Unpacking LogM: Toward a More General Theory of Party System Density

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Abstract

The consensus model of political party system density combines two traditions to explain why some countries have more political parties than others, one tradition that emphasizes social cleavages and another that emphasizes electoral institutions, especial district magnitude. Despite its considerable success, there are several reasons to be less than fully satisfied with the consensus model. We examine two of these problems associated with the scope of strategic voting and the functional form of the specification used to test the model. We then re-examine some of the key analyses that have been used to test the model to assess the severity of these limitations. In doing so, we inductively construct a broader, organizational ecology model that accounts for what the consensus model did so well, but also accounts for important anomalies it ignores.

Unpacking LogM: Toward a More General Theory of Party System Density

Political scientists have traditionally explained the density of political party systems – their number of parties – in two ways. The first, associated with political sociologists such as Grumm (1958), Lipset and Rokkan (1997) and Rose and Urwin (1970), emphasized social cleavages, arguing that political parties are primarily vehicles for representing pre-existing economic, regional, language, religious, or ethnic distinctions within electorates. The second approach, a political economy perspective based on the work of Lijphart (1990), Riker (1982), Taagepera and Shugart (1993), and Cox (1997), emphasized instead the role of electoral institutions in structuring party systems.[1] Based on Duverger's (1954) observation that simple-majority, single-ballot institutions favor the development of a two party system, these scholars explored how a range of electoral rules severely condition how many parties can meaningfully compete for legislative seats and executive offices. Newer versions of this model suggest that, given a set of electoral rules, citizens vote strategically or only for parties with reasonable prospects of victory. Further, new parties are established only when they have a reasonable prospect of winning seats.

These two approaches now have been combined into a single integrated model (Powell 1982; Taagepera and Grofman 1985; Neto and Cox 1997; Ordeshook and Shvetsova 1994; Cox 1997).[2] A strong consensus has developed within the discipline around this model, a consensus that has facilitated a strong research program exploring individual- and system-level properties of and interactions between social

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[1] Of these institutions, district magnitude or the number of seats allocated in electoral districts is generally seen as the most important determinant of electoral systems.

[2] This new consensus model of party systems does not, however, weigh equally the insights of the two traditional models. Rather, the basic structure of party systems in terms of the number of parties that can effectively compete for office is highly constrained by electoral intuitions. But these constraints must interact with cleavages in heterogeneous societies to accrue the full number of parties that can be expected to survive on the basis of the prevailing electoral rules alone.

systems and electoral institutions (Reed 1991; Chhibber and Kollman 1998; Jones 1997; 1999; Clarke and Stewart 1987; Fey 1997; Federson 1992). Despite this very real success, there are several reasons to be less than fully satisfied with the consensus model of party system density. These problems cover the full gamut of issues from lack of theoretical motivation for key elements of the model and inadequate testing on the theory's own terms to its potentially limited scope.

After first describing the consensus model, we examine what we view as its two most important problems in the first section of the paper. The empirical section of the paper then re-examines some of the key analyses that have been used to test the model to assess the severity of these limitations. In doing so, we inductively construct a broader model that accounts for what the consensus model did so well, but also accounts for important anomalies that it has essentially ignored. We conclude by comparing our organization ecology reinterpretation with prior work, arguing that the former offers a better appreciation of both the strengths and significant limitations of the consensus model. We also identify key test implications of our broader model that can guide further research on party system density.

The Consensus Model

The consensus model of the density of political parties, while building on a literature that developed over several decades, is perhaps best reflected in Gary Cox's 1997 book *Making Votes Count*. The model he presents seeks to explain empirical findings on electoral institutions inspired by and building on Duverger's (1954) conclusion, noted above, that simple-majority, single-member, single-ballot rules play a significant role in "pushing" electoral systems toward two major parties (Cox 1997, 98). Duverger's focus on electoral rules was quickly extended by Rae (1967) to consider a variety of electoral institutions found in multi-party systems, including electoral formula (majority, plurality, or various forms of proportional representation), district magnitude (the number of legislators elected from a district), and ballot structure (rules allowing or prohibiting voters to split their votes). Empirical research then confirmed that the district magnitude, especially, severely constrains the number of political parties that might be viable within an electoral system (Lijphart 1990). More specifically, "the generalized Duverger's rule is:

$$Ns = 1.15\ (2 + \log M),$$

where logM is the decimal logarithm of the district magnitude" and Ns is the number of parties in a political system (Taagepera and Shugart 1989, 142-155).[3]

Empirical observations require, of course, theoretical explanation. Duverger (1954) offered two. The first is an entirely mechanical effect. As Taagepera and Shugart (1993, 455) explain it, "With M = 1, only one party can win; and this has a strong tendency to impel the political forces to conglomerate into two large parties in order to have some chance of winning. As M increases, more parties can possibly win seats in the given district; hence more parties can afford to run." The mechanical explanation, unfortunately, leaves a great deal to be desired. Indeed, it is really only a restatement of the empirical generalization noted earlier without reference to *why* candidates and parties chose not to run. Indeed, Taagepera and Shugart acknowledge as much in their analysis (1993, 462). While considerable progress has been made in more precisely quantifying this mechanical effect (Taagepera 2001; Taagepera and Allik 2005), there has been as yet inadequate explication of its underlying causes.

Attention, accordingly, shifted to Duverger's second explanation, which he termed the psychological effect. It is squarely on this psychological effect that Cox

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[3] To simplify our analysis, we focus here on the core of the consensus model and do not consider more recent work discussing how interrelations among elections for different offices at different levels of government and other institutional arrangements might influence the relationship between district magnitude and number of parties (Jones 1997; 1999).

(1997) builds his analysis of party systems. That is, Cox argues that strategic voting on the part of individual citizens *largely* accounts for the strong relationship between district magnitude and number of effective parties. Simply put, "Instrumentally rational voters eschew wasting their votes on hopeless candidacies, preferring instead to transfer their support to some candidate with a serious chance of winning" (Cox 1997, 30).[4] Despite some very real misgivings about citizens' capacities, his model is firmly grounded on strategic voting on the part of individual voters

While most of Cox's (1997) attention is focused on strategic voting on the part of citizens in the context of a given set of electoral rules, his model – building on Powell (1982), Neto and Cox (1997), Taagepera and Grofman (1985), and Ordeshook and Shvetsova (1994) – also ~~seeks to~~ accounts for the role of electoral cleavages ~~within society~~ that allow more or fewer parties to emerge than would be expected given district magnitude alone.[5] T~~Surely, t~~his addition to the ~~core~~ model ~~focusing on the interaction of strategic voting and electoral institutions~~ was in ~~large~~ part a response to empirical anomalies. That is, some political systems simply supported more ~~or fewer~~ political parties – Canada, the United Kingdom, or India for example – than can be accounted for by ~~reference to~~ electoral rules alone. But whatever its origins, this additional attention to social cleavages marks the emergence of the modern consensus model combining insights from the two separate traditional

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[4] The modifier "largely" was added above because Cox (1997, 30) acknowledged that the strategic behavior driving the M+1 rule may be on the part of elites – donors, party officials, or opinion leaders. Indeed, given deep misgivings in the rational choice tradition within which he develops his model about the possibilities of strategic voting on the part of citizens (Meehl 1977; Riker 1982), Cox (1997, 98) expresses a clear preference for identifying such elites as the source of strategic behavior hypothesized to be responsible for the winnowing of effective parties. Nevertheless, the possibility of elite behavior plays relatively – and surprisingly – little role in his final model.

[5] This literature focuses on several types of cleavage that might matter electorally. Generally, this literature deals with the kinds of social cleavages such as ethnic divisions that are the focus on the political sociology tradition in the study of electoral systems. Taagepera and Grofman (1985), however, discuss cleavages more generally as issue dimensions. And more recent work focusing on regional-based voting (Clarke and Stewart 1987) can be viewed as tapping another sort of cleavage.

approaches to understanding the density of party systems.[6]

This combination is not produced via simple addition, however. Rather, the consensus model includes number of social cleavages in the model in interaction with district magnitude (Ordeshook and Shvetsova 1994; Neto and Cox 1997, and Cox 1997).[7] Cox's (1997, 206) plausible expectation – one at least as old as Key's analysis of party factions in *Southern Politics* (Canon 1978) – is that "political entrepreneurs" have strong incentives "to base separate parties on theses cleavages." By including the interaction term, the consensus model suggests that the effect of issue dimensions and/or social cleavages in promoting the development of parties is suppressed at an increasing rate as district magnitude declines.

Two Problems with the Consensus Model

Given the impressive body of work it both builds upon and which builds upon it, what is so wrong with the consensus model? It provides a less than fully satisfying account of party system density in several respects, only two of which will draw the bulk of our attention. The other issues are important, too, however. The consensus model, for example, says little about the nature of parties or how they are distributed across social or issue cleavages within the electorate, something that would seem related to the number of parties found in political systems (but see Cox 1990).[8] There

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[6] This raises one of many debates about endogeneity within the literature on party systems. It is often argued that electoral rules are in fact a function of social cleavages, with nations with many such cleavages more likely to adopt electoral rules favoring multiple party systems. But it is also argued that cleavages are not given, but at least in part are created by politicians seeking electoral advantages, with the products of such creations being larger in electoral systems supporting multiple parties. The reality, of course, is that everything is endogenous with everything else in this phenomenon, which makes most theoretical specifications – including our own – but partial representations of reality emphasizing differences in the salience of causal processes.

