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Multimember Districts' Effect on Collaboration between U.S. State Legislators

In this article, I demonstrate that multimember districts form a basis for collaboration between two legislators. In order to maximize the limited incumbency advantages they possess, legislators from multimember districts form coalitions in an effort to generate greater credit-claiming opportunities and policy benefits for their district. In order to test this conception, I utilize a natural experiment and an opportunity to observe institutional change in North Carolina's elimination of multimember districts during the 2000–2002 redistricting cycle. Coupled with cross-sectional analysis of several states that use both single-member and multimember districts, empirical evidence strongly corroborates my conception of multimember districts as a basis for collaboration between representatives.

American legislatures are more than a collection of individual agents calculating the costs and benefits legislation once implemented. They are social constructions inhabited by social beings that have complicated influences on one another. In other words, a legislature is a social network of rational actors making decisions in an interdependent system of relationships. Legislators influence and are influenced by their relationships with one another. Party (Sarbaugh-Thompson et al. 2006), geographic distance (Caldeira and Patterson 1987, 1988; Clark, Caldeira, and Patterson 1993), and gender (Bratton and Rouse 2011; Desmarais, Cranmer, and Fowler 2009) all influence these relationships, and these relationships in turn influence legislative outcomes (Arnold, Deen, and Patterson 2000; Fowler 2006a; Kirkland 2011; Peoples 2008). Qualitative interview evidence provides strong support for the notion that legislators take cues and signals from one another about which legislation to support (Kingdon 1973, 1989; Ray 1982; Songer et al. 1986; Sullivan et al. 1996).

The evidence that relationships play an important role in legislating is strong. What is missing from this literature is an understanding of how the institutions of a legislature influence the formation and maintenance

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of legislative relationships. The structure-induced equilibrium school of thought (Shepsle 1979; Shepsle and Weingast 1994) tells us that institutional arrangements help a chamber avoid suboptimal outcomes by constraining behaviors. However, most of the work in this tradition has focused on how institutions influence choices over bill outcomes and committee behavior. If institutions in a legislature can influence choices by legislators, then these institutions can also affect choices over collaborative relationships. For example, multimember districts force legislators to share geographic constituencies, which should alter their incentives for collaboration and provide natural allies for use in the securing of policy benefits.

In this research, I take advantage of a unique opportunity to study institutional change in a legislature. Using cosponsorship data as an indicator of a collaborative relationship between two legislators, I study the transition in the North Carolina legislature from a multimember district system to a single-member system in 2002. I couple this with cross-sectional analyses of cosponsorship networks in the four states that use some combination of single-member and multimember districts (Maryland, New Hampshire, Vermont, and West Virginia). Results support my theory indicating that multimember systems generate or strengthen relationships between actors with shared constituencies.

Institutional Incentives for Collaborative Relationships

To understand how multimember districts might shape legislative behaviors, I begin by assuming that legislative policy preferences are multidimensional and are driven by a desire to satisfy constituents' preferences for government action (Crespin and Rohde 2010; Hixon and Marshall 2007; Talbert and Potoski 2002). That is, legislators prefer to sponsor, promote, and pass legislation that assists them in maintaining their positions as elected representatives. I also assume that some issues have clear partisan definitions, while other issues are less easy to define along a partisan continuum.[1] For example, some legislative issues like abortion fall cleanly along partisan lines. However, legislators from multimember districts or similar geographic regions may have very similar preferences over distributive legislation even if they are of different parties.

Further, I also assume that a legislature has some finite amount of policy it can create targeted towards a specific district. That is, a legislature can only pass so many bills or distribute so much public funding before a session concludes or a budget is emptied. This constraint is a

function of time. Legislators face reelections and ends of legislative sessions that mean they work in a limited time frame for the creation of legislation. This implies that the decision by two actors to collaborate on legislation comes with very specific types of costs. Suppose legislators *A* and *B* are from single-member districts. If legislator *A* assists legislator *B* in passing legislation that in some way benefits *B*'s district, then that is legislation that both *A* and *B* can claim some credit for (though *A* would not want to claim credit for helping someone else's legislative district), but it also decreases the number of bills/distributive funds that might be targeted towards *A*'s district. This also implies that when *A* and *B* do collaborate on legislation, some expected reciprocity should exist to offset the costs *A* incurs by assisting *B*.

Now suppose that legislators *A* and *B* are from the same multimember district. When *A* assists/collaborates with *B* and they are from the same district, the benefits realized through their collaboration help both *A* and *B*'s district, rather than coming at the cost of one of their districts. Their coordinated efforts produce greater policy benefits for their district and greater opportunities for each to claim credit for a relevant legislative success.[2] Given that individual legislators from multimember districts are confronted with weaker incumbency advantages, they possess a need to maximize their coalitional advantages and generate greater benefits and credit within their home districts (Berry, Berkman, and Schneiderman 2000; Carey, Niemi, and Powell 2000). This implies that legislators from multimember districts have a strong incentive to collaborate on, pass, and claim credit for legislation. The costs from a finite supply of legislative actions associated with collaboration between legislators in single-member districts is not felt by legislators from multimember districts.[3]

I discuss this increased coordination amongst legislators from multimember districts in the context on single bills on very specific legislation. In the real world, omnibus legislation and other legislative procedures allow legislation to simultaneously provide benefits to many districts. Nevertheless, so long as the legislature faces some real constraint on the amount of legislation it can pass, legislators from multimember districts will always have greater incentive to coordinate their efforts than their counterparts from single-member districts. Because legislators from a multimember district share a constituency and can both realize exactly the same benefits from their coordinated efforts, they always have greater incentive to work together.[4] Additionally, these legislators also feel some partisan pressures from their copartisans in the legislatures. However, because not all legislation is clearly defined by a partisan dimension, legislators from multimember districts have

opportunities to collaborate on legislation in which their partisan affiliation provides no clear position. This means that legislators from multimember districts have opportunities and incentives to collaborate, even if they are of different parties.

