2010

The Factors of Interest Group Networks and Success: Organization, Issues and Resources

Dino P. Christenson
OSU, christenson.24@polisci.osu.edu

Janet M. Box-Steffensmeier
steffensmeier.2@osu.edu

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Janet M. Box-Steffensmeier
Vernal Riffe Professor of Political Science
Professor of Sociology
The Ohio State University
steffensmeier.2@osu.edu

Dino P. Christenson
PhD Candidate
Department of Political Science
The Ohio State University
christenson.24@polisci.osu.edu

May 15, 2010

*Paper prepared for the Annual Political Networks Conference at Duke University in Durham, NC on May 22, 2010. Further information on the original data and other papers on this project can be found at http://polisci.osu.edu/grads/dchristenson/lobbyists.htm.

†The authors would like to thank Larry Baum, Allan Cigler, Anand Sokhey for helpful comments and/or discussions, and Jamie Richards for superb research assistance. We also thank our undergraduate research assistants for excellent coding work.

Abstract

While interest groups use a variety of techniques to exert influence, coalition strategies are the dominant lobbying technique. However, many questions remain about such coalitions. This paper is the second in a series of social network analyses of purposive and coordinated interest group relationships. We utilize a network measure based on cosigner status to United States Supreme Court amicus curiae, or friend of the court briefs. The illuminated structures lend insight into the central players and overall formation of the network over the first several years of the 21st century. The factions are tied together by various central players, who act as hubs, leaving a disparate collection of organizations that work alone. Using an exponential-family random graph model (ERGM), we find that graph-theorectic and organizational characteristics, such as size and budget, as well as policy interests explain interest group network formation.

Winning in front of the courts, the legislative arena, or the executive branch is not a solitary act. While interest groups use a variety of techniques to exert influence, coalition strategies are the dominant lobbying technique. That is, interest groups do not work alone. However, many questions remain about such coalitions.

Interest groups form coalitions to pursue their strategic goals at reduced costs, shape public debate by influencing a broader platform, gather information, and receive symbolic benefits (Hula 1999). Further, Hula's classic work emphasizes the need to explain interest group coalitions, which can be viewed as institutions of collective leadership, bargaining, and strategy among member organizations. In other words, it is necessary to understand interest groups as part of a network and the relationships among them. In this piece, we examine interest group network linkages.

The network structure of interest groups is important because the structures serves as a conduit of information. It also matters because of the strategic interaction of networked groups. In the political world, where it is often said that who you know matters as much as what you know, both aspects of network structure are important.

1 Interest Group Network Formation

Classic works in the interest group literature have sought to understand why interest group coalitions form. A discussion of resources initiates most scholarly work on this topic. That is, scholars maintain that coalitions serve as an economical and efficient means to form a more powerful bloc (e.g., Berry 1977, Berry & Wilcox 1989, Schlozman & Tierney 1986, Cigler & Loomis 1991, Hula 1995, Hojnacki 1998, Whitford 2003). Hojnacki's (1998) theory of strategic coalition formation summarizes the factors influencing coalition formation as perceived strength of the opposition, previous experience in a coalition, whether the group is pivotal, and whether the group is critical to the success of the coalition, see also (Gray & Lowery 1998).[1] Coali-

[1]Some interest coalition formation literature distinguishes types of interest groups, arguing that different types of interest groups are more or less likely to join coalitions (Clark & Wilson 1961, Caldeira & Wright 1990). This suggests that one should account for the type of interest group, such as whether it is a trade association, citizen group, or union, though Mahoney (2004) did not find this distinction to be statistically significant in their recent work.

tions then signal broad support to policy makers on an issue (Mayhew 1974, Kingdon 1981, Loomis 1986, Esterling 2004, Mahoney 2004, Mahoney 2007).

Social network theory also suggests that alliances form out of the pursuit for access to resources and information (Gilsing et al. 2008). That is, coalitions function as 'pipelines' through which information and knowledge flow. The incentive for interest groups to form networks appears to be similar to that of firms: to share information and to diffuse information more quickly or to enhance the efficiency of cooperation (Teece 1986, Whitford 2003, Gilsing 2005, Gilsing et al. 2008). In addition, there are control benefits, such as sanctions, reputation, and trust. The social network literature discusses the positive effects of networks on group performance; growth (Powell, Koput & Smith-Doerr 1996), speed of innovation (Hagedoorn 1993), organizational learning (Hamel 1991), and reputation (Stuart 1998).

Bacheller (1977) emphasizes the importance of both group characteristics and group relationships for a complete understanding of the role of interest groups. The interest group literature provides an extensive and thorough examination of individual group characteristics. In spite of strong interest in group relationships, (e.g., Heinz et al. 1993, Carpenter, Esterling & Lazer 1998*a*), heretofore, there has not been much empirical work on group relationships. Whitford (2003, p. 46) states that "as recent studies suggest, the network aspects of group coordination - the specific interconnections between groups - may be as important as whether participation occurs at all." Our work brings renewed focus on the interconnections between groups.

Network hypotheses often focus on the location of groups in the network. If a group has a high measure of centrality they hold a brokerage position between groups. Central interest groups are better informed and more attractive network partners. Views of network density also provide interesting hypotheses to examine (Granovetter 1973, Coleman 1988, Carpenter, Esterling & Lazer 1998*b*, Burt 2001). For example, Coleman's (1988) theory states that network closure creates trust in a social structure and secures information flows. Teasing out how different interest group networks vary on the measure of closure and what factors explain this is an interesting question that has not yet been addressed in the study of interest groups.