[7] In Ordeshook and Shvetsova's (1994) analysis, the interactive model is supported only in single member district systems. In proportional representation systems, a simple additive model was superior.

[8] These traits of party systems are better explained by the interpretation of political parties as election machines serving the interests of candidates developed by Downs (1957), Schlesinger (1984; 1985) and Aldrich (1995). But while widely accepted, this approach – with the exception of Downs' work – remains remarkably American-centric. Indeed, it has proven more effective in retrospectively describing the historic, path-dependent evolution of American parties (Hoadley 1980) than developing a priori theoretical propositions about distributions of party positions under varying environmental

are other issues associated with measurement that also could well be noted.[9] And perhaps most importantly, no one has provided a good theoretical account – whatever the functional form of the relationships examined – for *why* number of parties increases at a slower rate than district magnitude. These are important issues, but here we wish to focus on two related key issues that concern the core of the district magnitude and, especially, strategic voting interpretations of party system density.

The first and most obvious issue concerns the very strong assumptions about the capacities of individual voters (or elites) to engage in strategic voting (or entering into campaigns, endorsing, or donating). Cox (1997, 79) appropriately noted that the model would fail if voters are not short-term instrumentally rational, if there is a lack of information about voter preferences and vote intentions, if voters believe that a given candidate is certain to win, or if there are voters who care intensely about their first choice, but are indifferent toward other candidates. A significant body of work, of course, finds little support for either strategic entrance into candidacy on the part of political elites (Born 1986) or sophisticated voting on the part of either elites (Hertzberg and Wilson 1988; Krehbiel and Rivers 1990) or citizens (Converse 1964;

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conditions. A fully integrated model of party systems should generate such propositions, and it should do so within the same theoretical framework used to account for number of parties. Good examples of both a less American-centric orientation and a stronger theoretical foundation – one we believe to be broadly consistent with organization ecology's analysis of organizational niches (Baum and Singh 1994; Carroll 1985; Boone, van Witteloostuijn, and Carroll 2002; Gray and Lowery 1996) – are provided by Meguid (2005) and Tavits (2008).

[9] Empirical tests of the consensus model consider only an extremely limited range of potentially politicized sources of cleavage – usually the number of ethnic or religious groups – in interaction with district magnitude. This measure misses, of course, many other sources of cleavage. More problematic still in light of the theory, the interactive measure essentially assumes that all such cleavages are deterministically and mechanically translated into politically meaningful issues. In the end, the gap between the core theory and empirical measurement is significant. A far better reflection of the theory – and one that is agnostic about the number or source of potentially exploitable issues and/or social cleavages within a society – is the hypothesis that the results of regressing number of parties on the log of district magnitude should be heteroskedastic with respect to ethnic diversity or other measures of potential cleavages. That is, not all political systems have as many or as few parties as might be predicted from electoral institutions alone. Errors in prediction should increase as district magnitude becomes larger and more potential cleavages *might* be expressed as politicized cleavages and/or issues. But also see our discussion of the relationship between social cleavages and issues in the final note in this paper, where we suggest that the later may matter more when district magnitude is high in a completely different manner than simple interaction.

Delli Carpini and Keeter 1996; Macdonald, Rabinowitz, and Listhaug 1998). Indeed, Luskin (2002, 282) summarized several decades of research on public opinion when he noted that: "At long last, and despite some flickering dissent…, there now seems to be a near-consensus that by anything approaching elite standards most citizens think and know jaw-droppingly little about politics." [10] In short, a model founded on the capacities of citizens to engage in strategic voting represents a rather strong claim that demands strong proof that, to date at least, has not been provided.

It is hardly surprising, then, that *Making Votes Count* provides a thorough review of the evidence supporting strategic or sophisticated voting. Still, even with this defense, Cox rather severely limits the scope of his primary causal account of the M+1 rule.[11] Most importantly, he notes that "strategic voting ought to fade out when the district magnitude gets much above five" (Cox 1997, 100). Elsewhere, Cox (1997, 141) observes that "whatever it is that explains why so few lists appear in large magnitude districts operating under PR, it is not systematic downward pressure derived from the fear of wasting votes." Indeed, with application to only cases in which district magnitude is five or lower, Cox (1997, 203-224) suggests that his causal account of the M+1 rule applies to only 27 of the 54 national cases he analyzes in his cross-national test of the consensus model (Cox, 1997, 203-224).[12] And if elite behavior associated with Duverger's law sufficiently determines the two-party result

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[10] It is not surprising, then, that several prominent models of electoral behavior are far less dependent upon strong assumptions about the capacities of voters (see, for example, Erikson, MacKuen, and Stimson 2002; Rabinowitz and Macdonald 1989).

[11] He also limits the scope of the model to exclude new democracies where strategic voting and strategic entrance do not seem to apply. The problem, of course, is that many emerging democracies have too many candidates and parties given the M+1 rule. Cox (1997, 159) essentially adds an asterisk to such cases, allowing strategic voting not to apply in such cases because strategic voting does not seem to apply in such cases. Little effort is devoted to accounting for why such delays in enforcing the M+1 rule are so common or specifying the pace of party winnowing in such systems. One explanation that would be consistent with a focus on individual-level decision-making is that some learning on the part of voters and candidates is required for strategic winnowing to occur, an idea first suggested by Reed (1991). The problem, however, is that such learning implies that party systems develop only over time, an idea difficult to merge with notion that voters are natural odds makers.

[12] Average ML of the other cases, excluding the extreme cases of Israel and the Netherlands, is 13.86.

of systems with single-member districts, then strategic voting would only be expected to occur in seven of those cases: Mauritius and Ecuador, with a district magnitude of 3, El Salvador and Japan, with a district magnitude of 4, and Malta, Ireland, and the Dominican Republic, which have a district magnitude of 5.

Importantly, we do not yet wish to argue that this severe limit in the applicable scope of strategic voting in the consensus model is wrong, although it obviously merits considerable attention.[13] Rather, we wish only to point out here that use of strategic voting as a key part of the consensus model's theoretical interpretation of Duverger's (1994) mechanical effect is thereby limited in its range of application and yet nonetheless still vulnerable to challenges on the basis of relying on a very demanding model of individual behavior. Stronger evidence is needed for strategic voting and its range of application or lack thereof.

A <u>second</u> problem concerns the functional form of the core district magnitude variable routinely used in cross-national tests of the consensus model. The district magnitude term is included in the model in either a decimal or natural logged form suggesting that the relationship is curvilinear. Unfortunately, this specification is treated largely as a measurement convenience that remains virtually undefended theoretically in the literature on party system density. Indeed, there is no theory of logged units mentioned anywhere in this literature. The closest one finds of a theoretical argument is Ordeshook and Shvetsova's (1994, 106-107) summary of Sartori's (1986, 67, n. 15) observation[14] that "although we might predict that single

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[13] Despite widespread and sometimes rather almost joyful use of implausible assumptions, their scientific status has not gone without serious challenge (Moe 1979). As an example of a more natural progression of analysis, Tiebout's (1956) powerful theoretical model of voting with one's feet rested on clearly implausible assumptions about the rationality of individual voters (Lowery and Lyons 1989). Despite its analytic utility, it was subsequently replaced by the Schnieder, Teske, and Mintrom's (1995) far more plausible model based on rational decision-making by local elites.

[14] A close examination of Sartori's actual argument as cited by Cox in Sartori (1986, 67, n. 15), unfortunately, does not seem to have much to do with Cox's summary of it. Indeed, it seems to address an entirely different point. Thus, Sartori's argument seems to have something of a detached character,

member districts imply two-party systems, and that, say, 15-member districts might imply four or five parties, it is unreasonable to suppose that 120- or 150-member districts (Israel and the Netherlands) will generate 30 or 40 parties, ceteris paribus." We have no trouble with this observation per se. Any number of models of decision-making might suggest that the relationship between district magnitude and number of parties is characterized by declining marginal utility, although none of the several versions of the consensus model actually specify such a relationship, thereby leaving these cases, too, beyond its scope. Or worse, these exceptions are buried deep in the logged values, where their exceptional character is effectively hidden.

Even more importantly, the measurement convenience of relying on logged values leads researchers to miss an important opportunity to probe the limits of the strategic voting analysis underlying the consensus model. Consider Cox's (1997, 100) earlier noted claim that "strategic voting ought to fade out when the district magnitude gets much above five." If this is true, then we can identify valuable test implications associated with the nature of that curvilinearity. That is, the effects of strategic voting should be more binding at low values of district magnitude and become progressively less telling as district magnitude increases. If this is so, the relationship between district magnitude and number of parties should be convex, slopping upward as the capacities of citizens to engage in strategic voting are exhausted and number of parties is free to accelerate to its theoretical limit.

