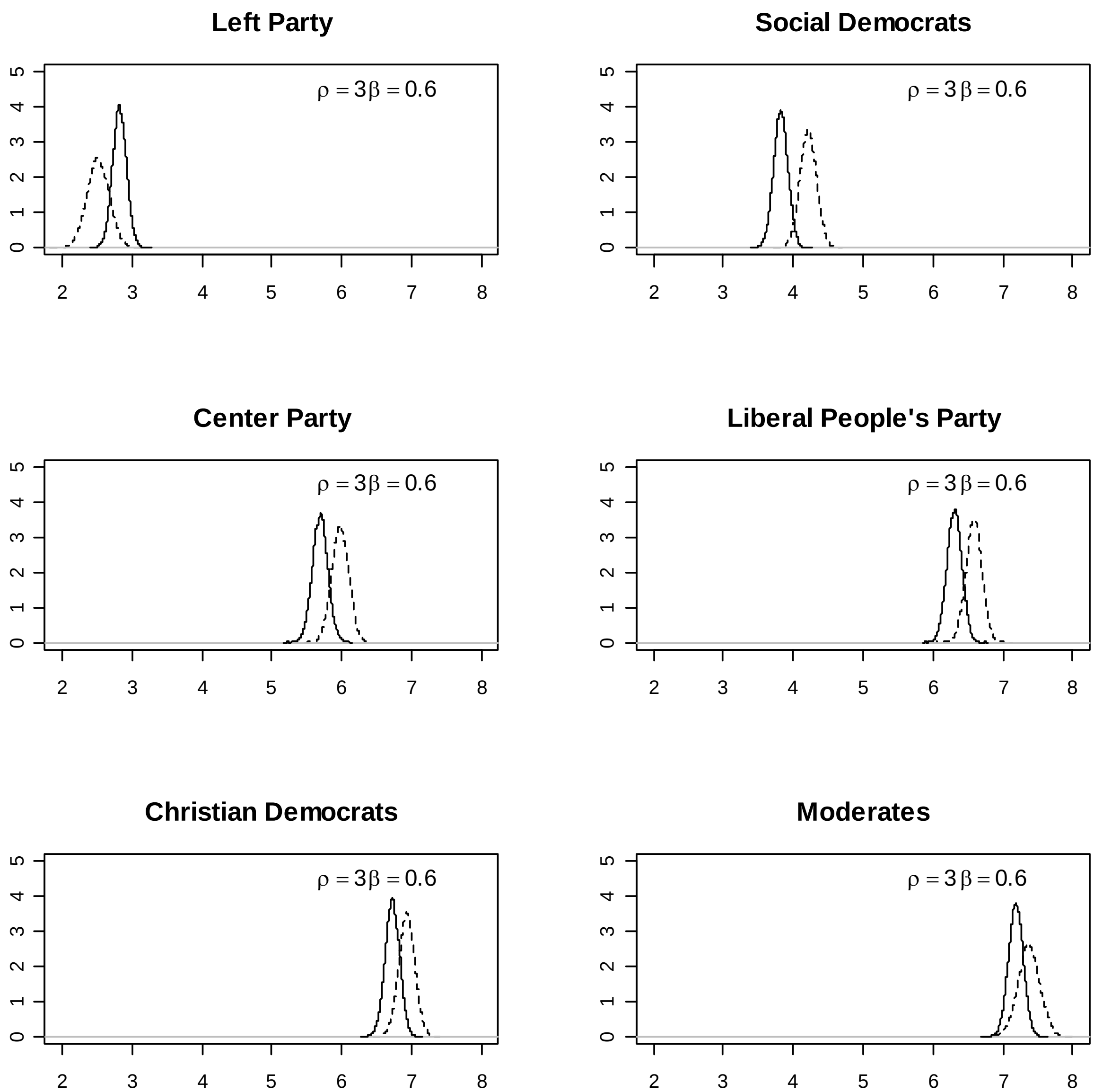
Table 2. The Influence of the Mechanical and Psychological Effects of Electoral Rules on Party Nash Locations and on the Number of Party Competitors

	Model 1 DV: ΔNash[a]	Model 2 DV: ENCP
ρ	.112**	-.224**
	(.006)	(.017)
β_2	.462**	-1.612**
	(.019)	(.050)
Biased Against Party	.444**	.273**
	(.024)	(.063)
ρ x Biased Against	-.145**	-.029
	(.007)	(.019)
β_2 x Biased Against	-.685**	-.331**
	(.022)	(.056)
ENCP, baseline model	-.015**	.472**
	(.004)	(.010)
Constant	-.236**	3.082**
	(.032)	(.083)
Country fixed effects	Yes	Yes
Adj R^2	.67	.90
N	2370	2370

Notes: Cells report OLS regression coefficients with standard errors in parentheses. Estimates for country fixed effects are not reported for presentation purposes. ** $p < .01$, * $p < .05$, two-tailed test.