2 Group Structures

We use a broad definition of interest groups, following (Knoke 1990). We avoid limiting our analysis to the sample of interest groups that officially register as a lobbyist with Congress, since the popular press has established that many groups simply do not register (Mayer 2007, Cummings 2008). Our interviews with groups confirm this behavior. In addition, using groups that register to lobby associates groups by topic, not by directionality. That is, groups may be associated that have opposing views on the issue. Similarly, if we look only at groups that contribute campaign contributions, we are again unnecessarily limiting the study of coalitions to only a subset of pressure groups that give money and groups will be connected even without direct, coordinated action. That is, groups would be linked by giving to the same member of Congress. Yates (2010) looks at interest groups, social movement organizations, nonprofit organizations, private enterprises, business associations, and governmental agencies in her work on influential organizations. We use cosigners to United States Supreme Court amicus curiae, which also gives us a broad array of groups that have purposive and coordinated action. We believe our work is the first to use a *purposive* and *coordinated* measure of interest group relationships (Box-Steffensmeier & Christenson 2009)[2] The network structure illuminated by these interest group linkages provide interesting information about the central players and overall formation of the network over the first seven years of the 21st century.

In Supreme Court cases, various parties with related interests submit briefs to the Court in favor of the petitioner, respondent, or in some cases, neither. Cosigners on amicus curiae briefs coordinate the content of the briefs and signatories.[3] These cosigners are often comprised of interest groups.

A large percentage of amicus briefs come from interest groups (Collins 2008). The earliest papers found that approximately fifty percent of interest groups indicated in surveys that they have participated in writing amicus briefs when asked about activity in the last two years, (e.g., Solberg &

[2]Iida's (2010) recent work also looks at amicus briefs via a sample of cosigners (see Gibson 1997).

[3]The term "cosigners" is sometimes used to distinguish the individual or group that initiated the brief from others that signed onto it. We use the term here to refer to everyone on the brief as a cosigner(see also Gibson 1997). We would like to distinguish the initiator and use the associated network methods that take this into account, however, it is not empirically possible in the data.

Waltenburg 2006, Scheppele & Walker 1991). Schlozman & Tierney (1986) ask interest groups about litigation or otherwise using the courts and reported that over seventy percent of groups did so. Our comprehensive list of amici will allow us to get as reliable measure as possible because we can compare it to databases of interest groups. We will also be able to see if the number of groups participating in the process has increased over time as some have posited. Kearney & Merrill (2000) find that the number is closer to eighty percent and Almeida (2004) finds seventy-six percent. Whitford (2003) argues that because judicial strategies are high cost efforts, coalitions are optimal strategies, and concludes that the eighty percent participation rate over two years seems reasonable.

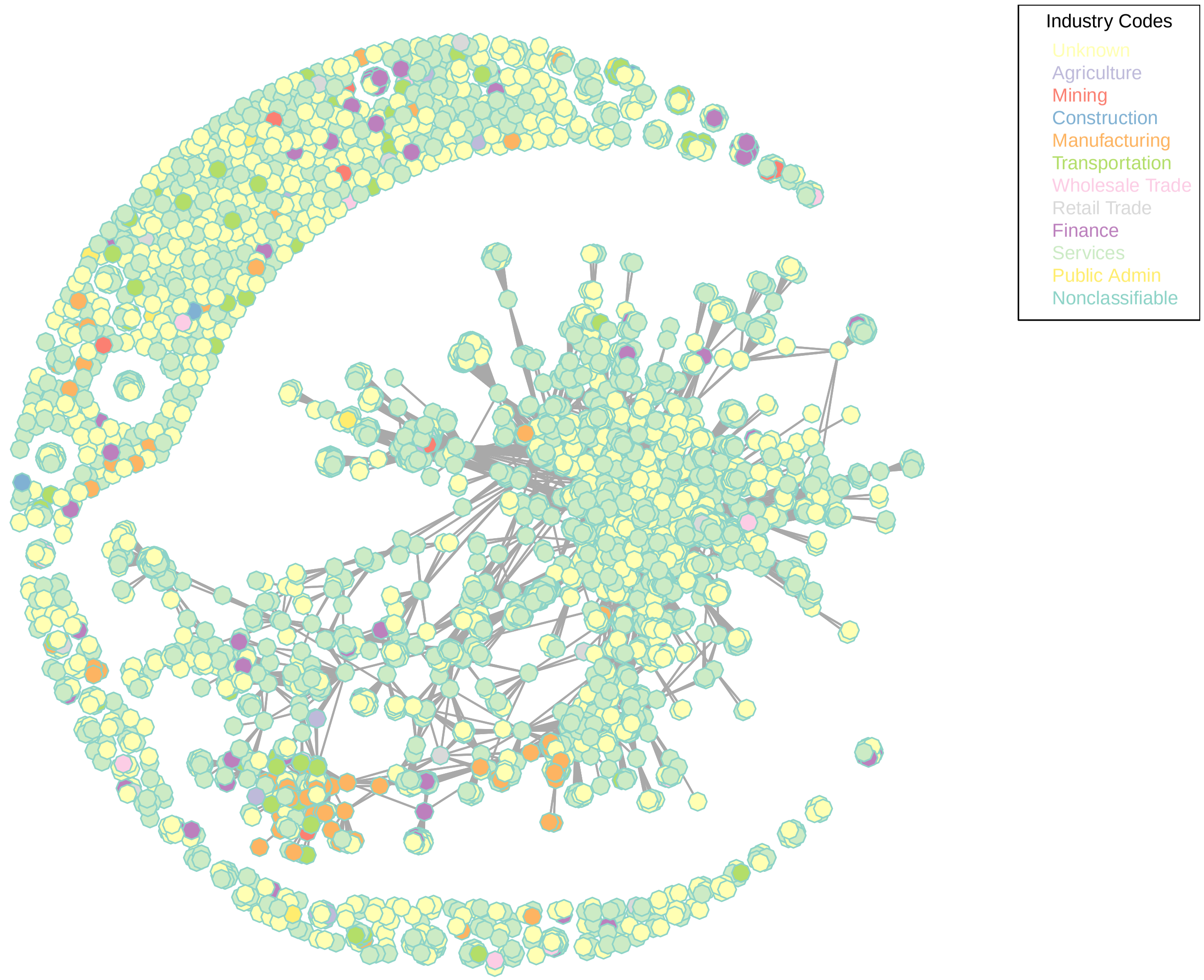
Our network measure has a number of desirable properties. First, it occurs naturally in the function of government activity. Our data is not based on surveys, contrived settings or incidental links, but culled from the actual, purposive and coordinated work of interest groups in front of the Court. Second, we come close to a complete network of the population of interest, with an increasing probability of capturing the full population given longer time spans. Third, the data we have gathered are longitudinal, which is of fundamental merit for future work on the evolution of complex social networks (Burt 2000, Rogers 1987, Marsden 1990, Christakis & Fowler 2007).