If we find no difference in the severity of the rate at which district magnitude determines number of parties, then this would indicate either that strategic voting is operative across the full range of district magnitude, which is implausible even to supporters of the consensus model, or that strategic voting poses no real threat to

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although Cox's summary captures well the flavor of how this literature deals with extreme cases.

smaller parties. More likely, we will – as suggested by Cox – find that strategic voting is important in some number of cases at lower levels of district magnitude, but indeed fades in importance as district magnitude increases. Identifying when and how fast such fading occurs will reveal the range of cases to which the strategic voting explanation applies, as well as those for which we must seek other explanations if we are to build a more comprehensive and thereby more satisfying account of the densities of systems of political parties. To do so, however, requires that we unpack the logged value of ML using a polynomial specification.

Such diagnostic unpacking would also be useful to assess what happens when strategic voting fades to unimportance. Does the number of political parties continue to rise to its theoretical limits governed only by the M+1 rule? This is unlikely to be true given the curvilinear relationship between district magnitude and number of parties implied by the logged functional form of the consensus model and Ordeshook and Shvetsova (1994, 107) earlier noted observation that "it is unreasonable to suppose that 120- or 150-member districts (Israel and the Netherlands) will generate 30 or 40 parties, ceteris paribus." To understand these extreme cases with large district magnitudes up to single national districts and, thus, district magnitudes of 120 (Israel) and 150 (the Netherlands), we will need to, as Cox (1997, 141) suggested, "look elsewhere: to economies of scale in advertising, raising funds, securing portfolios, supplying policy benefits, and so on." In short, the explanation of these cases is unlikely to be found in either strategic voting or district magnitude alone, but something else as yet not included in the consensus model.

This is a good point. But there remains a real question about when we must consider such alternative theoretical accounts. That is, with specifications relying on a logged functional form, conventional tests of the consensus model simply do not have the sensitivity needed to assess *when* such other variables might be important. It remains an open question, then, whether such issues become important *only* in the very extreme cases of single national districts or at much lower levels of district magnitude. The latter would highlight another limitation in the applicable scope of the consensus model, and would require us to develop a better model able to incorporate such cases in a more theoretically satisfying manner.

Reanalyzing the Cross-National Data

To explore these issues, we employ the simple version of the consensus model presented by Ordeshook and Shvetsova (1997, 11) – including district magnitude, ethnic heterogeneity, and their interaction – because it is a bit simpler than Cox's, yet produces quite similar results (Cox 1997, 221). However, we employ Cox's data – 54 national cases (circa 1985) – because they provide us many more observations. The dependent variables are the effective number of parties receiving votes (ENPV) and the effective number of parties receiving legislative seats (ENPS).[15] While we present analyses with both, they produced remarkably similar results. The key independent variable is district magnitude (ML), the number of legislators elected from the median legislator's district,[16] which we examine in nominal, natural log, and polynomial forms. The final independent variable in the specification is the effective number of ethnic groups (ENETH), which is included in interaction with district magnitude.[17]

We conduct our re-interrogation of Odeshook and Shvetsova's (1997, 11) model and Cox's data (1997, 221) in three steps. First, we estimate the model using data from all 54 cases using linear, logged, and polynomial specifications of the critical district magnitude (ML) variable. The purpose of this first test is simply to

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[15] ENPV=$1/\Sigma v^2_i$, where *vi* is party *i*'s vote share in the legislative election and ENPS=$1/\Sigma s^2_i$, where *si* is party *i*'s seat share in the legislature (Cox 1997, 311).

[16] This is the number of legislators elected from the district of the median legislator.

[17] ENETH=$1/\Sigma g^2_i$, where *gi* is the proportion of the population in ethnic group *i* (Cox 1997, 311).

show that a polynomial specification produces quite similar results to those reported for the logged measure of ML and that both are superior to a simple linear specification. Second, we then use the polynomial version of the model to examine subsets of the data in terms of the sizes of their district magnitudes. This will enable us to identify inflection points in the relationship that indicate when first the constraints of strategic voting on number of effective parties begins to fade away and subsequently when district magnitude itself fades away as a determinate of party density in favor of the other, unspecified kinds of variables noted by Cox (1997, 141). In the third set of analyses, we consider what our findings can say about the extreme cases of single national districts found in Israel (ML=120) and the Netherlands (ML=150). More specifically, we ask whether they are really so extreme.

Critically, we exclude several cases in the second set of analyses. First, we exclude Israel and the Netherlands not just because they are so extreme, but also so that they can provide in our third set of analyses an external and markedly more rigorous assessment of the generalizability of our findings generated from analyzing the nature of party density using cases with more typical values of ML. So, these two cases will return in our third set of analyses. Our decision to exclude three other cases – Ecuador, Brazil, and Belgium – will almost certainly be more controversial. But all three have extremely high numbers of parties receiving votes (PNPV): respectively, 3.93, 3.56, and 2.66 standard deviations above the mean when the next most extreme standard deviation value, for Switzerland, is only 1.42. Just as importantly, Brazil and Ecuador, with district magnitudes 30 and 3, respectively, fall at or near the ends of the distribution of ML, which ranges from 1 for countries with single member districts to 30, once we exclude Israel and the Netherlands.

As a consequence, they exercise disproportionate influence on our regression results for several subsets of the data. Indeed, their inclusion can generate some rather nonsensical results when we focus on smaller sets of data. For example, estimation of our core model for cases of district magnitude of 5 or smaller (model 1 in table 2) while including Ecuador transforms what is otherwise a strong convex relationship into a sharply concave one. More modestly, Brazil's inclusion at the end of the distribution somewhat weakens a strong concave relationship into one that is a bit weaker. Including Belgium, because it has a moderate ML value of 8 and thereby falls in the middle of distribution of district magnitude, has much less impact on the form of the relationships. But its inclusion does depress coefficients of determination to some degree. It seems likely, then, that there is unobserved heterogeneity in these cases that is simply not adequately captured in standard specifications of the consensus model. We have, therefore, opted to exclude them.

Critically, however, their exclusion neither advantages nor disadvantages the polynomial specification we rely on in contrast to the logged form of the model more commonly used. When the standard form of the consensus model is applied to the 27 cases with district magnitude below 6, those cases for which Cox (1997) suggests that strategic voting is likely to be important, by regressing the effective number of parties receiving votes (ENPV) on logged district magnitude (ML), the effective number of ethnic groups (ENETH), and their interaction, the estimate for logged ML is negative, none of the estimates produces a t-value greater than 0.55 and the coefficient of determination is only 0.089. In short, these extreme cases are as equally problematic for the standard logged model as for the polynomial results we present here. We will discuss in notes at appropriate points in the analysis, however, how the inclusion of the three extreme cases would influence our results and our interpretation of them.

Analysis 1: The Equivalence of Functional Forms

Our first analysis serves the housekeeping function of establishing the equivalence of the logged and polynomial versions of the consensus model using all 54 cases. Two sets of results are presented in table 1, one set for the effective number of parties receiving votes (ENPV) and the other for the effective number of parties receiving legislative seats (ENPS). Both produced, as will be true throughout our analyses, very similar results. In each set, three pairs of estimates are presented using, respectively, a linear, logged, or second-order polynomial specification of district magnitude (ML). The first of each pair is a simple additive specification of ML and the effective number of ethnic groups (ENETH), while the second of each pair includes their interaction (or interactions in the polynomial models).

Three conclusions can be drawn from these results. The least surprising is that, in terms of both explained variance and the size of the estimates, both the logged and polynomial specifications outperform the linear specifications. Clearly, the relationship between district magnitude and number of parties is strongly curvilinear across its full range, and this must be addressed in one manner or another.

Second, it is clear that the specifications including interactions perform much better in terms of explained variance than their additive counterparts. Still, it can be difficult to interpret the estimates of both the logged form of the interactive model and, especially, the polynomial specification given their – not unexpected – high collinearity. But examination of plots of predicted values from both the logged and polynomial interactive models indicate that effective number of parties rises with both district magnitude and the effective number of ethnic groups. Further, the effect of either is enhanced as the other increases in magnitude. The importance of district magnitude is evident in figure 1, which reports the second-order polynomial trends of the predicted values generated from both the interactive logged (column 4) and polynomial (column 6) models for the effective number of parties receiving votes and the interactive logged (column 10) and polynomial (column 12) models of the effective number of parties receiving seats. The paths of the predicted values for both dependent variables for both models are so similar that we do not label them.

So, which specification of the full interaction model is to be preferred: the logged or the polynomial? It is, frankly, difficult to choose between them at this point. The explained variance in the competing pairs of models – for example, models 3 and 5 for the additive ENPV specifications and models 4 and 6 for the interactive specification – are quite similar, although a bit higher for the polynomial version of each pair. And they generate similar predicted values. Indeed, as reflected in the plots reported in figures 2 and 3, the simple correlation of the predicted values from the interactive logged (column 4) and polynomial models (column 6) of ENPV reported in table 1 is 0.945. The corresponding correlation coefficient for ENPS from the predicted values generated by the two sets of estimates reported in columns 10 and 12 of table 1 is 0.937. Thus, the logged and polynomial interactive models are functionally equivalent. Still, the latter has one important advantage. We can use it to unfold the variation lost when district magnitude (ML) is logged and then use that variation to examine additional test implications of the strategic voting hypothesis as well as other hypotheses about the density of party systems.