The coalitional advantages provided by shared constituencies would help create the increased levels of dimensionality in the behavior of legislators from multimember districts observed by Bertelli and Richardson (2008). Legislators from these districts are under pressures from both their legislative party and their reelection constituency (which may not be strongly partisan) that can be competing, which in turn generate solutions to voting patterns that scaling procedures cannot simplify to a single partisan dimension.[5] These competing pressures also would create the increased party diversity and factionalism in legislatures using multimember districts observed by Adams (1999). Natural partnerships besides political party exist in legislators using multimember districts. Thus, partisans have coalitions besides the political party they wish to respect.[6]

This geographically based inducement of collaboration is somewhat at odds with early comparative work on the effects of mixed member and multimember systems. Loewenberg and Patterson (1975) hypothesize that legislators from multimember districts are more likely to toe the party line than their single-member colleagues. Because the single-member district legislators have clear geographic constituencies, they will occasionally have incentives to deviate from party preferences. Multimember district representatives lack a clear signal about which geographic constituencies they represent, thus these legislators have less incentive to deviate from party positions. Stratmann and Baur (2002) provide evidence supporting this notion when they uncover that single-member district representatives tend to serve on committees where they can serve their constituents while multimember district representatives tend to serve on committees that serve the party. However, Haspel, Remington, and Smith (1998) and Herron (2002) find no difference in the party cohesion of multimember versus single-member elected representatives. While multimember district legislators may not know precisely who in their district has elected them relative to single-member district representatives, the notion that multimember legislators do not wish to enhance their electoral chances through service and funding for their district seems untenable. While in most international mixed-member systems candidates are a part of a party list submitted for an election, in U.S. elections candidates arrive on the ballot via primary-voting share providing them with a clearer image of their geographic constituencies.

This notion of constituency-induced collaboration particularly across party lines is also at odds with some of the existing literature on the influences of shared constituency in American legislatures. In particular, Richardson, Russell, and Cooper (2004) note that the Arizona House, which uses multimember districts, is more ideologically polarized than the Arizona Senate, which uses single-member districts. Additionally, Schiller (2000) notes that U.S. Senators from the same state generally act as rivals rather than partners. In an effort to differentiate themselves, Senators from the same state craft very different agendas focusing on different issues and different constituencies in their legislative behavior. Snyder and Ueda (2007) note that legislators from multimember districts have incentives to free ride on the effort of the other legislators from their districts and thus are less likely to collaborate to pursue legislation. Given that constituents rarely know precisely who to credit for outcomes, legislators from the same district have limited incentives to work together to achieve goals.

Snyder and Ueda also point out, however, that several forces at work within multimember districts may discourage free riding. One of these forces is the potential for increased effectiveness through coordinated behavior. By acting as a team, legislators from a multimember district can wield larger power within the chamber than they could by acting as rivals. In other words, previous research has focused on the costs of coordinated behavior without also recognizing that coordination provides additional benefits through better policy outcomes and more opportunities for credit claiming. In a competitive legislative environment, these benefits will often outweigh the costs a legislator might bear through coordination.[7] Coupled with the result that legislators from multimember districts face decreased incumbency advantages (Carey, Niemi, and Powell 2000) and an increased need to maximize the advantages they do possess, this would indicate that multimember district legislators have an incentive to be productive and work together in the legislature to ward off challengers. This need for productivity, however, must be balanced with the need to satisfy partisan constituencies and party leadership. As such, the existing literature on multimember districts offers competing stories. Legislators have incentives to work together to maximize their coalitional advantages on behalf of their constituents, but also have incentives to free ride off of one another's efforts.

Thus, multimember districts generate collaboration between legislators particularly on issue dimensions not clearly defined by party. The natural partnership created by multimember districts provide coalitional advantages that grant legislators from these districts better chances to direct policy in their districts' favor and greater opportunities to claim

credit for legislative successes. From this characterization of the impact of multimember districts on legislative behaviors, I generate several hypotheses. First, shared party identification will drive tie formation. Even legislators from multimember districts feel partisan pressures because of the procedural advantages controlled by parties. Second, a shared constituency encourages the formation of ties between legislators as legislators try to maximize the benefits provided to them by shared district coalitions. Third, the influence of a shared constituency is not conditional on party. Both cross-party and copartisan legislators from the same district have opportunities to collaborate on legislation not well defined by party. Finally, legislators from multimember districts will be closer on second and third dimensions of behavior than their single-member counterparts. This implies that once an analysis controls for party, these legislators' behaviors will appear more similar to one another than their single-member counterparts' behaviors.

Design and Data

In order to test my hypotheses about multimember districts and their influence on collaborative tie formation between legislators, I require an observable indicator of a legislative collaboration. I make use of the instances of cosponsorship of bills between legislators in order to measure tie formation and strength.[8] This approach has a large precedent (Bratton and Rouse 2011; Fowler 2006a, 2006b; Gross and Shalizi 2009). Additionally, there is ample anecdotal evidence that cosponsorship matters to legislators (Tam Cho and Fowler 2010) and is a useful indicator of a collaborative relationship between representatives (Koger 2003). Regardless of whether cosponsorship represents a signal to constituents (Mayhew 1974) or a signal to other members (Kessler and Krehbiel 1996), legislators take the act of cosponsorship as a serious signal of support for other legislators and their legislation (Campbell 1982).