2.1 Exploring the Networks

Who are the key opinion leaders and influentials? Where does influence flow? Who are the "connectors" (those who connect the unconnected in the network) and the "mavens" (who are sought out for knowledge)? Where is the power in the networks? The first major part of the project applies basic network analysis to the interest group arena. We begin to answer the questions posed by mapping the full network created by interest group interaction in signing amicus briefs.

Figure 1 displays the network mapping of all interest groups that have signed amicus briefs on USSC per curiam or full opinions from 2000 to 2007. We define the universe by choosing the most recent decade of cases available from the Spaeth (1953) data set. We then go to the actual briefs to code every group that has signed onto a brief. We look at the network across all seven years, recognizing that ties between groups will not always be apparent within short windows of time. Specifically, there are 4,111 organizations that signed onto 2,469 amicus briefs on 456 cases in our data set (see Table 1).

Figure 1: Interest Group Network in 21st Century



The nodes represent interest groups. Interest groups that are linked together by virtue of signing the same amicus briefs are denoted by way of a joining edge. While the linked groups have cosigned at least one or more amicus briefs, the stand-alone groups have signed one or more amicus briefs without any cosignatories during this period.

Figure 1 illustrates that there is both a host of coalitions as well as various solitary actors on the periphery of the graph. All of the interest group relationships are symmetric, or undirected, because they represent the act of cosigning of an amicus brief. Despite the fact that one of the organizations is listed first as the filer of the amicus brief, to give more weight to such an organization would be inappropriate. Often times the reports are filed alphabetically or in some other manner that gives no indication as to a lead signatory (see also Gibson 1997). Thus, all cosignatories should be considered equally in the network. The data does not specifically indicate which group first contacted its cosignatories or did the bulk of the work on the brief. However, the mapping of the full network does provide insight into the most likely first movers and dominant players.[4]

Hanneman & Riddle (2005) state that all sociologists would agree that power is a fundamental property of social structures. Importantly, social network analysis has explicitly developed methods to study power. These include a variety of network measures that are useful for characterizing and understanding interest group networks at the node level. Krebs (2004) discusses some useful measures, including betweenness, which "measures the control a node has over what flows in the network - how often is this node on the path between other nodes?" And closeness, which measures how easily a node can access what is available via the network - or how quickly can this node reach all others in the network? A combination where a node has easy access to others, while controlling the access of other nodes in the network, reveals high informal power (Krebs 2004). Here we attempt to locate the

[4]In this analysis, we have chosen to only link those interest groups that have signed the same brief. An alternative approach would be to link all interest groups that sign a brief in the same direction (i.e., for respondent or petitioner or neither). This would certainly create a denser or more linked network of interest groups based on both issue area and ideological direction; however it would not signify any sort of coordinated action on the part of the signers. Coordinated action is central to our beliefs about interest group networks, because it denotes a deliberate link between organizations. While interest groups undoubtedly interact broadly, an interest group network based on amicus briefs suggests, at a minimum, a regular contact, or a "weak tie" (Carpenter, Esterling & Lazer 1998*c*).

Table 1: Interest Group Properties

Node Properties			
Degree			
Mean	*Std Dev*	*Max*	*Min*
23.6	(29.1)	189	0
Betweenness			
Mean	*Std Dev*	*Max*	*Min*
4031.1	(28658.8)	821571.7	0
Structure			
USSC Cases	456		
USSC AC Briefs	2469		
Interest Groups	4111		

Node properties refer to the average and range of degree and betweenness centrality measures with standard deviation in parentheses. *Structure* refers to the total number of cases, briefs and interest group signatories in the data.

wielders of power among interest groups by using network analysis.