Analysis 2: Unpacking the Logged Model

We now turn our attention to the 49 cases excluding the two countries with extreme values of district magnitude (the single national districts of Israel and the Netherlands) and the three countries with extremely large numbers of parties (Belgium, Ecuador, and Brazil). These 49 cases were initially used to estimate models of both ENPV and ENPS using the interactive polynomial specification employed in columns 6 and 12 in table 1 for all 54 cases (results not shown). The relationships between the predicted values from these two regressions and district magnitude are reported in figure 4, again using a simple second-order polynomial model.[18] In effect, the two response functions highlight the part of the explained variance from the basic model associated with district magnitude while the residuals associated with the cases around the two lines are the unique effects of the effective number of ethnic groups (ENETH).[19] Clearly, district magnitude (ML) dominates the results and has a strong concave relationship with the two dependent variables. While we are interested primarily in examining the role of district magnitude and strategic voting that might be associated with it, we still need to account for the unique effects of ENETH as reflected by the distribution of the cases around the two lines in figure 4. Accordingly, all of the predicted values generated from the fully specified interactive polynomial model in table 2 for subsets of our 49 remaining cases used in subsequent analyses were generated using the estimates from table 2 after setting ENETH at its mean of 1.55 for all cases. In short, we will be examining only the effect of district magnitude on ENPV and ENPS.

The estimates reported in table 2 were generated using the full model, but for successively greater numbers of cases including higher value of district magnitude (ML): the 26 countries with ML values from 1 to 5 that are expected to be the most likely places to find evidence of strategic voting, the 41 countries with ML values from 1 to 12, the 45 nations with ML values up to 20, and the 49 countries with

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[18] Figure 4 is used for a quite specific purpose here: examining the relative contribution to the model of ENETH and ML. Indeed, the curvilinear functional form with predicted values *declining* after ML 20 or so is a function of using a second-order polynomial model. As will be seen later, a more complex functional form – and one better matching the data – is a sigmoid function in which the predicted values of PNPV and PNPS flatten at higher levels of ML.

[19] Thus, given the coefficients of determination reported in figure 4, 88.6 percent of the explained variation of ENPV in the model using 49 cases is due to ML and the remaining 11.4 percent due to ENETH, and 87.7 percent of the explained variation of ENPS in the model using 49 cases is due to ML and the remaining 12.3 percent due to ENETH.

district magnitudes up to 30.[20] It is clear from looking at the table, however, that a simple interpretation of the results is very difficult. The signs of the estimates, for example, flip from model to model, something that, while it may be momentarily disconcerting, is central to our analysis. Even so, interpreting the effects of ML or ENETH on party density within any single set of estimates is difficult given the sheer number of interactions. It is not at all obvious how sometimes positively and negatively signed estimates combine to define together how a single variable is related to numbers of parties. Just as confusing, the models are, not surprisingly given the use of interactions, extremely collinear. Thus, the stars attached to the coefficients merely note that an estimate is larger than its standard error.

Yet, even with all of these surface limitations, the results in table 2 can tell us quite a bit about the density of party systems. One clue that this is so lies in the coefficients of determination of the models, which are as large or larger than those for the models reported in table 1. Something is clearly going on even with all the non-discernible estimates. It remains for us to extract the message. We do so graphically. Figures 5 and 6 report, respectively, the predicted values of PNPV and PNPS using the two sets of four estimates reported in table 2, but, as noted earlier, after setting the effective number of ethnic groups at its mean, thereby allowing us to highlight the key relationships between district magnitude (ML) and number of parties.

The short lines on the left-hand side of figures 5 and 6 report the relationship between district magnitude and the effective number of parties (ENPV and ENPS,

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[20] We examined a very large number of subsets in values of ML, including looking at successive sets of cases with increases in ML values of 5. All of these analyses produced essentially the same results as those reported here. We opted for this fourfold classification both because this seemed to follow the natural breaks in the clustering of cases along the distribution of district magnitude and because the four groups collectively highlight the major changes in the curvilinear relationship between district magnitude and number of parties in as parsimonious a manner as possible.

respectively) generated from the 26 cases with ML values from 1 to 5.[21] This is the range of ML in which strategic voting is most likely to be telling. Yet, both functions slope upward at an increasing rate or are convex, albeit more so for the voting model (ENPV) than for the seats model (ENPS). We argued earlier that such a convex pattern would indicate that the impact of strategic voting is fading or becoming less constraining as district magnitude increases. The pair of convex relationships suggest that the impact of strategic voting, while still at least to some extent constraining newer parties from taking full advantage of the opportunities provided by greater district magnitude, begins to fade surprisingly quickly as ML increases, even within the ML frontier of 5 suggested by Cox (1997, 100).[22]

This interpretation is confirmed by the second set of plots on the left-hand side of figures 5 and 6 generated by adding the 15 cases with ML values from 6 to 12 to models 2 and 6 in table 2.[23] Both plots of predicted values are clearly convex, again suggesting that the import of strategic voting diminishes rather quickly. This is especially so after ML values of 5, as suggested by Cox, when both lines begin to rise sharply as more parties begin receiving votes and seats in a nearly linear fashion as district magnitude rises.[24] Thus, these first two sets of results do not suggest that strategic voting is unimportant, only that its impact on party system density is limited in scope. Its constraint on party numbers diminishes even at very low values of ML, and then essentially disappears after district magnitude values of 5. This both

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[21] Fully 20 of these cases have an ML value of 1 with Mauritius at 3, El Salvador and Japan at 4, and Malta, the Dominican Republic, and Ireland with ML values of 5.

[22] Of our three excluded cases, including Ecuador (ML=3) has the most profound effect on our results. As noted earlier, these convex relationships become strongly concave, a result that does not correspond to anyone's theory of party system density since it suggests that strategic voting and/or district magnitude produce many more parties at an ML value of 3 than at ML values of 4 and 5.

[23] Greece, Spain, Iceland, Colombia, Peru, Argentina, Honduras, Costa Rica, Norway, Venezuela, Uruguay, Denmark, Sweden, Cyprus, and Switzerland.

[24] Including Belgium, another of our excluded cases, with its district magnitude value of 8, modestly reduces the convex character of these functions, basically suggesting that the impact of strategic voting fades even sooner. But the impact of including this excluded case has much less impact on our results than the other two cases at the extremes of the ML distribution.

confirms Cox's (1997, 100) intuition, but also points to the restrictive scope of strategic voting as an account of party system density. For fully half of the cases in the data set, those with ML values greater than 5, strategic voting plays no role. And if elite behavior, ala Duverger (1954), fully accounts for the two-party solution found in cases of ML=1, then strategic voting matters in only six of our cases.

The third response functions in the left-hand side of figures 5 and 6 were generated from models 3 and 6 in table 2 for all cases with district magnitude (ML) values of up to 20. This adds only four more cases to the model, and the highest ML value of these is Bolivia's 17.5.[25] Still, these four cases have a significant impact on the form of the relationship between district magnitude and number of effective parties receiving votes and legislative seats. In effect, the relationships between district magnitude (ML) and number of parties (ENPV and ENPS) become linear. After ML values of 5 or so, district magnitude dominates the results. The number of parties receiving votes and seats rises at a sustained and consistent rate as the values of district magnitude increase. This, then, is the world – the range of ML values – in which the purely mechanical effect of the generalized Duverger's rule of 2+LogM (Lijphart 1990; Taagepera and Shugart 1989) most clearly applies.

The story, however, does not end there, which suggests that the generalized Duverger's rule and strategic voting provide an incomplete account of party density. As seen in the longest plots of predicted values in figures 5 and 6, generated from models 4 and 8 in table 2, the relationship between ML and number of effective parties switches to concave for higher values of ML or when the four cases[26] with ML values from 20 to 30 are included in the estimating models. Indeed, closer examination of several other response functions not included here suggests that the

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[25] The other cases are Liechtenstein, Portugal, and Finland.

[26] These are Luxemburg, the Czech Republic, Italy, and Austria.

relationship becomes essentially flat for the last eight cases included in the estimating models in table 2, those with district magnitude values of 15 or higher.[27] This is a world in which neither strategic voting nor district magnitude seems to matter. More to the point, this world is essentially invisible when the logged form of artificially flattens these cases into the upper end of the nearly linear distribution observed for our third set of response functions. As Cox (1997, 141) noted, "something else" must be going on when district magnitude rises to higher values of ML > 15 or so. That "something else" should be part of a general model of party system density. This is especially so since Cox's statement, as well as similar comments by Ordeshook and Shvetsova (1994, 106-107), seem to address only the really extreme cases of single national districts. Our results suggest that the "something else" begins to significantly constrain party system density at much lower levels of district magnitude.[28]

We will speculate later on what such a more general model might include to address these cases. But we can get a good hint about its nature now by looking at the overall shape of several of the distributions reported in figures 5 and 6. We do so somewhat arbitrarily, if instructively, by combining the predicted values of ENPV and ENPS from the three more inclusive sets of response functions in figures 5 and 6 for district magnitudes running from 1 to 12, 1 to 20, and 1 to 30. We start with the predictions for ML 1 to 12, but substitute these with those from the ML 1 to 20 estimates starting at the point at which the ML 1-12 response function crosses that for

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[27] Including Brazil with its district magnitude of 30 raises the end of the distribution a bit higher, but does not have a significant impact on the general impression of linearity after ML values of 15 or so.