Additionally, my expectations about similarity between legislators are based on a multidimensional conception of behavior. The social network of cosponsorships between legislators is a multidimensional phenomenon (Talbert and Potoski 2002; Zhang et al. 2008; but see Alemán et al. 2009), making it an ideal legislative behavior for examination.[9] Aggregate roll-call voting patterns (a potential alternative operationalization) have been noted on many occasions to be one-dimensional (Poole and Rosenthal 1997; Shor, McCarty, and Berry 2010; Wright and Schaffner 2002; but see Crespin and Rohde 2010). This single-dimensional result may emerge from a variety of sources (Crespin and

Rohde 2010; Heckman and Snyder 1997; Koford 1989), but regardless of cause, it makes roll calls an inappropriate test for my theory.

Using a web-scraping routine, I have developed cosponsorship networks[10] based on the instances of cosponsorship on every lower chamber bill for the North Carolina House of Representatives in 1997, 1999, 2001, 2003, 2005, and 2007.[11] During the 2000–2002 redistricting cycle, North Carolina's lower legislative chamber switched from a system that had 17 multimember districts electing 30 of the 120 legislators to a system that exclusively used single-member districts in legislative elections. This institutional change provides the opportunity to isolate the influence of multimember districts and accurately test my hypotheses concerning the influence of multimember districts on individual legislators.[12] Because legislative turnover is low, I can examine the legislators who were members of multimember districts and study their behavior relative to single-member legislators contemporaneously and relative to their own behavior after the institutional change. Any change in their behavior is then directly attributable to the change in the nature of their electoral district. North Carolina also makes an ideal test case for this theory because the change from multimember districts to single-member districts was mandated by the State Supreme Court (*Stephenson v. Bartlett* 2002), meaning the treatment effect I examine is exogenous to the actors I study. I also reproduce my models of the North Carolina cosponsorship network in four other states that use some combination of single-member and multimember districts (NH, VT, MD, and WV).[13]

Testing hypotheses about relational, interdependent outcomes like cosponsorship poses some unique methodological problems (Cranmer and Desmarais 2011; Erikson, Pinto, and Rader 2009). Primarily, standard regression techniques will produce biased and inefficient coefficients because of the violation of the standard regression assumption of *conditionally independent outcome variables*. Social network scholars have developed a number of techniques for analyzing relational data. I employ the latent space approach to social networks (Hoff, Rafferty, and Handcock 2002) which models the probability of some Y_{ij} given some X, Z, and θ, where X is a matrix of observed characteristics, θ is a vector of parameter values, and Z is a vector of positions in latent Euclidean social space of the actors in the model.[14] Accordingly, the unit of analysis in my models will be the dyadic observation of tie strength between two legislators. Y_{ij} in these models will represent the number of times legislator i cosponsored legislator j.

The latent social space refers to a space of unobserved latent characteristics that represent patterns of connections in network relations. In other words, the latent social space represents unmodeled similarities

between actors that are implied by their relationships with one another. A probability measure over these unmeasured but distinguishable characteristics fits a model in which the presence of a tie between two individuals is dependent on the presence of other ties. For example, a tie between *i* and *j* and *i* and *k* suggests that *j* and *k* are not very far apart in the latent space. The distance between *j* and *k* is dependent on the observations of both the connection between *i* and *k* and *i* and *j*. Thus, based on the patterns of connections between other actors in the network, the latent space model allows for the assessment of distance between two unconnected actors while simultaneously controlling for the interdependence inherent in network data. This interdependence in latent space positions allows the model to control for common network effects like reciprocity or transitivity that would ordinarily bias results. Given these estimated positions, the ties in the network can be assumed conditionally independent and can be modeled as some function of positions and actor or pair-specific characteristics using standard GLM models like a Poisson. Scholars have successfully used the latent space model to study the impact of race and gender on cosponsorship in Congress (Desmarais, Cranmer, and Fowler 2009), conflict between Asian states (Hoff and Ward 2004), and affinity between monks (Hoff, Rafferty, and Handcock 2002).

While latent space models of social networks allow for traditional hypothesis testing on relational variables, they are also useful as dimensional placement tools. Because these models place actors in a multidimensional social space based on their connections with one another across many bills, they provide me with the opportunity to observe whether multimember legislators are closer on nonpartisan dimensions of behavior to one another than their single-member colleagues are. Using the 2002 change in North Carolina can provide a clear examination of whether multimember legislators are closer than their colleagues on these dimensions when they share a constituency, and whether that similarity on alternative dimensions diminishes once shared constituencies are eliminated.

Individual Behavior and Multimember Districts

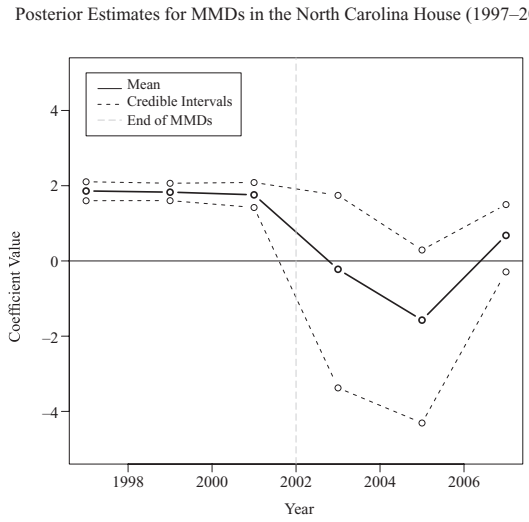
In testing my hypotheses about the formation of ties between individuals who share a constituency in North Carolina before and after the elimination of multimember districts, I estimate a Poisson latent space model.[15] The latent space generated by this approach accounts for the interdependence between actors allowing for the estimation of exogenous pair-specific characteristics like shared party identification and