Table 1 provides some basic properties of the network. Various centrality indices help characterize the extent to which any particular group plays a central role in the network (Freeman 1979). In other words, centrality helps us understand the key interest groups in the network. Here we list the degree and betweenness of the groups, which are typical network measures of centrality.[5]

In our maps of interest groups, degree is simply the number of interest groups directly linked to any other single group in the network. Degree helps determine centrality in so far as interest groups with high degree can be

[5]Because so many interest groups lack paths to other groups in this network, i.e., fail to cosign with other interest groups, the range of values for the centrality measure of closeness is zero. Closeness measures the degree to which a group is close to all other groups in the graph; thus despite collections of tightly grouped networks the overall graph is quite disconnected. Smaller windows of cases are indicative of the complete network as well. Interest groups continue to sign alone, suggesting that not all interest groups value these networks equally.

thought of as being directly connected to other interest groups. High degree interest groups are well connected in that they are signatories on many amicus briefs. A high degree might therefore signal key players that bring together other interest groups on common issues. In the network, several interest groups signed an amicus brief alone, which means the minimum degree is zero. The best linked interest group, the National Wildlife Foundation (NWF), was linked to 189 others, which begs the question: why do so many groups form coalitions with the NWF?

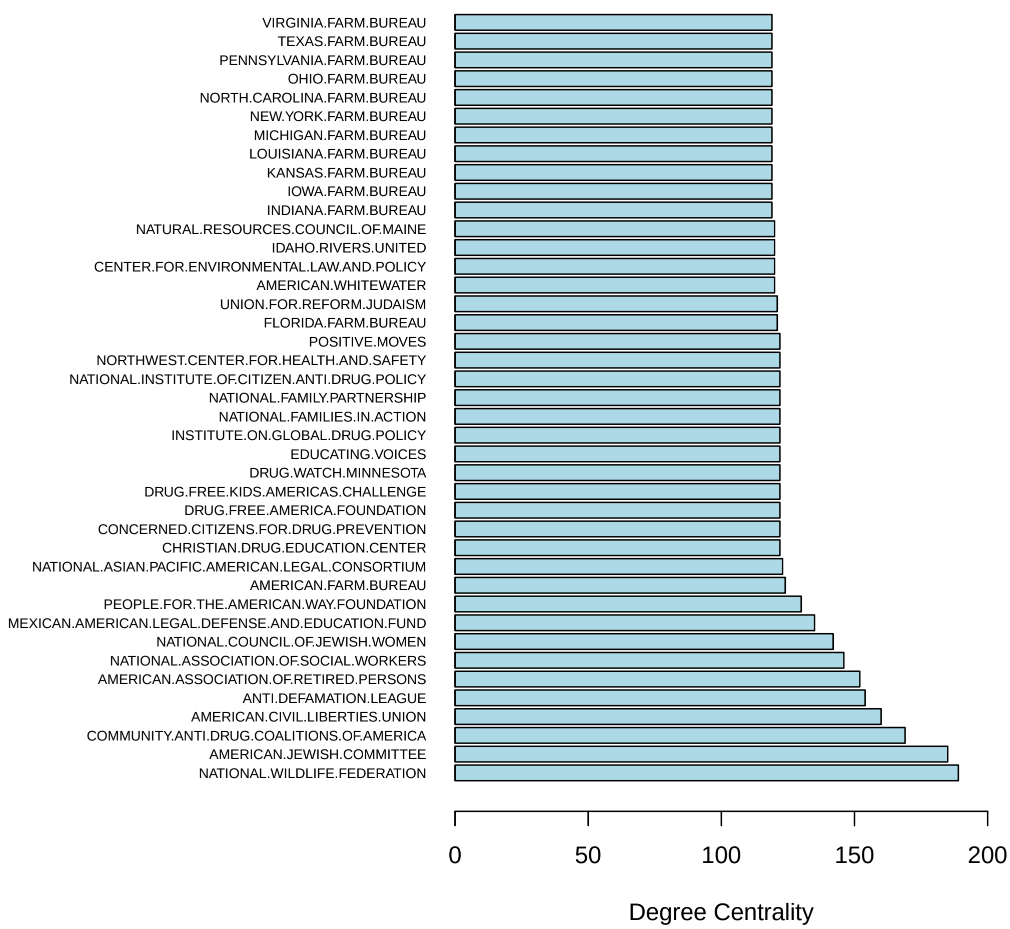
Figure 2 presents the top percentile of degree centrality interest groups. Given the multiple case framework of the network, the links can be over several cases and thus repeat players are typically, but not always, those with a higher degree. Table 1 shows that on average, degree is 23.6, implying that over the seven year period any interest group amicus brief filer would have about 24 cosigners.

Another way an interest group might play a central role is as a middleman between two other groups. Betweenness measures the number of times an interest group lies on the shortest path between several other groups. High betweenness interest groups are then directly along the stream of communication between other interest groups. The average period betweenness ranges from 157 to 4031 across these networks. Such a large range illustrates that some interest groups belong to large and intertwined networks, while others appear as a friend of the Court alone. The highest number, in this case for the National Association of Criminal Defense Lawyers (NACDL), suggests that removing this organization would have a disproportionately large impact on the connections of other groups to each other. The high betweenness groups are less easily categorized, but appear to revolve around various issue groups, including: civil rights, mental health, environment, education and technology, as shown in Figure 3.