[28] The response functions outlined in figures 5 and 6 highlight the impact of adding even a few cases to the end of a distribution in a second-order polynomial specification. In effect, we are using a second-order specification to map these effects without arguing that any one of the several response functions alone provide an accurate or complete account of the distribution of the data given the limits of this simplest of polynomial specifications. That is, the response functions reported in these figures are best viewed as diagnostic tools, and not as a full specification of the relationship between ML and the dependent variables. But based on examining multiple subsets of data, including several fully within the full range of the data, we believe that the response functions presented in figure 7 – the sigmoid functions – provide the best account of these data.

ML 1-20 (ML=9). Similarly, we then substitute the predictions of the ML 1 to 30 response function starting at the point at which the ML 1-20 response function crosses that for ML 1-20 (ML=12). Thus, we always select the lower predicted values from the response functions because these were generated from data series in which the cases in question were closer to the mid-point of the values of ML. The resulting combined predictions of ENPV and ENPS are reported in figure 7. They outline a sigmoid distribution that is initially flat, then convex, rising through a period of linear growth, then concave as the growth of party density slows, and finally flat as there is no further increase in number of parties as district magnitude increases.

Such sigmoid functions are the very hallmark of the growth of populations of many different kinds of organizations considered in the literature on population or organizational ecology, which suggests that the theory of party system density may best be viewed as one case explainable by a more general theory of the evolution of populations of organizations of all kinds. Organizational ecology is a sociological theory that examines the evolution of populations of organizations through processes of selection (Hannan and Freeman 1977). The approach, as noted by Baum and Oliver (1996: 1378-1379), emphasizes "how competition for scarce common resources and mutualism based on complementary functional differences" affects organizational founding and failure rates. That is, the ecological approach "examines the effects of competition and environmental selection on population dynamics."

To date, the model has been used to understand the dynamics of many quite different populations of organizations, including, among many others, newspapers (Carroll and Hannan 1989; Boone, Carroll, and van Witteloostuijn 2002), labor unions (Hannan and Freeman 1988), audit firms (Bröcheler, Maijoor, and van Witteloostuijn 2004), and, in the political domain, lobby organizations (Lowery and Gray 1995) and national laws (van Witteloostuijn and de Jong 2009). Although organizational ecology is a paradigm that hosts many different theories, it is fair to say that the theory of density dependence is at the heart of this perspective. This theory predicts a sigmoid-shaped evolution of organizational density by emphasizing two selection forces. The first force is legitimation. At low density, an extra organization will contribute to further establishing the legitimacy of the organizational form. This implies positive density dependence. That is, higher density will increase entry and depress exit. The second force is competition. At higher levels of density, there are simply too many organizations competing for the same set(s) of scarce resources needed for their survival. Then, density dependence will become negative, inhibiting organization births and/or increasing the death rate of those already in the population.

Combining both forces generates the sigmoid function of density evolution. In organizational ecology terminology, the peak of this sigmoid curve reflects the population's carrying capacity. Following bio-ecology, carrying capacity is defined as the maximum number (density) of organizations that can viably operate in the population. In organizational ecology, a theory of what determines a population's carrying capacity is missing. Generally, in empirical studies, carrying capacity is controlled for by adding control variables in the analyses that capture the demand for the products or services of the population's organizations. Examples of such control variables are a country's gross domestic product or the size of the human population, or dummies for shocks such as periods of war or waves of key regulation.

From an organizational ecology perspective, the slow growth in number of viable political parties at low values of ML in figure 7 results from a problem of "legitimacy," a failure on the part of organizations to find acceptance even when the environment (values of ML greater than 1) might allow them to be established. In our case, strategic voting constitutes a problem of legitimacy as voters rush to support winners *even though* more than two parties might survive.[29] The fear of wasting votes thereby either implies that party newcomers fail to obtain a viable foothold among their potential electorate, which might even deny them the opportunity to enter the party system altogether. As problems of legitimacy fade or as capacities for citizens to engage in strategic voting become limited, number of parties in relation to district magnitude increase in an unfettered fashion according to the M+1 rule. Finally, as political parties exhaust environmental resources needed to survive, the population of political parties enters a period of negative "density dependence" in which the carrying capacity of the system for additional parties is reached. Negative density dependence implies such severe crowding of political parties within the political system that competition increases at an accelerating rate with incremental party entry. At the limit, entrance of any new party must come at the expense (death) of an old party. What remains for our model of party system density to be encompassed within the larger research program on organizational ecology is some specification of the environmental resources than impose density dependence, the "something other" noted by Cox (1997, 141), a critical issue we return to in the conclusion. But clearly, the need to specify what that something other might be is all too neatly avoided by too ready recourse to the LogM formulation of the consensus model.

Analysis 3: Extension to Extreme Cases

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[29] In early versions of organization ecology, legitimacy referred to the "taken-for-grantedness" of the form of organization under investigation. The theoretical argument concerning legitimation was that the environment (customers, regulators, lenders, et cetera) have to "learn" that the new organizational form is the "normal" vehicle to provide the organizational services related to that form. Our interpretation suggests a somewhat different kind of legitimation. That is, the strategic voting hypothesis suggests that at low levels of district magnitude, voters, because they fear wasting their votes, systematically underestimate the chances that voting for a smaller party or one predicted to be less successful than others will lead to successful election of representatives of their preferred party. This limitation fades as the costs of calculating who might win increase as district magnitude becomes larger. In a sense, voters (as customers) are more likely to take it for granted that voting for their preferred party may lead to that party achieving some level of representation in the next legislature.

One additional way in which we can test this organizational ecology interpretation of our findings is by using the predicted results from table 2 and then combined in figure 7 to consider how other cases not used to generate the predictions themselves fit into the expected distribution of the effective number of parties in relation to district magnitude. We have, of course, two such cases: the extreme cases of Israel and the Netherlands, both single national districts with district magnitudes of 120 and 150, respectively. The negative density dependence emerging at values of ML greater than 15 reported in figure 7 suggests that the number of effective parties receiving votes and seats should not increase even if district magnitude were to increase to even much greater values than the maximum value of 30 found in the data used in our second set of tests. Political systems, because of negative density dependence, reach their carrying capacity for political parties long before the realization of single national districts. Thus, figure 7 suggests that even with very extreme values of 120 and 150, the effective number of political parties found in the Netherlands and Israel – due to negative density dependence – should be about the same as those found in countries with ML values greater than 15: Portugal, Finland, Bolivia, Luxemburg, the Czech Republic, Italy, and Austria.

And as seen in figure 8, they are. District magnitude explains virtually none of the variance in ENPV and ENPS for cases of ML above 15. The ENPV and ENPS values (represented by squares and triangles in the figure, respectively) of Israel and Netherlands nestle quite comfortably about the mean values of these two variables for the other seven cases with much lower levels of district magnitude. All are at the limit of the carrying capacity of their political systems for political parties, implying crowding within the electoral space that effectively blocks further party density growth. Of course, such an observation is not new. But in the consensus model's emphasis on strategic voting and the generalized Duverger M+1 rule, the cases of Israel and the Netherlands remain anomalies that are whisked under the rug of LogM. From an organizational ecology perspective, Israel and the Netherlands highlight a vital test implication of a more general model of party system density.

Conclusion

By unpacking the LogM term of the consensus model, we have found not one system of party density, but four quite different worlds. There is Duverger's (1954) world of single-member districts where a district magnitude of 1 and elite calculations produce, unless regional of ethnic enclaves otherwise provide a viable niche for specialist parties, only two parties. Then there is the Cox's (1997) twilight world of low district magnitude in which party numbers are suppressed below what district magnitude alone might allow because of the continued influence of strategic voting, the impact of which nevertheless ebbs rather quickly. The third world – from ML 5 to ML 15 or so – is the exclusive province of the Lijphart's (1990) generalized M+1 rule in which only district magnitude matters. And finally, there is the as yet unexplored world of cases with ML greater than 15 in which district magnitude plays little role in determining party density. But while these worlds are very different, we have seen at least some hints that they might be effectively subsumed under a more general organizational ecology model of party system density in which different kinds of constraints operate under different environmental conditions.

While the alternative that we have sketched out here does not address all of the potential problems of the consensus model (see notes 7 and 8), we believe that further development of such a general organizational ecology model of party system density has much to recommend itself. First, it effectively accounts for – indeed, theoretically incorporates and empirically replicates – much of the existing work on party density.