shared constituency. Thus, the coefficient values reported are standard Poisson coefficients controlling for interdependence between actors. In these models, the dependent variable is the dyadic observation of the number of cosponsorships between two legislators in the network of cosponsorship counts. As independent variables, I include a dummy variable if two actors are in the same party, if two actors share a constituency, an interaction of these two variables, and two latent space dimensions. I define shared constituency as any pair of legislators who at one point in time shared a district together. Two legislators in 2003 from single-member districts who had been from multimember districts are coded one for shared constituency. For example, Cary Allred (R) and E. Nelson Cole (D) were elected from the multimember 25th district in 2001. They were elected from separate districts in 2003, but are coded as having a shared constituency because in the past they came from a multimember district. This allows me to observe whether collaboration between members from these kinds of districts persists into the future in spite of the change in the nature of their district. The coefficient on same party is expected to be positive and significant; the coefficient on shared constituency is expected to be positive and significant; and the interaction is expected to be insignificantly different from zero.[16]

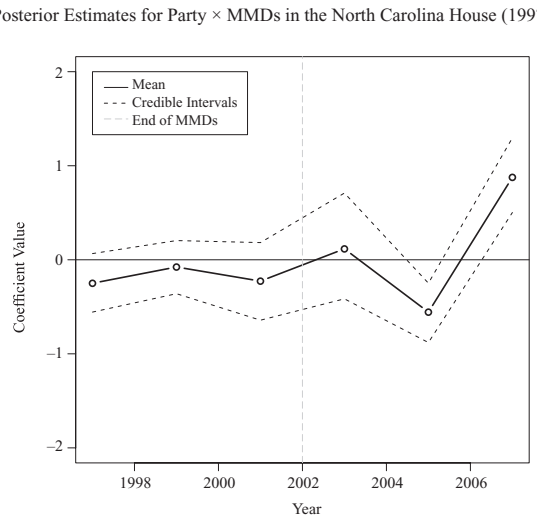
Rather than present a series of six tables of coefficients, I place the tables in an appendix and present the results graphically. In Figure 1, I present the coefficient estimates for the shared constituency variable from the Poisson regressions from 1997 to 2007 along with their 95%-credible intervals.[17] The bottom panel of Figure 1 also plots the coefficients for the interaction of same party and shared constituency. Before the elimination of multimember districts, shared constituency was a strong predictor of tie formation between actors. This indicates that legislators from multimember districts cosponsored one another at a higher rate than legislators from single-member districts. However, after the elimination of multimember districts, those same individuals who once shared a multimember district (and who once had connections with one another in a cosponsorship network) no longer work together at a rate higher than other members do.[18] The interaction term in the bottom panel is only significantly different from zero in 2005 and 2007, well after the change in electoral systems. This indicates that multimember districts' effect on cosponsorship is not significantly different for same party versus cross-party pairs of multimember legislators. Because I draw this inference only from legislators who at one point shared a constituency and this inference is based on individuals who are present throughout the time series, I can be reasonably certain that the only change occurring is their loss of a shared district. It is unlikely that their policy preferences

FIGURE 1
Multimember District Coefficient Estimates and Credible Intervals for Legislators Who Shared a District (1997–2007)

(a) Shared Constituency Coefficients



(b) Interaction Coefficients



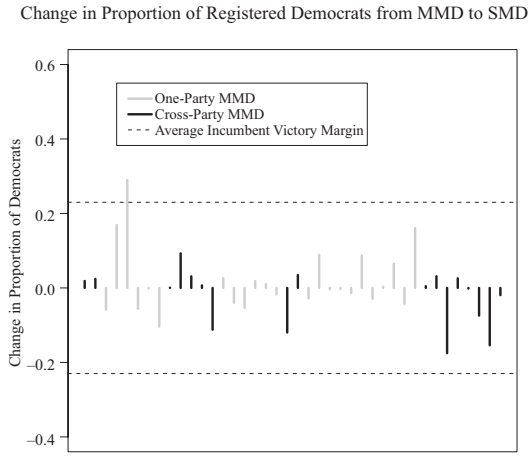
are changing, given the stability in ideology of political elites (Poole and Rosenthal 1997), and their party identifications have not changed.[19]

There is the potential, however, that the change in collaboration is a result of a dramatic change in constituency from the multimember district system to the single-member district system. For example, a Republican and a Democrat from a multimember district may cooperate because they have an overall moderate constituency. During redistricting, this moderate multimember constituency may be broken up into more extreme single-member districts, which in turn may cause the drop in collaboration. In this scenario, similarity in constituency causes collaboration, not the institution of multimember districts. If, however, the constituencies in the single-member district are very much like the original multimember district, then the same representatives work together when they share a district and stop after the division of their district, even though their districts remain similar. This would strongly imply that it is the institution of shared constituency and not similarity in constituency that is causing collaboration.

Figure 2 shows the change in the proportion of registered Democrats and the change in per capita income in the resulting single-member district from the originating multimember districts. For example, if a single-member district's proportion of Democrats is very different from its original multimember district's proportion of Democrats, then the lines from zero in the left panel will be quite long.[20] Additionally, the dotted lines in the figure provide a sense of the magnitude of these changes by plotting the average incumbent advantages held in both vote totals and fundraising. Only one of the multimember districts has a shift in partisanship such that it might affect an average electoral outcome. None of the districts have a shift in income that would influence the fundraising advantage held by incumbents. The figure indicates that in terms of both partisan make-up and income distribution, the resultant single-member districts look very much like their originating multimember districts. This provides evidence that what is driving multimember-based collaboration is the institution of a shared constituency, not a similar constituency. Once this active sharing of constituents vanishes, members who once worked together cease working together even though their districts look quite similar. There are large, observable changes in legislative behavior when there are only small changes in the make-up of legislators' constituencies. Thus, it seems unlikely that the election of ideologically similar legislators for the 2001 session created the collaboration between legislators observed under multimember districts. If these legislators were ideologically similar in 2001, they would have no reason to cease collaborating in 2003.[21]