2.1.1 Egocentric Networks

While the average node centrality measures tell us a great deal about the structure of the network, we next unpack the highest centrality interest groups and more carefully examine their respective egocentric networks. These are the key players in the network and may lend insight into the common networking practices of successful interest groups. As mentioned above, two common measures of centrality avail themselves to this study. However, these measures (by definition) differed in their selection of the most central

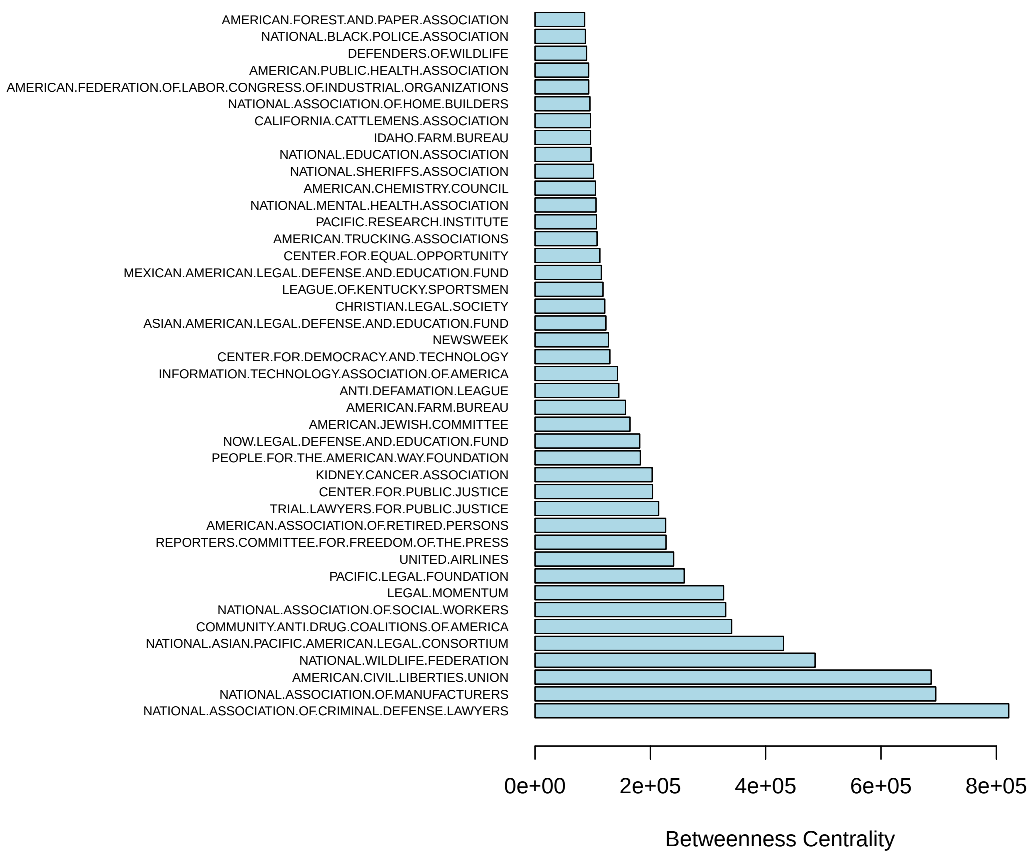
Figure 2: Top Percentile Degree Centrality



interest group. Degree suggests that the NWF was the most central of interest groups. Betweenness suggests that the NACDL was the most central. While the NWF was in the top percentile with either measure, the NACDL was only a central player by measure of betweenness centrality. In typical social science fashion, both measures of centrality are applicable and lend unique insight into how interest groups can successfully use their networks to accomplish their objectives.

Figures 4 and 5 present the egocentric networks of the two central players:

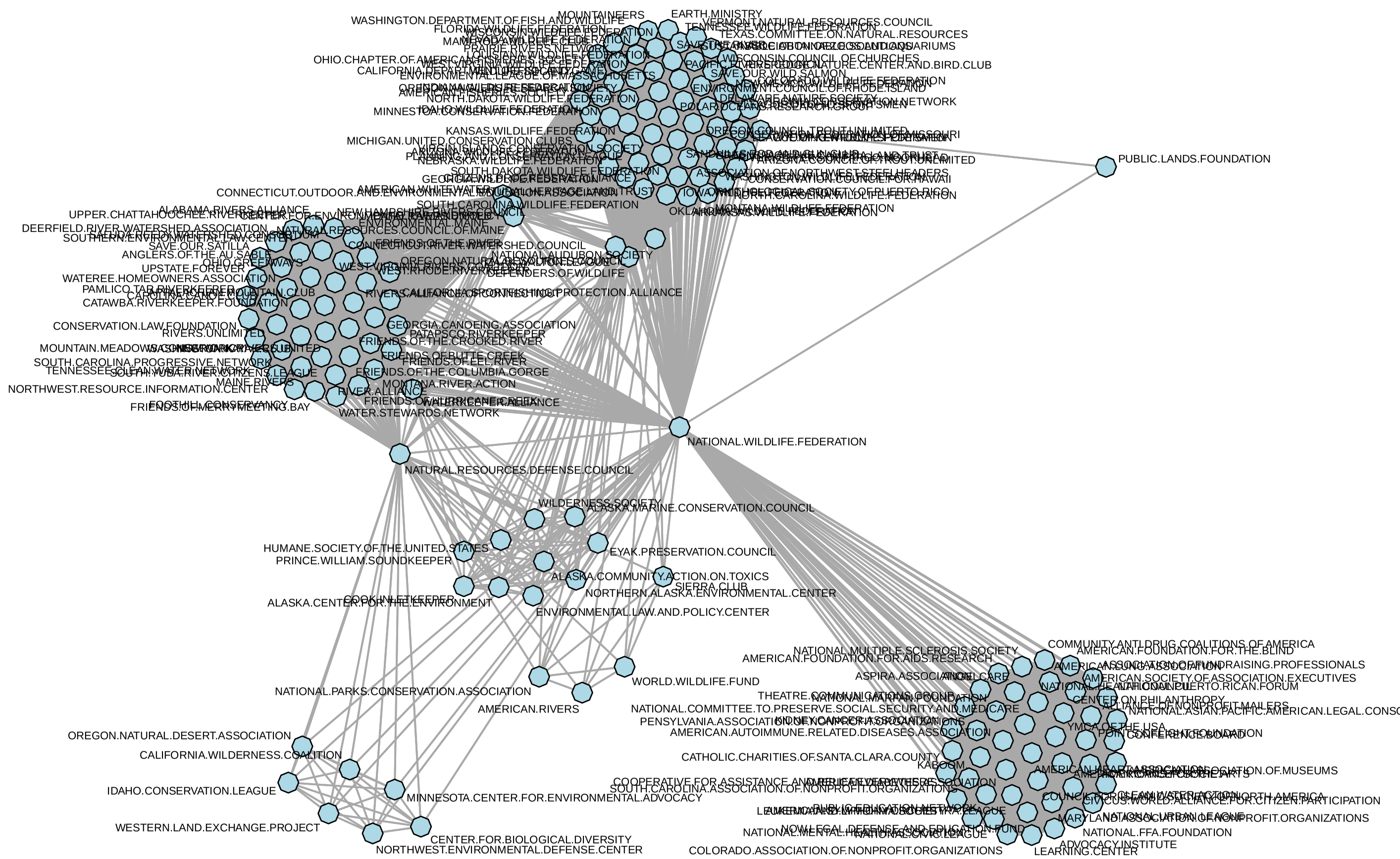
Figure 3: Top Percentile Betweenness Centrality