Strategic voting and the M+1 rule still matter. But even with the addition of attention to ethnic cleavages, they do not on their own constitute a general model that is fully satisfactory. Second, our interpretation accounts – if not yet fully satisfactorily in theoretical terms – for anomalies that the consensus model either effectively ignores by recourse to the logged measurement of district magnitude and/or by too readily dismissing some extreme cases as exceptional when, on the face of it, they behave quite similarly to several other cases the model purports to account for. Especially important in this regard are the cases of single national districts and the high levels of density dependence observed in figure 7 at even more moderate levels of district magnitude. Finally, the broader model suggested here would bring party system density into the larger research program on organizational populations of all kinds.

However, political parties are, of course, not organizations "of all kinds." There is no single set of environmental constraints that apply to all organizations. Therefore, the organizational ecology framework must be adapted to the case of political parties, something that is equally true when the model has been applied to other specific types of organizations. The most important step in doing so with the case of party system density entails theoretically explaining the negative density dependence of party systems in cases of ML greater than 15, the unexplored territory noted above. While testing such an explanation is beyond the scope of this paper, organizational ecology theory would point us toward vital environmental resources that set limits on the carrying capacities of political systems for political parties.

Our intuition is that the critical resources are the issues that allow parties to meaningfully differentiate themselves. Parties attract voters with issues (Schlesinger 1984, 383). Downs (1957, 28) even asserted that "Parties formulate policies in order to win elections rather than win elections to formulate policies." But if, in contrast to the strategic voting interpretation of voters as clairvoyant calculators of electoral odds, they are poorly informed and generally inattentive to politics (Converse 1964; Delli Carpini and Keeter 1996; Macdonald, Rabinowitz, and Listhaug 1998; Luskin 2002), then it will be increasingly difficult for parties to attract their attention as numbers of parties increase. This will especially true for new parties, which explains why office seekers rely on established parties rather than acting as party entrepreneurs and striking out on their own. Established parties offer an established issue repertoire, a known brand, and/or a reputation that helps to overcome the problem of inattentive voters in a noisy environment (Aldrich 1995, 49-56).

Unfortunately, while the density of the issue set facing a nation may ebb and flow over time, there are very real limits to the issue agenda practically available to politicians ~~to use so as~~ to differentiate themselves in the eyes of inattentive voters. Indeed, while party entrepreneurs will look for new issues with which to attract voter attention and mobilize their support (Rabinowitz and Macdonald. 1989), a growing body of work ~~research~~ suggests that agenda space available for issues ~~in political systems~~ is itself limited (Baumgartner and Jones 1993; Jones and Baumgartner 2005) and that it is very difficult for newcomers to displace older parties even when new issues ~~might~~ arise (Rohrschneider 1993). Given ~~As a result of~~ the inattention of voters and the limited supply of issues available to parties to distinguish ~~differentiate~~ themselves, the density of the political party system itself will act as an increasingly powerful drag on further party formation even as the *potential* number of survivable parties increases. This provides us, fortunately, with ~~several~~ important test implications for further research. That is, for those cases beyond the ML 15 limit,[30]

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[30] Importantly, we do not see this process as operative at lower levels of ML. In such cases, there is more than enough issue space for party differentiation and strategic voting, implying that the M+1 rule sets the carrying capacity of party systems. ~~This represents what for some will be perhaps a too subtle distinction between issues and the role ethnic cleavages play in the consensus model. But issues and~~

we should see that existing parties die at higher rates – fail to secure votes or seats – as the size of the available issue agenda contracts. Further, we should see new parties form more readily in these cases when the issue agenda expands and party entrepreneurs take advantage of their thereby enhanced capacity to differentiate themselves before inattentive voters. We will test both hypotheses in further research.

~~cleavages are not the same thing. We view cleavages as providing niche space for specialist parties at all levels of ML, including countries with single member districts. In contrast, the issue hypothesis noted here only becomes telling when the number of parties begins to exceed the number of plausibly different issue profiles available to them. Clearly, however, cleavages may act as a potential multiplier for issues per se, which are more generally limited by the size of the available issue agenda.~~

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Table 1: OLS Tests of Three Modes of Specifying Party Vote Density Functions, 54 Countries (circa 1985)

	Dependent Variables											
Independent	ENPV: Effective Number of Political Parties Receiving Votes						ENPS: Effective Number of Political Parties Receiving Seats					
Variables	Linear		Log		Polynomial		Linear		Log		Polynomial	
ML	0.012 * 1.340	-0.079 -1.990	--	--	0.090 *** 2.750	-0.030 -0.380	0.015 ** 1.930	-0.089 *** -2.880	--	--	1.030 *** 4.050	-0.037 -0.640
ENETH	0.543 * 1.640	-0.026 -0.070	0.552 ** 1.770	-0.025 -0.060	0.524 * 1.660	-0.007 -0.020	0.293 1.070	-0.359 -1.140	0.302 1.240	-3.090 -0.950	0.272 1.100	-0.355 -1.080
ML*ENETH	--	0.074 ** 2.360	--	--	--	0.083 ** 1.760	--	0.085 *** 3.440	--	--	--	0.100 *** 2.810
Log(ML)	--	--	0.459 *** 2.860	-0.190 -0.500	--	--	--	--	0.532 *** 4.240	-0.155 -0.550	--	--
Log(ML)* ENETH	--	--	--	0.438 ** 1.900	--	--	--	--	--	0.464 *** 2.650	--	--
ML-SQ	--	--	--	--	-0.057 *** -2.470	0.043 0.060	--	--	--	--	-0.066 *** -3.610	0.058 1.070
ML-SQ * ENETH	--	--	--	--	--	-0.074 -1.230	--	--	--	--	--	-0.092 ** -2.040
Constant	2.537	3.250	1.971	2.842	2.070	2.847	2.297	3.115	1.649	2.572	1.764	2.673
R-Sq	0.074	0.167	0.174	0.230	0.175	0.225	0.081	0.257	0.271	0.361	0.271	0.375

The values under coefficients are t-values; *=p<0.10; **=p<0.05; **=p<0.01, one-tailed tests. 'Data are from Cox (997: 309-311).

Table 1: OLS Tests of Three Modes of Specifying Party Vote Density Functions, 54 Countries (circa 1985)

	Dependent Variables											
Independent	ENPV: Effective Number of Political Parties Receiving Votes						ENPS: Effective Number of Political Parties Receiving Seats					
Variables	Linear		Log		Polynomial		Linear		Log		Polynomial	
ML	0.012 *	-0.079	--	--	0.090 ***	-0.030	0.015 **	-0.089 ***	--	--	1.030 ***	-0.037
	1.340	-1.990			2.750	-0.380	1.930	-2.880			4.050	-0.640
ENETH	0.543 *	-0.026	0.552 **	-0.025	0.524 *	-0.007	0.293	-0.359	0.302	-3.090	0.272	-0.355
	1.640	-0.070	1.770	-0.060	1.660	-0.020	1.070	-1.140	1.240	-0.950	1.100	-1.080
ML*ENETH	--	0.074 **	--	--	--	0.083 **	--	0.085 ***	--	--	--	0.100 ***
		2.360				1.760		3.440				2.810
Log(ML)	--	--	0.459 ***	-0.190	--	--	--	--	0.532 ***	-0.155	--	--
			2.860	-0.500					4.240	-0.550		
Log(ML)* ENETH	--	--	--	0.438 **	--	--	--	--	--	0.464 ***	--	--
				1.900						2.650		
ML-SQ	--	--	--	--	-0.057 ***	0.043	--	--	--	--	-0.066 ***	0.058
					-2.470	0.060					-3.610	1.070
ML-SQ * ENETH	--	--	--	--	--	-0.074	--	--	--	--	--	-0.092 **
						-1.230						-2.040
Constant	2.537	3.250	1.971	2.842	2.070	2.847	2.297	3.115	1.649	2.572	1.764	2.673
R-Sq	0.074	0.167	0.174	0.230	0.175	0.225	0.081	0.257	0.271	0.361	0.271	0.375

The values under coefficients are t-values; *=p<0.10; **=p<0.05; **=p<0.01, one-tailed tests. 'Data are from Cox (997: 309-311).

Table 2: OLS Tests of Density Dependence from Model 6 and 12 for Values of District Magnitude, Table 1

	Dependent Variables							
Independent	ENPV: Effective Number of Political Parties Receiving Votes				ENPS: Effective Number of Political Parties Receiving Seats			
Variables	ML 1-5	ML 1-12	ML 1-20	ML 1-30	ML 1-5	ML 1-12	ML 1-20	ML 1-30
ML	3.383	0.488 *	0.018	0.144	0.015	0.295	0.061	0.161 *
	0.880	1.090	0.080	1.000	0.010	0.770	0.310	1.230
ML-SQ	-0.603	-0.041 *	0.003	-0.006	-0.010	-0.020	0.001	-0.007 *
	-0.880	-1.000	0.200	-0.920	-0.020	-0.560	0.090	-1.110
ENETH	1.822	0.082	-0.320 *	-0.266	-0.376	-0.156	-0.405 *	-0.381 *
	0.880	0.210	-1.000	-0.890	-0.250	-0.470	-1.450	-1.410
ML*ENETH	-2.542	-0.378 *	0.032	-0.001	-0.019	-0.233	0.022	0.007
	-1.030	-1.300	0.250	-0.010	-0.010	-0.940	0.200	0.080
ML-SQ * ENETH	0.456	0.038 *	0.000	0.002	0.019	0.024 *	0.001	0.002
	1.030	1.430	-0.050	0.340	0.060	1.050	0.080	0.360
Constant	0.338	2.649	3.106	2.903	2.645	2.368	2.581	2.434
R-Sq	0.132	0.351	0.321	0.305	0.252	0.504	0.482	0.439
N	26	41	45	49	26	41	45	49

The values under coefficients are t-values; *=estimate larger than its standard error.