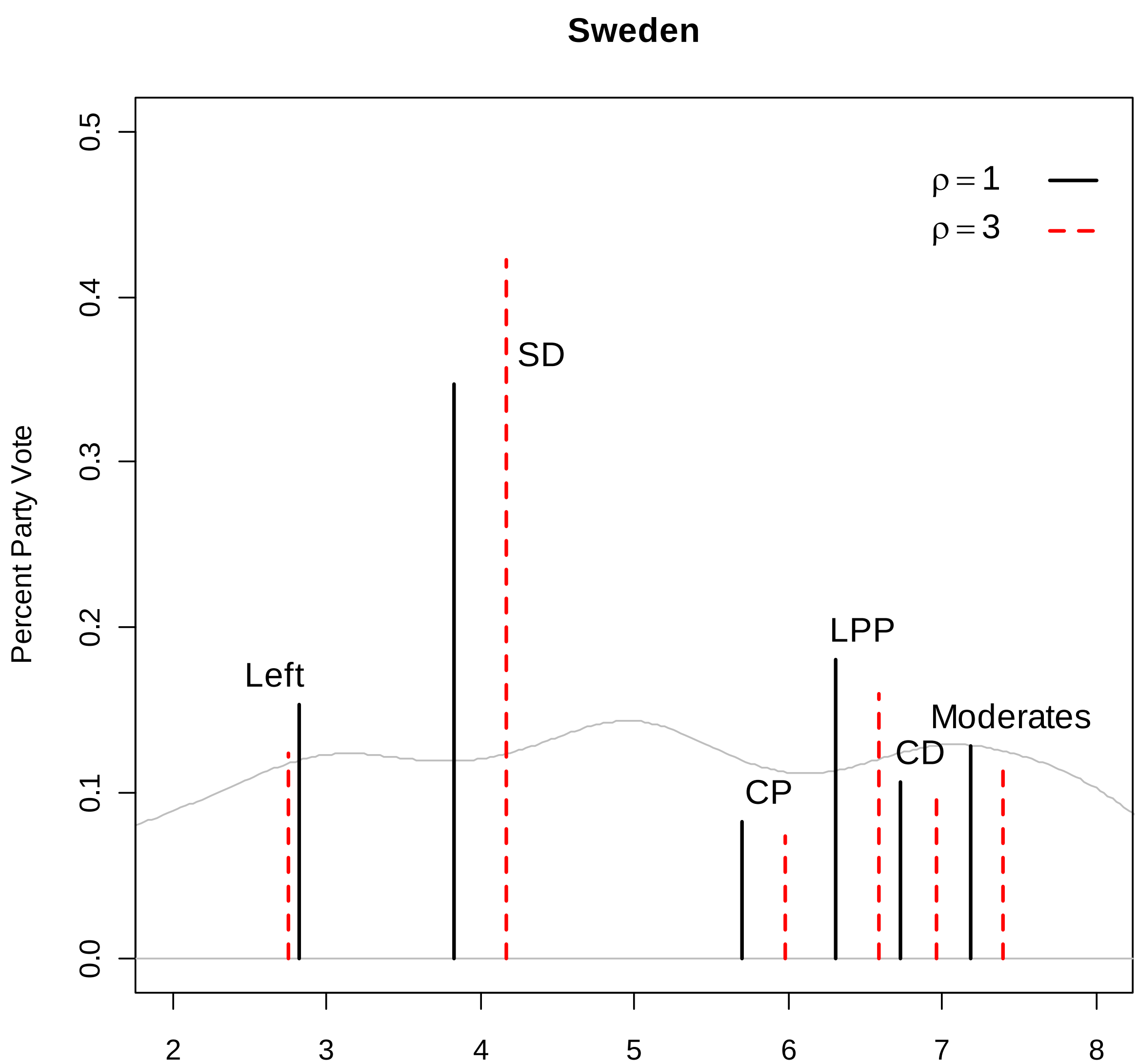
a) Higher values on *ΔNash* coded such that higher values indicate centripetal movements.