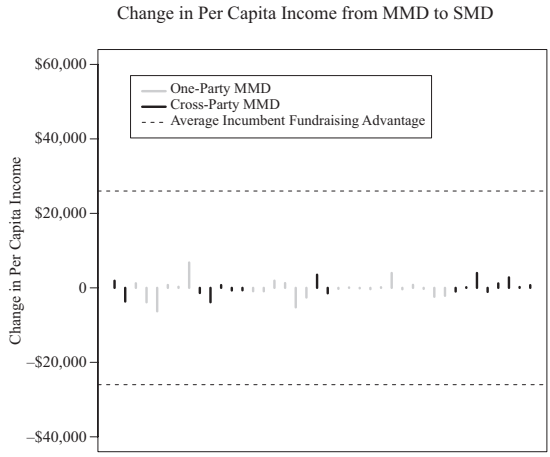
FIGURE 2
Change in Partisan Makeup and Income as Districts Transition from Multimember to Single-Member Districts

(a) Partisan Change



Note: Lines indicate difference in SMD from originating MMD.

(b) Income Change



Note: Lines indicate difference in SMD from originating MMD.

FIGURE 3
Party Coefficient Estimates and Credible Intervals
(1997–2007)

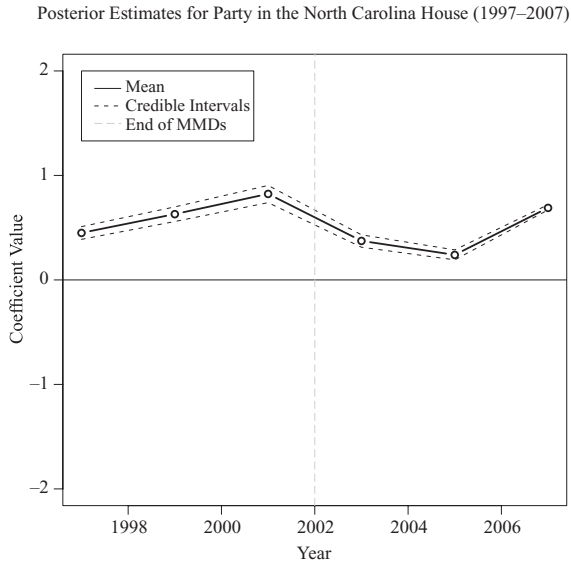
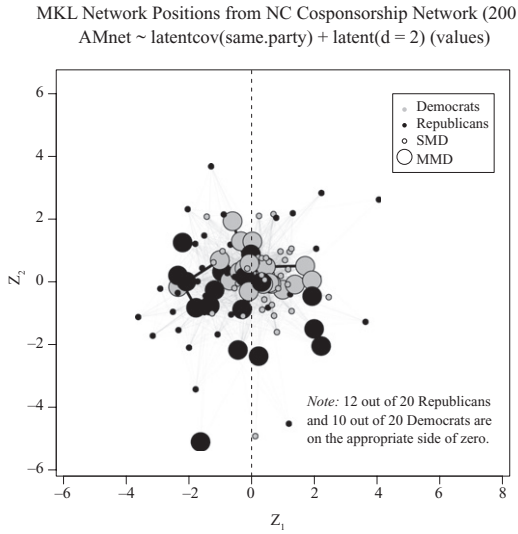


Figure 3 presents coefficient densities on same party from the model associated with Figure 1. Being members of the same party strongly predicts tie formation between two legislators both before and after the elimination of multimember districts. Because the party coefficients from both the models analyzing legislators who were once members of a multimember district and legislators who represent what was once a multimember district are virtually indistinguishable, I present only the coefficient densities from the model associated with Figure 1.

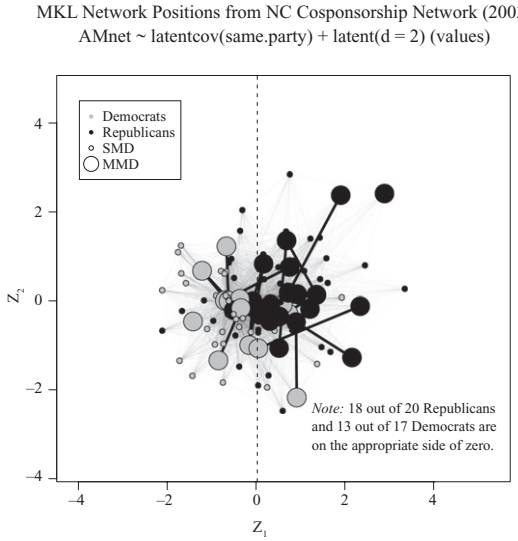
Finally, the latent space model produces estimates of positions for actors in a latent social space (Hoff, Rafferty, and Handcock 2002). These positions are defined by the patterns of connections observed in the dependent variable while controlling for the specified covariates.[22] Therefore, these positions represent actor positions in a social space on unmeasured dimensions. Figure 4 plots these network positions for North Carolina legislators in 2001 and 2003. My theory specifies that multimember legislators will be closer to one another on nonpartisan dimensions than single-member legislators will. Accordingly, I construct a simple latent space model with a covariate for same party and two latent

FIGURE 4
North Carolina Legislators' Positions in Two-Dimensional Social Space in 2001 and 2003