NWF and NACDL. It is readily apparent that groups network with others that share issue area interests as well as ideological positions. Thus contrary to networks built on the LDA issue areas or contributions alone, the amici network illustrates links that are based on both issue areas and ideological direction.

As shown in Figure 4, the NWF cosigned amicus briefs that link various regional wildlife organizations, conservation organizations and more general non-profit organizations, which may share interests and/or ideology. Particularly interesting and the reason why it is a central player, is that despite various clusters in the network, the NWF cosigns widely. Other groups sign

Figure 4: Egocentric Network of Central Node by Degree: National Wildlife Foundation



exclusively with a seemingly set network of like-minded organizations, illustrated by the tight star-like clusters, but the NWF appears to have broad interests in cases before the USSC and shares ideological positions with a host of groups. Thus the NWF serves as a hub to organizations sharing a common interest in the environment.

Contrarily, Figure 5, suggests that the NACDL power stems from their ability to indirectly link a host of seemingly unrelated organizations, which appear to only share a common left-leaning ideology. Particularly interesting and the reason why it is a central player, is that the seemingly broad issue interests in the network would not be linked to each other without the NACDL. The network suggests that the NACDL is a key hub organization for various groups of a common ideological bent.

Like the NWF, The American Civil Liberties Union (ACLU) shows up in the top percentile in both indicators of centrality (see Figures 2 and 3). It should come as no surprise to find the ACLU among those most connected interest groups before the USSC. The less obvious point is that it is also among the most central players in terms of betweenness. The ACLU, with its general scope and pervasive influence before the USSC, links a host of interests that would be unrelated otherwise.

Figure 6 illustrates the ACLU's egocentric network. It exhibits characteristics of both high degree and high betweenness. As such, it looks like a combination of features from the previous NWF and NACDL networks. Much like the NWF, the ACLU reaches out to tightly grouped factions, and much like the NACDL it acts as a central hub for diverse groups with less obvious commonalities.

3 Ideal Coalitions & Real Mixed Strategies

The full interest group network escapes an easy characterization. In addition, the egocentric networks of the most central players show that different groups apply varying coalition strategies. The distribution of centrality suggest that both circle and star networks exist simultaneously (see Barabási 2002). Rather than one or the other, clusters of tightly linked organizations, linked circularly and individually, are networked to other clusters by hub organizations, creating a sort of large scale star network. Furthtermore, looking at some of the key subnetworks above suggest a broad typology of interest group coalition strategy.

Figure 5: Egocentric Network of Central Node by Betweenness: National Association of Criminal Defense Lawyers