Figure 1. Equilibrium Location of Parties in 2002 Swedish Election



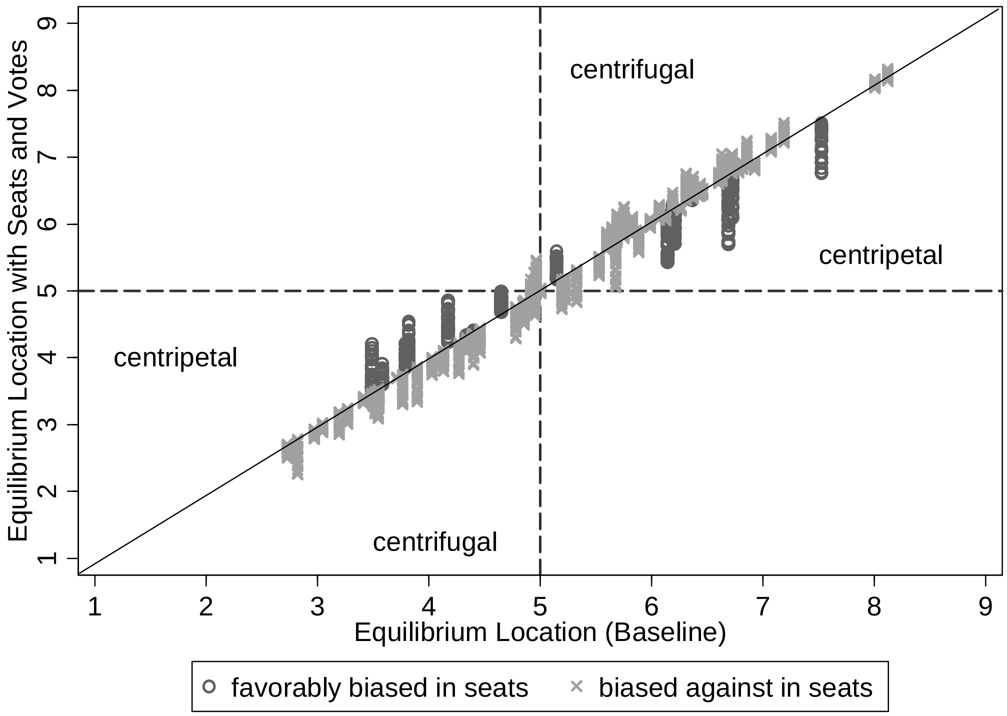
Notes: Figures report the posterior probability distributions as located along the 0-10 Left-Right scale as described in the text. Distributions displayed with a solid line describe party equilibrium strategies based on a model of voter utility with $\rho = 1$ (see Equation 5). Dashed line distributions describe party equilibrium strategies for $\rho = 3$. For both cases $\propto$ is set to -.05, β_1 to 1.0 and β_2 to 0.6.

Figure 2. The Effect of a Change in Electoral Rules on Party Equilibrium Locations and Vote Shares in 2002 Swedish Election



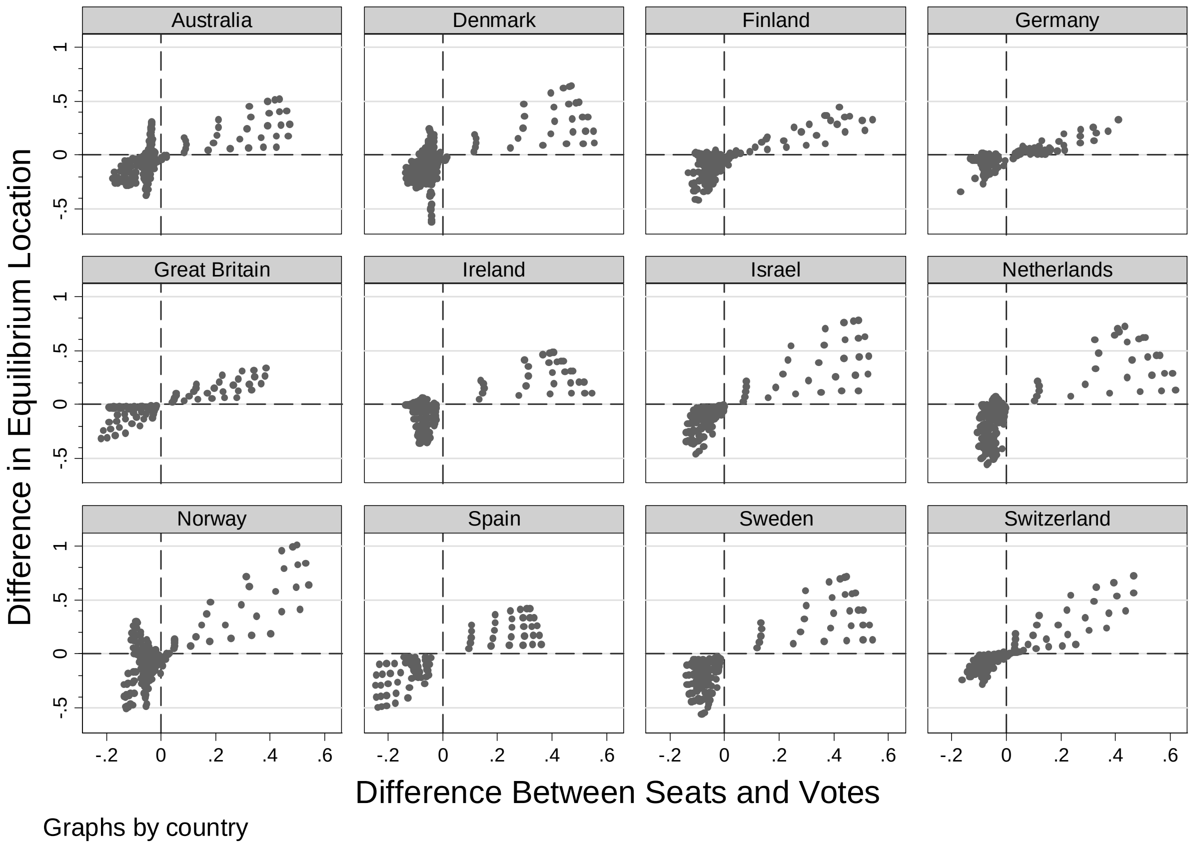
Notes: Equilibrium Location of parties along the Left-Right scale in the 2002 Swedish election if ρ = 1 (solid line) and if ρ = 3 (dashed line). For both cases $\propto$ is set to -.05, β_1 to 1.0 and β_2 to 0.6. Height of vertical lines describes the share of votes obtained by each party at their equilibrium location. The grey line displays distribution of the voters.