Figure 1: Predicted Estimates of Effective Number of Parties Receiving Votes (ENPV) and Seats (ENPS) from interactive Logged (models 4 & 10) and Polynomial (models 6 & 12) Specifications by ML, Table 1

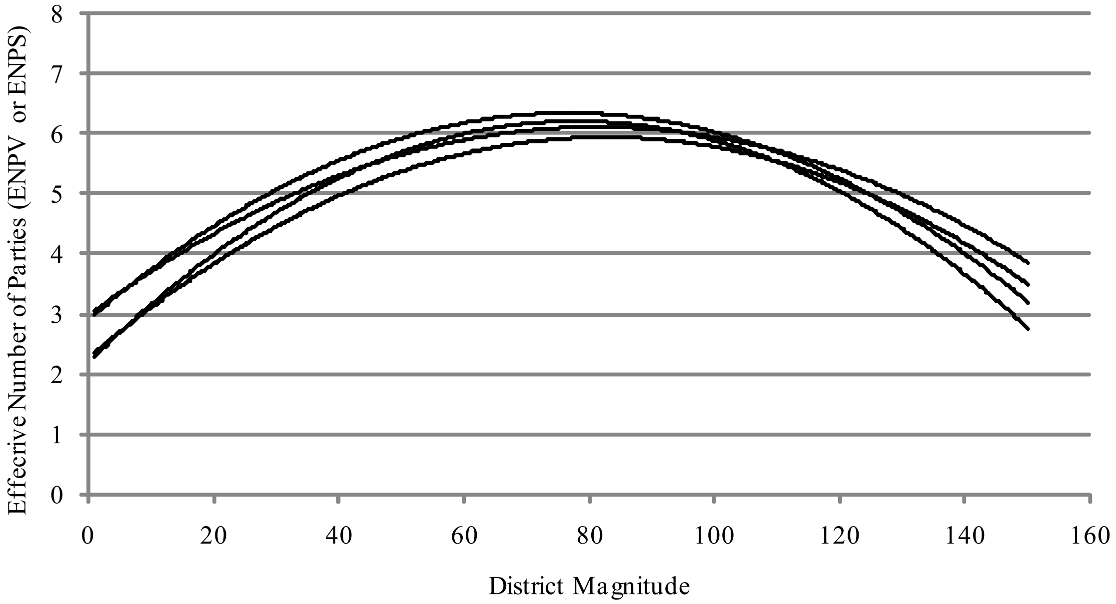

Figure 2: Predicted Values Effective Number of Parties Receiving Votes (ENPV) from Models 4 and 6, Table 1

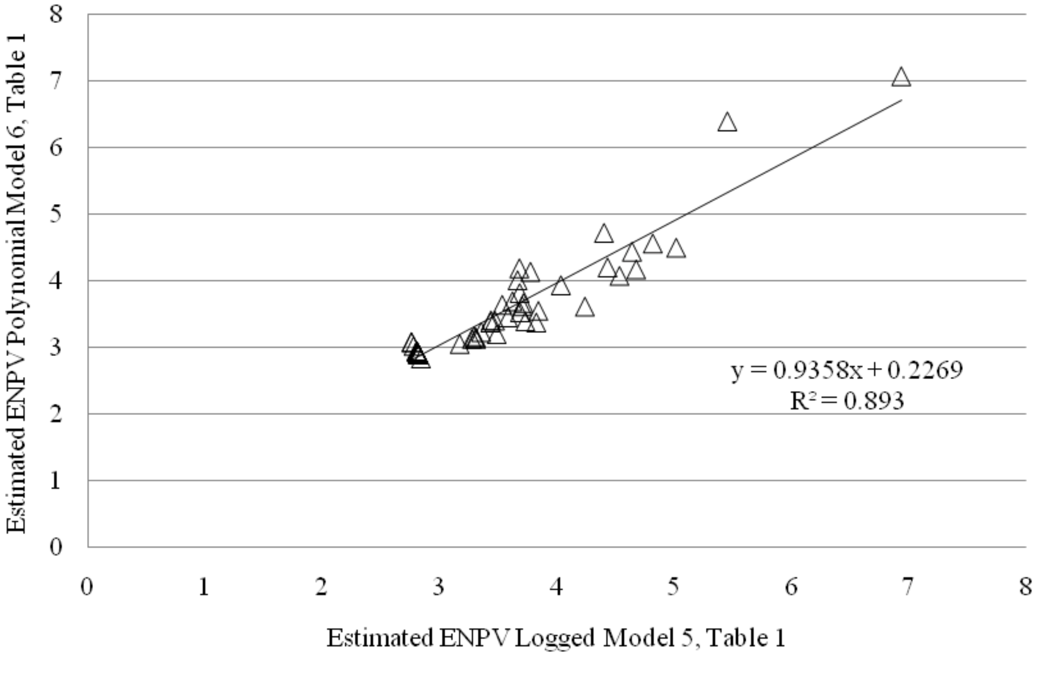

Figure 3: Predicted Values Effective Number of Parties Receiving Seats (ENPS) from Models 10 and 12, Table 1