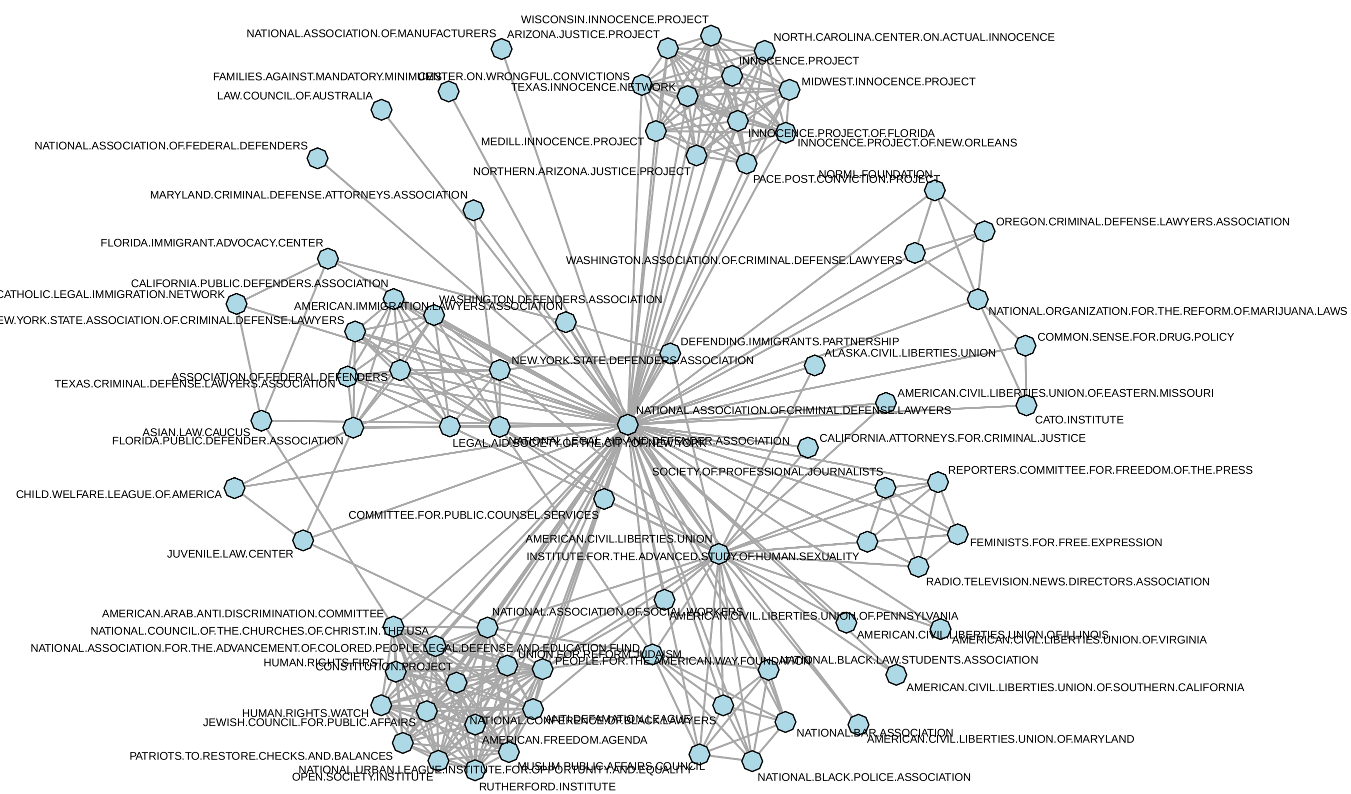


Figure 6: Egocentric Network of Jointly Central Node: American Civil Liberties Union