Figure 3. Party Equilibrium Locations With and Without (S_k-V_k) in Utility Function



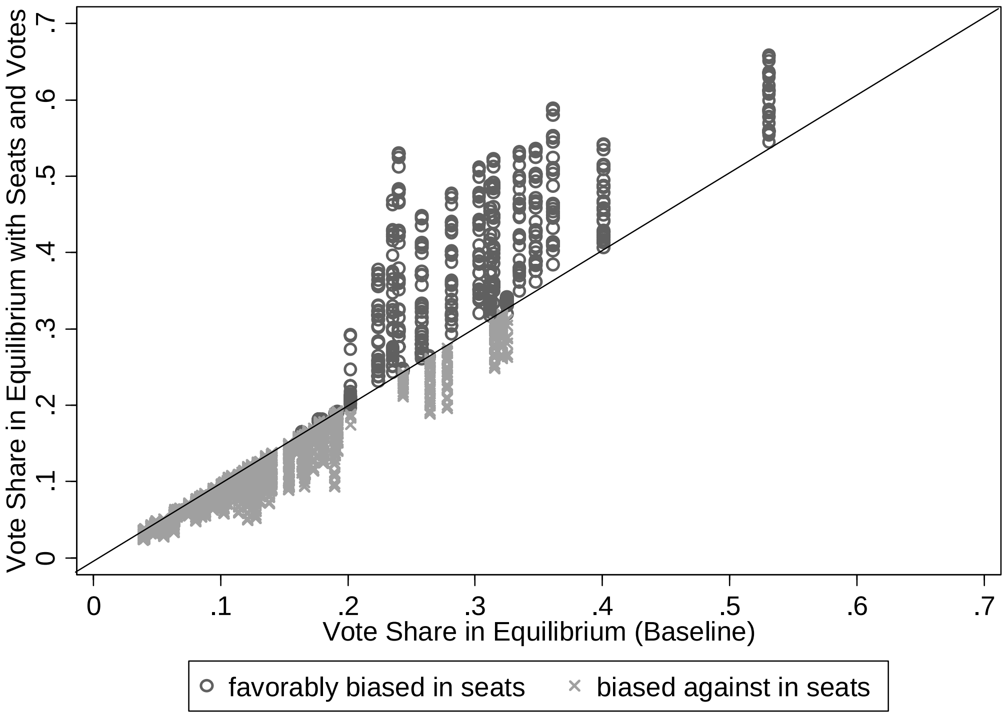
Notes: The horizontal axis reports party equilibrium locations produced by applying equation (1) and solving for L_k as described in the text, section 2.3 and equations (6) and (7). The vertical axis reports party equilibrium locations produced by applying equation (5) and proceeding as above to estimate equilibrium positions.