(a) NC Network Positions in 2001



(b) NC Network Positions in 2003

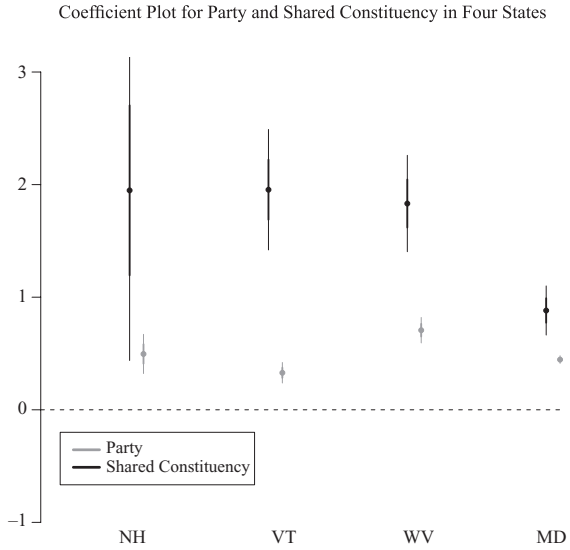


dimensions. These latent dimensions are the first and second observable dimensions of legislative behavior after party.

When looking at actual differences in positions between legislators, I make use of rank-order comparisons and the Wilcoxon rank-sum test. The Wilcoxon test is a location-shift test that will determine the probability of a location shift in the distribution of ranks for two different samples. It provides a useful way to differentiate whether the distribution of position differences in the legislative network systematically ranks legislators from multimember districts lower than other pairs of colleagues. The Wilcoxon test is useful here because it does not require any assumptions about the distribution of differences. Multimember district legislators are closer to one another on the first dimension controlling for party than the average two legislators not sharing a district in both 2001 (p-value of 0.001) and 2003 (p-value 0.007). On the second dimension, however, multimember legislators are closer than the average pair of legislators not sharing a district in 2001 (p-value of 0.003) but no longer closer than expected in 2003 (p-value of 0.36), precisely as predicted.

Comparing the distances on dimensions of behavior between legislators who share a district and all other legislators is relatively weak null comparison. A more strenuous comparison of multimember similarities relative to other legislators is to compare legislators who share a district to pairs of single-member legislators who are of the same party (rather than all single-member legislators). The differences on the first dimension of cosponsorship behavior controlling for party between legislators who share a district are also significantly smaller than differences between pairs of single-member legislators who are in the same party in 2001 (p-value of 0.044). Yet, this difference is no longer statistically significant in 2003 (p-value of 0.15). The difference between legislators who share a district and pairs of same-party single-member legislators is insignificant on the second extraparty dimension in both 2001 and 2003. Once again, empirical evidence indicates that in 2001, multimember legislators were more similar to one another than their single-member colleagues were, but following the exogenously imposed change in electoral districts in 2003, these same multimember legislators are no longer statistically significantly different from their single-member colleagues. If the common cosponsorship between legislators I observe were just a function of multimember districts electing two similar legislators, then there would be no reason for movement following the elimination of multimember districts, particularly given the fact that their districts changed very little before and after the switch.[23]

FIGURE 5
Multimember District Coefficients Estimates and Credible Intervals in NH, VT, WV, and MD



Mixed-Member Systems in Other States

While the inferences drawn from my analysis of North Carolina are clean thanks to the observable change in institutions, a more general examination can be crafted using states that use combinations of multi-member and single-member districts in legislative elections. There are four such states in the country: New Hampshire, Vermont, West Virginia, and Maryland.[24] Within these states, I can make the similar comparisons as in North Carolina to determine whether shared constituency encourages collaboration across other state legislatures.

Figure 5 replicates the analysis from Figure 1 in each of the 4 states I mention, but only in 2007. The plot presents point estimates from a Poisson Latent Space model with two latent dimensions. The points in the plot represent the actual point estimates and the lines coming off the points represent 95% credible intervals. Grey points represent model estimates for party's effect on cosponsorship behavior and black points represent the effect of shared constituency on cosponsorship behavior for members of opposite parties. The interaction term demonstrating the effect of shared constituency for members of the same party is not presented in the plot, but

is reported in Table 4 in the appendix. This interaction is never statistically different from zero. The consistently positive effect in each of these states mirrors the results in North Carolina, indicating that shared constituency is a driver of cooperative behavior in these states as well.

Once again, I make use of the Wilcoxon rank test in order to examine whether differences on first and second dimensions after controlling for party are smaller for multimember legislators than pairs of single-member legislators. The hypothesis here is that the distribution of differences between legislators will systematically rank pairs of legislators who share a district lower than pairs of single-member legislators. This indicates that their differences are on average smaller than differences between single-member district legislators. There is a statistically significant shift downward in the rankings of difference between legislators who share a district in Maryland (p-value of 0.0001) and West Virginia (p-value of 0.000). Vermont misses the 0.05 cut off, but there is a significant shift downward at the 0.10 level (p-value of 0.061). There is no statistically significant difference between legislators who share a district and their single-member colleagues in New Hampshire (p-value on downward shift of 0.489). The same pattern appears when comparing legislators who share a district to pairs of single-member legislators of the same party. Maryland and West Virginia have significant shifts downward (p-values of 0.001 and 0.000, respectively), and Vermont has a significant shift downward at the 0.10 level of significance (0.080). New Hampshire has no significant shift. New Hampshire's insignificant findings are likely a result of the limited number of single-member legislators elected in that state (only 4% of 400).

While these comparisons are taking advantage of only within-legislature variance and not temporal or between-legislatures variance, these results do indicate that cosponsorship is more common among legislators from a shared constituency in each of these four states. Furthermore, in three of the four states, legislators from multimember districts are more cohesive than single-member legislators from the same party. Thus, in both a natural experiment and a cross-sectional comparison of legislatures, the hypotheses about the influences of multimember districts on cosponsorship behavior receive support.