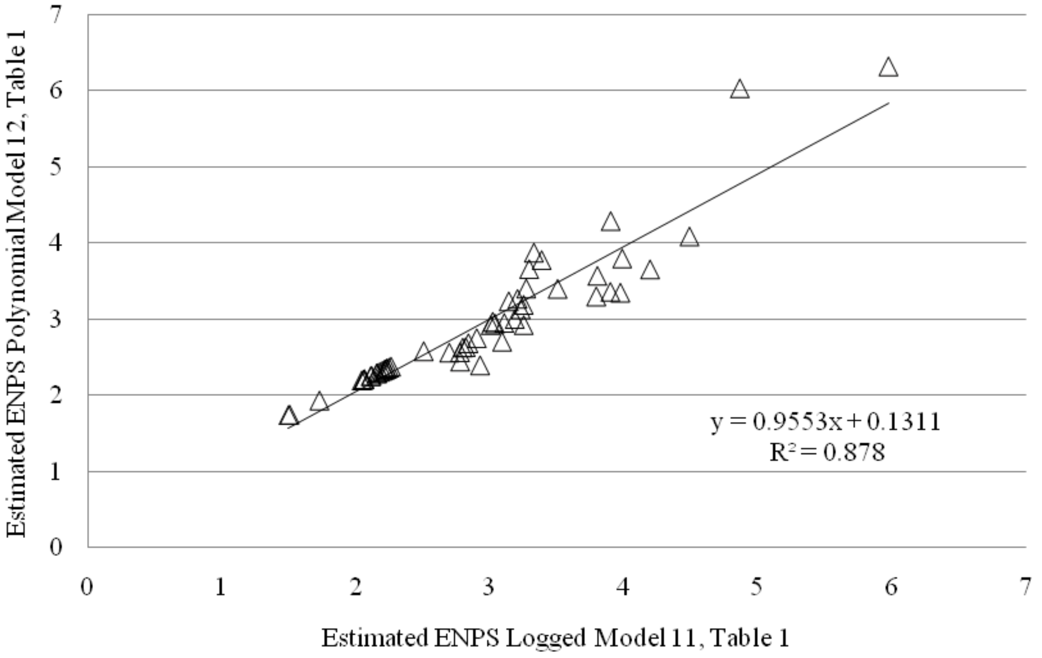

Figure 4: Predicted Values of ENPS and ENPV for 49 Cases

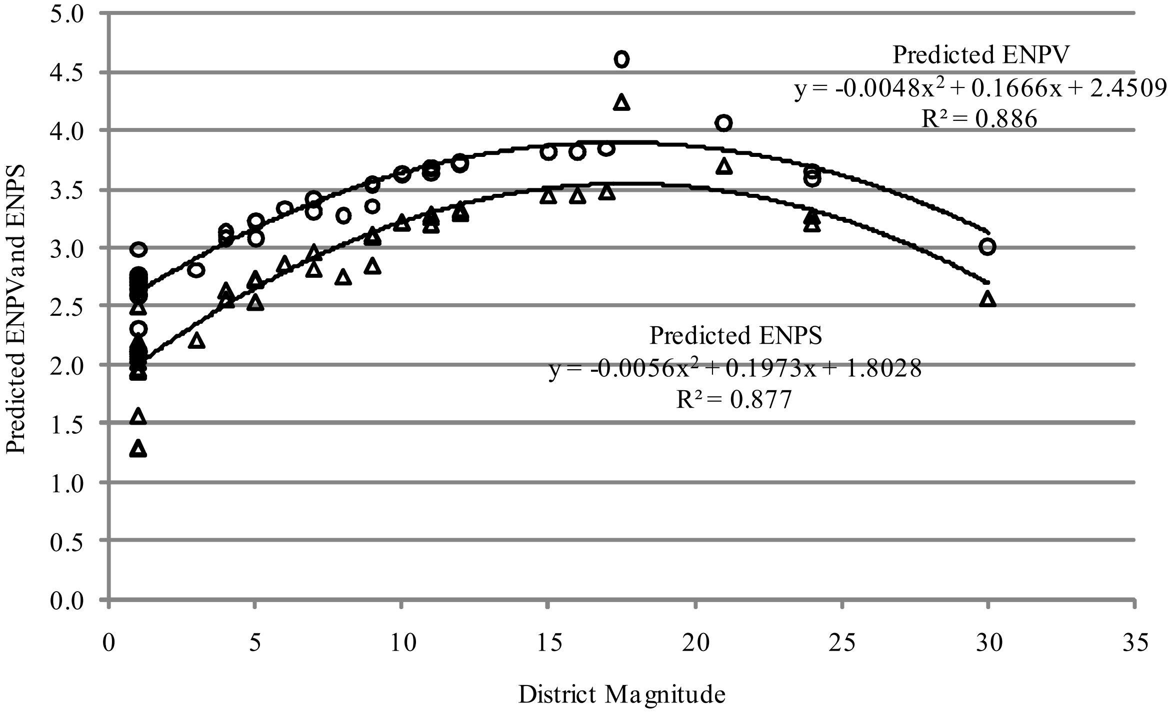

Figure 5: Predicted Relationship between Number of Parties Receiving Votes (ENPV) and District Magnitude (ML) for ML 1-5, 1-12, 1-20, and 1-30

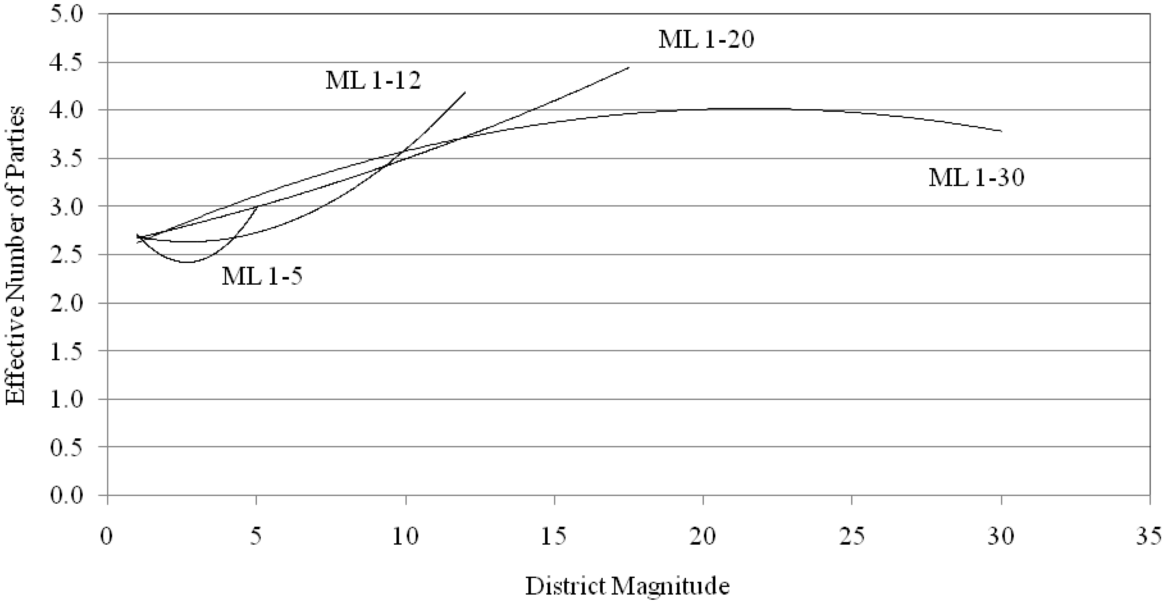

Figure 6: Predicted Relationship between Number of Parties Receiving Seats (ENPS) and District Magnitude (ML) for ML 1-5, 1-12, 1-20, and 1-30

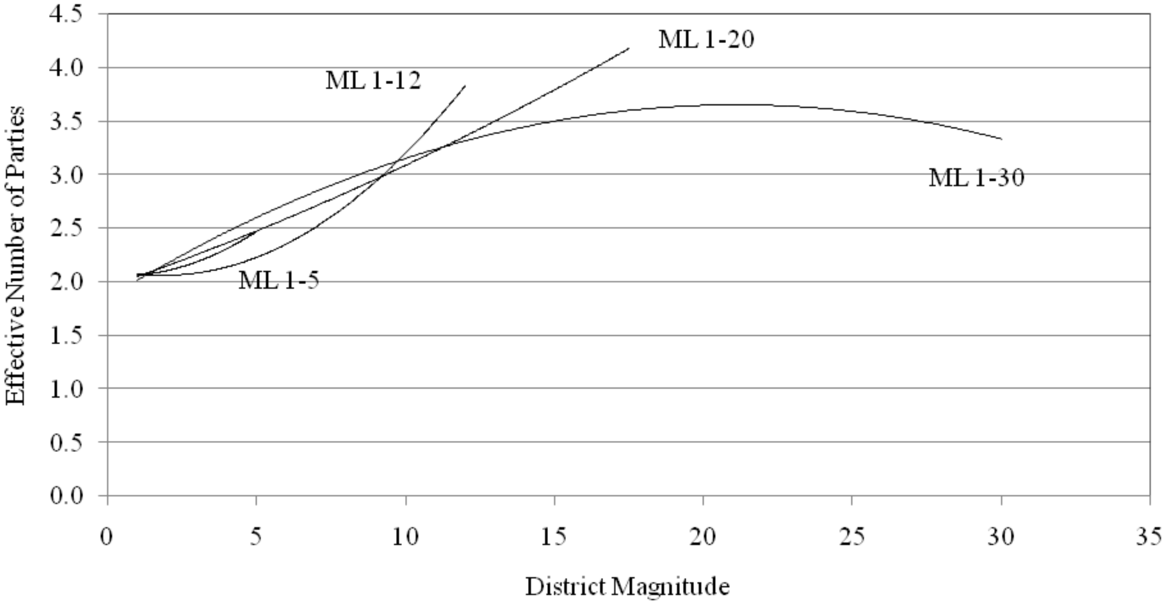

Figure 7: Combining the ML 1-12, 1-20, and 1-30 Predictions from Figures 5 and 6 for ENPV and ENPS by District Magnitude

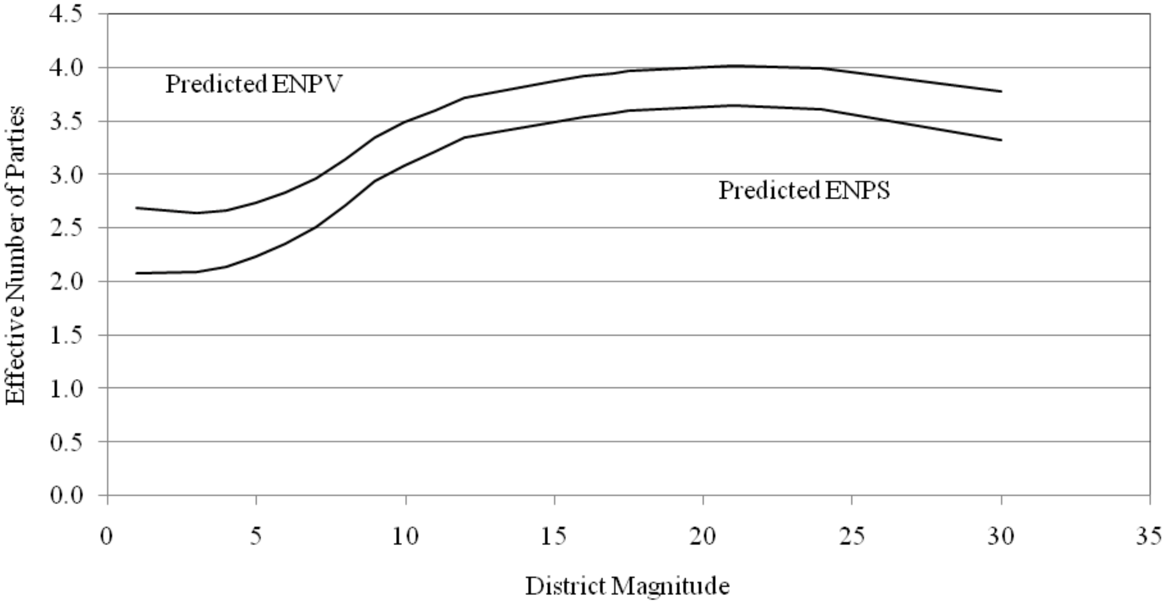

Figure 8: Relationship Between Effective Number of Parties Receiving Votes (ENPV) and Seats (ENPS) and District Magnitude for ML > 15