Figure 4. Seats-Votes Differences and Party Equilibrium Locations Compared



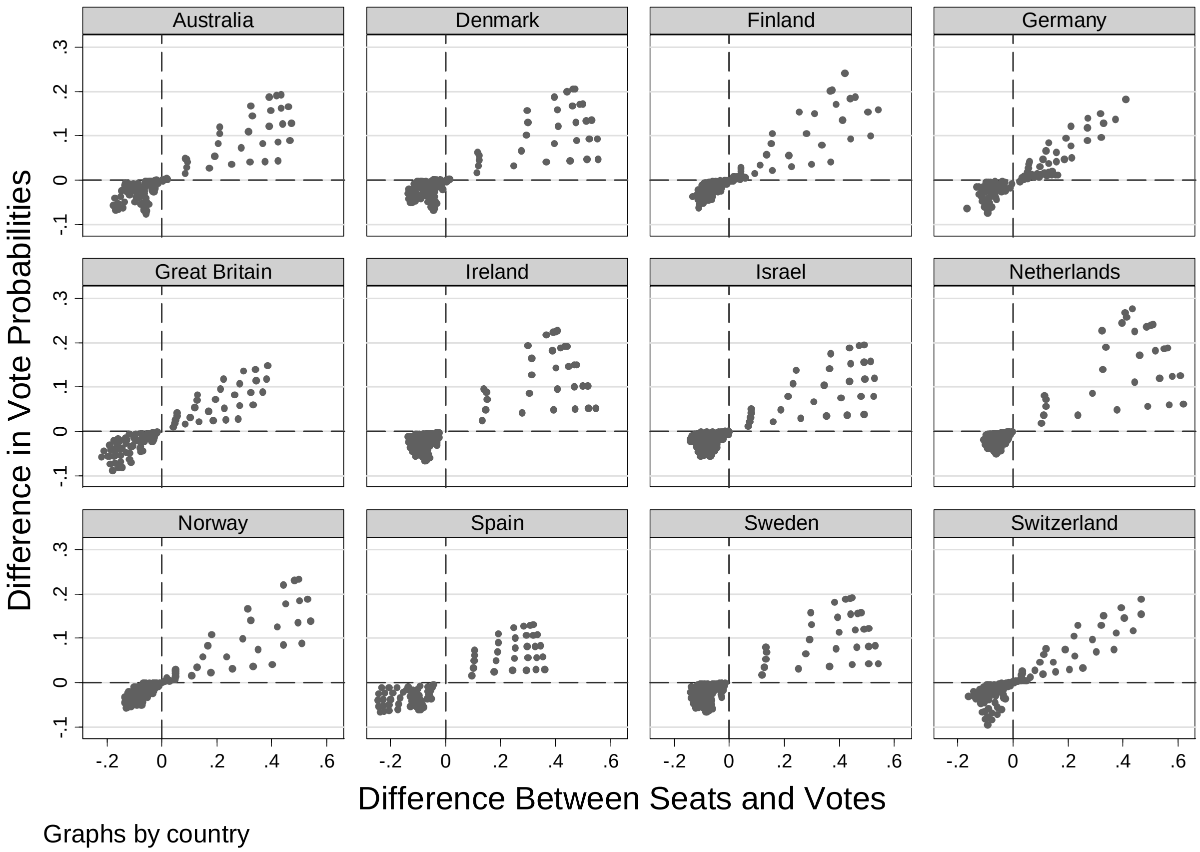
Notes: For each graph, the horizontal axis reports the difference in seat share and vote share received by the party where higher values indicate greater seat premiums. Vertical axes report the party's difference in Nash locations based on a utility model without consideration of seats and votes ($\beta_2 = 0$ in equation (5)) compared to one with seats and votes considerations ($\beta_2 > 0$). Values greater than zero on the vertical axis connote centripetal incentives. Values less than zero on the vertical axis connote centrifugal incentives. For presentation, one of the thirteen countries (New Zealand) is not shown.

Figure 5. Party Expected Vote Shares With and Without (S_k -V_k) in Utility Function



Notes: The horizontal axis reports party expected vote shares produced by applying equation (1) and solving for EV_k as described in the text, section 2.3 and equation (6). The vertical axis reports party expected vote shares produced by applying equation (5) and proceeding as above.

Figure 6. Seats-Votes Differences and Party Expected Vote Shares Compared



Notes: The horizontal axis reports the difference in seat share and vote share received by the party where higher values indicate greater seat premiums. The vertical axis reports the party's difference in expected vote probabilities based on a utility model without consideration of seats and votes (equation (1)) compared to one with seats and votes considerations (equation (5)). For presentation, one of the thirteen countries (New Zealand) is not shown.