Discussion

This research has demonstrated how the electoral institution of a shared constituency influences the subsequent collaborative behavior of state legislators. By granting legislators a natural coalitional partner that can help provide greater influence over limited legislative resources, multimember districts increase the probability that two legislators will

collaborate over the course of a bill's life. When those two legislators are from the same party, multimember districts increase their rate of collaboration. When those two legislators are of different parties, multimember districts actually create collaboration. Using a natural experiment from North Carolina's state legislature, empirical evidence indicates that multimember district legislators are more likely to cosponsor together and that multimember legislators are closer together on unobserved dimensions driving behavior when controlling for party. In the absence of multimember districts, these characteristics fade away, and legislators formerly from multimember districts begin to look exactly like their single-member counterparts. Cross-sectional evidence from Vermont, Maryland, and West Virginia provide additional evidence supporting these hypotheses.

Most early work on multimember districts in state legislatures focuses on understanding the effects of these institutions on questions of representation, like how these institutions influenced the minority, gender, and partisan makeup of a chamber (Gerber, Morton, and Rietz 1998; Grofman, Migalski, and Noviello 1986; Niemi, Hill, and Grofman 1985; Niemi, Jackman, and Winsky 1991; Welch and Studlar 1990). Prior work on the postelectoral behavior of legislators from multimember districts indicated that these districts amplified polarization, created rivals rather than partners, and created incentives to free ride on the efforts of other legislators from the shared district. I find that multimember districts actually generate collaboration when controlling for partisanship. This collaboration stems from efforts by legislators in multimember districts to maximize their limited incumbency advantages and ward off potential challengers. Additionally, this work provides clear evidence that institutional arrangements in a legislature can and do influence the collaborative behavior of legislators. By altering the incentives for shared credit claiming, rules and constraints can engender or eliminate cooperation between members. It is possible then that other legislative institutions beyond multimember districts can condition the collaborative behavior between representatives.

As Snyder and Ueda (2007) point out, this coordinated behavior by legislators from multimember districts should alter their legislative productivity and their district's share of legislative benefits. Kirkland (2011) has noted that both a large and diverse coalition of support helps legislators pass bills. Thus, multimember districts provide legislators with natural allies that should help them swing legislative outcomes in favor of their home district. Legislators from single-member districts lack allies expressly interested in helping them benefit their home districts. Additionally, by creating an electoral environment where legislators have incentives to work across party lines, multimember districts should limit

the party cohesion within a legislature (a result supported by Adams 1996) and create more ideologically diverse political parties.

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NOTES

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1. Cox and McCubbins (2005) suggest that parties use the political process to kill legislation that divides the party. The very fact that the party is divided on some issues suggests that some dimensions are not defined by party preferences.

2. Given the lack of awareness about legislative behavior that most voters possess, it is unlikely that voters will be able to distinguish which of their legislators to reward for policy that benefits a multimember district. This is the source of the free-riding problem often associated with multimember district legislators (Snyder and Ueda 2007). I argue that this ignorance actually provides legislators with an opportunity to work together if that collaboration can benefit their district.

3. That is not to say that collaboration between multimember district legislators does not come with any costs. We could easily envision electoral costs that result from this type of collaboration, but that cost would be borne by legislators from single-member and multimember districts.

4. Returning to the earlier example, *B* may introduce a bill that benefits both *A* and *B*'s districts rather than just *B*'s. Even in this circumstance the direction of benefits towards *B*'s district reduces the benefits that could in the long run target *A*'s district. *A* never has an incentive to assist in the provision of a limited resource away from his or her own district. If *A* and *B* were from the same district, this problem would not exist.

5. To be clear, I assert that an individual piece of legislation may occur on a highly partisan dimension or a dimension of legislative preferences not clearly defined by partisanship. In the aggregate, legislators tend to vote on bills along the partisan dimension. However, multimember legislators feel the pull of nonpartisan constituents more strongly, and thus, should evidence multidimensional behaviors more clearly.

6. Because U.S. senators also share constituents, there is reason to believe that this same pattern of collaboration should exist in the Senate. Gross and Shalizi (2009) observe the expected patterns amongst senators. The authors observe strong state effects on cosponsorship between senators after controlling partisanship. This result is in keeping with constituency overlap as a reason for collaboration between legislators.

7. The benefits of coordinated legislative behavior are one of the key reasons for the centrality of political parties in the legislative process. Many actors working alone achieve little. Many actors working together towards a common goal achieve much more.

8. One might imagine an alternative measurement of collaboration as covoting on roll calls. I believe cosponsorship to be the better measure because cosponsorship requires a decision to send a signal by both the potential cosponsor and potential sponsor. Sponsors can turn down cosponsors, and cosponsors can refuse to sign onto bills. It is much less likely that a bill's sponsor will turn down a vote than it is that a bill's sponsor will turn down a cosponsor. Thus, cosponsorship represents a type of coordinated behavior that covoting is unlikely to tap.

9. Each of the studies cited here observe higher dimensionality in cosponsorship than in roll-call voting. Disagreement between the studies about the appropriate number of dimensions largely stems from disagreements about how to treat decisions not to cosponsor a bill. Talbert and Potoski use NOMINATE, which treats decisions not to cosponsor as "Nays." Aleman et al. use a principal components analysis that focuses on the agreement matrix, and thus, has many fewer zeros about which to worry. The debate about which method is appropriate is largely irrelevant to the point I make, which is that cosponsorship has higher dimensionality than roll-call voting. Both articles agree on this point.

10. A social network is an adjacency/square matrix where A_{ij} represents the number of times legislator i has cosponsored legislator j.

11. Supplemental Appendix A to this article contains descriptive statistics for the data used in the analysis.

12. It is possible that these 17 multimember districts represent a nonrandom sample of the districts in North Carolina, meaning the treatment of institutional change is not being applied at random. However, whatever nonrandom characteristics might have been the impetus for the creation of the multimember districts did not *change* in 2002. This means that any observed change in behavior at this time point cannot be a function of the static characteristics that generated the nonrandom selection of multimember district creation.

13. In the 2001–2002 session, the Democrats controlled a majority of the lower chamber seats with a 62–58 advantage. Following the 2002 election, the Republicans retained a slight 61–59 advantage. This change in majority party control could potentially threaten inferences regarding the contemporaneous institutional change. One could imagine that the incentives for collaboration may be quite different in the Republican and Democratic controlled chambers. However, this is not quite as dire a threat to inference as it may seem. In fact, just before the opening of the 2003–2004 session, Michael P. Decker (a generally conservative legislator) switched allegiance from Republican to Democrat. This abrupt change means that the Democrats and Republicans were tied for chamber control at 60–60. This also means that the Democrats retained substantial procedural power over almost the entire sample I observe (the exception being 1997), electing co-Speakers of the House in the 2003–2004 session and splitting committee chair positions with the Republicans. Investigations would later reveal that Decker accepted a $50,000 bribe from Democrat Jim Black in order to switch parties. There is no reason to expect that a tied chamber would prove less collaborative and thus be collinear with the change I predict in 2003. In fact, Fenno (1973) might lead us to expect *more* collaboration in a tied chamber.

14. An alternative to the latent space approach is the Exponential Random Graph Model (ERGM). The ERGM has not been extended to cases with nonbinary edges making it an inappropriate modeling choice for this data. Thus, to use an ERGM I would

have to censor a great deal of information out of the dataset and collapse counts of cosponsorship between two actors to dichotomous observations. Additionally, cosponsorship networks are commonly dense graphs (meaning they have many connections), and ERGMs are commonly nonconvergent in dense social networks.

15. Recall that the network of cosponsorships I model is a count network of the instances of cosponsorship between two people across all the bills of a legislative session.

16. While including a term expected to take on an insignificant coefficient is unusual, this allows me to demonstrate that the effects of multimember districts are the same within and across parties. An additive term alone would fail to make such a distinction.

17. The table that produces this plot is located in Appendix D as Table 2.

18. In Supplemental Appendices E and F to this article, I present several other operationalizations of this test. I include an analysis of specific kinds of legislation rather than the universe of bills and an analysis of roll-call voting rather than cosponsorships.

19. While the models I present are simple specifications, Appendix D presents a series of graphs indicating the quality of predictions from each model. The models accurately predict 89% of ties across all six North Carolina models. This suggests that even though the model specification contains only three variables, there is little variance left to explain.

20. As an example, the multimember district 4 for North Carolina's House was 53% Democrat before redistricting. The redistricting effort created the single-member districts 13 and 14 from the 4th district. These two districts were both roughly 55% Democrats, creating a change of roughly +2%.

21. Rather than simply graphing the data, I have also included the ideological and racial makeup of a legislator's district as covariates in latent space models of the cosponsorship networks for 2001 and 2003. These covariates add a term to the network model that measures the absolute difference in the North Carolina House Democratic vote share in two legislators' districts or the absolute difference in the percent of a districts' population that identifies as black on the U.S. Census. When the ideological absolute difference is high, then legislators have very different proportions of Democrats voting for them. When the absolute difference in percent black is high, then the legislators have very different racial makeups in their districts. These covariates take on the expected negative and statistically significant signs, but do not affect the sign or significance of the other covariates.

22. For example, transitivity or reciprocity in network connections provides information about the distance between actors in the social space.

23. Analysis of roll-call votes also indicates that legislators from multimember districts change their voting behavior following the change to single-member districts. Because these analyses involve the exact same individuals, this means that the voting behavior and cosponsorship behavior of individual legislators is changing following their change to single-member districts. The roll-call analysis is presented in Appendix F to this article.

24. New Hampshire elects 96% of its 400 legislators from multimember districts. Vermont elects 57% of its 151 legislators from multimember districts. West Virginia elects 63% of its 100 legislators from multimember districts, and Maryland elects 79% of its 141 legislators from multimember districts.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Figure S1. Multi-Member District Coefficient Estimates and Credible Intervals for Legislators from Formerly Overlapping Districts (1997–2007)

Figure S2. Density of Prediction Errors from Poisson Latent Space Models for 1997–2007

Figure S3. Density of Prediction Errors from Poisson Latent Space Models in Four States (2007)

Figure S4. Coefficient Estimates and Credible Intervals for Appropriations, Finance, and Rules Committee Networks in 2001 and 2003

Figure S5. Optimal Classification in One Dimension of Roll Call Voting by NC House Legislators in 2001 and 2003

Table S1. Descriptive Statistics for the Analysis of the North Carolina House (1997–2007)

Table S2. Poisson Latent Space Models of Cosponsorship in the North Carolina House (1997–2007)

Table S3. Poisson Latent Space Models of Cosponsorship in the North Carolina House (1997–2007)

Table S4. Poisson Latent Space Models of Cosponsorship in State Legislatures (2007)

Appendix A. Descriptive Statistics

Appendix B. Latent Position Methods for Social Network Analysis

Appendix C. An Alternative Measure of Shared Constituency

Appendix D. Model Results from Latent Space Models of Cosponsorship

Appendix E. Committee Specific Results from Latent Space Models of Cosponsorship

Appendix F. But What About Roll Call Votes