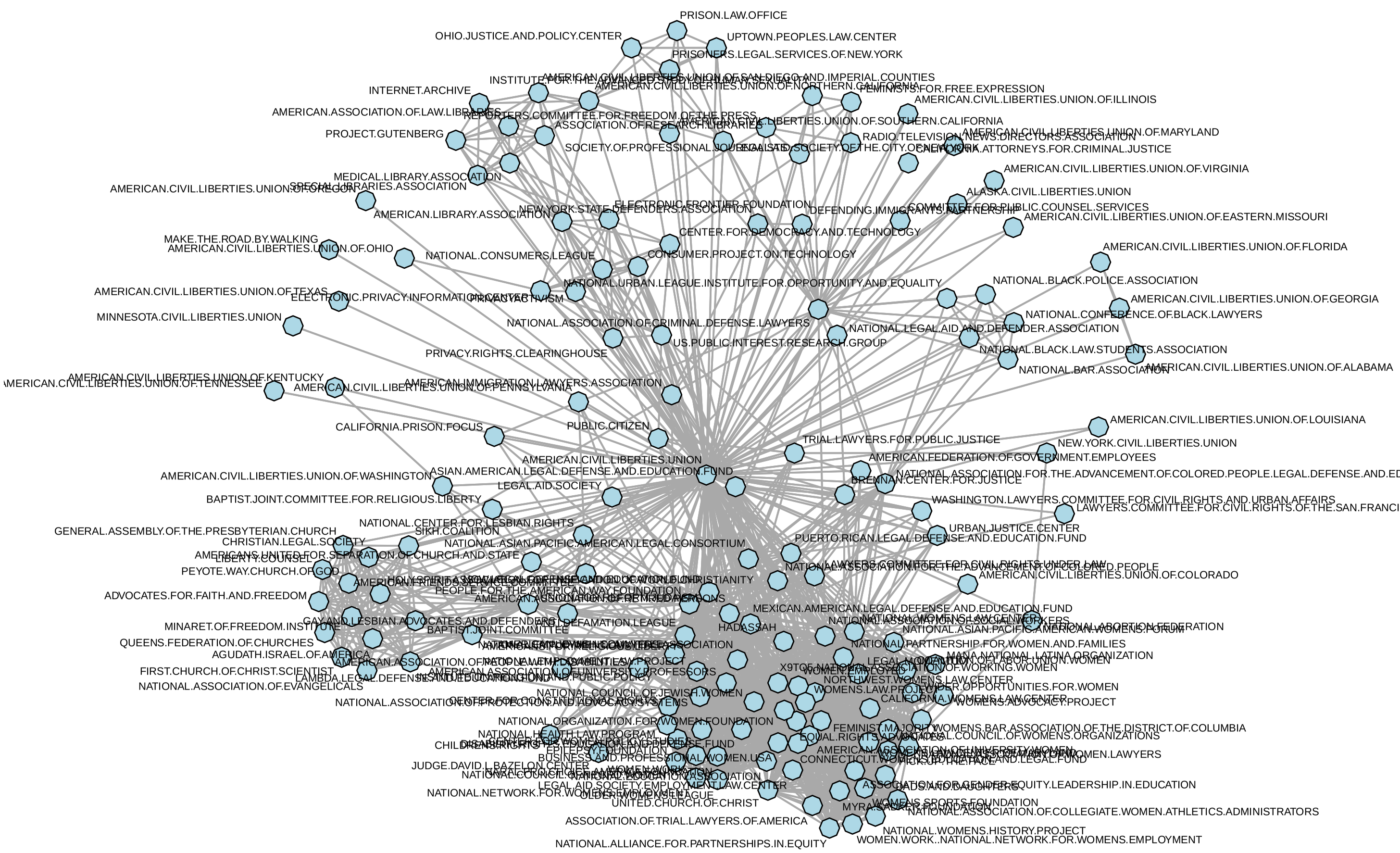
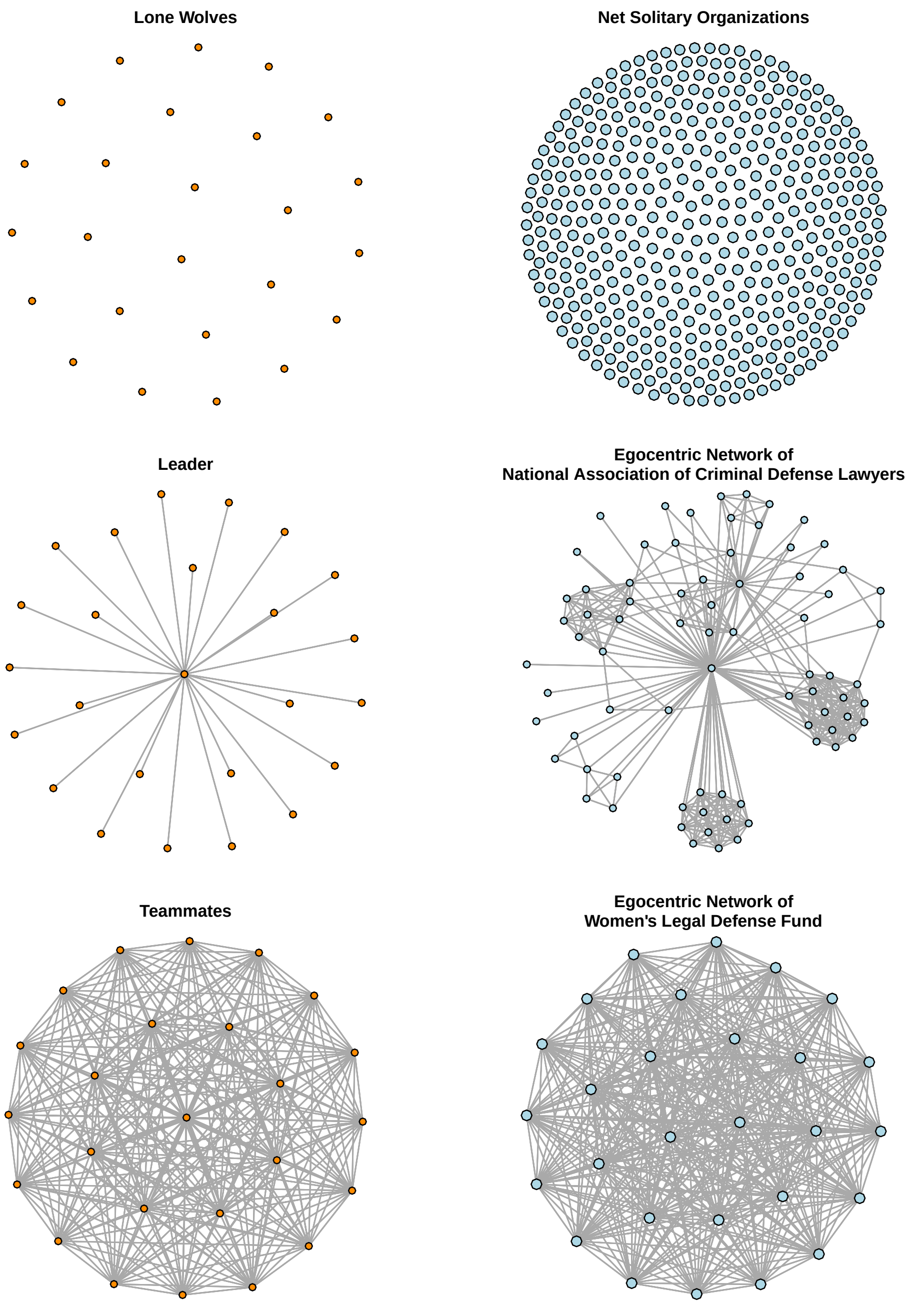


Figure 7: Ideal & Actual Interest Group Coalition Strategies



Ideal coalition structures are graphed in orange in the left column. Examples of similar egocentric interest group network structures are graphed in blue in the right column.

We contend that there is a reference set of ideal types that are useful when looking at interest group subnetworks. The ideal types are shown in Figure 7, in the left-hand column. *Lone Wolves* are solitary organizations that do not work as part of a coalition, but rather pursue their ends alone. *Leaders* connect groups to themselves and function as hubs. These groups take a strong leadership and coordination role between groups that would be otherwise unconnected. Subnetworks formed around such a leader will score relatively low on the density and clique measures. However, these networks are highly centralized and efficient. Finally, *Teammates* are all equally connected in their subnetworks. Both density and transitivity measures are high, while centralization and efficiency are low.

Figure 7, the right-hand column, shows actual groups from the data set that resemble these ideal types. There are a number of Lone Wolves in the data. Specifically, 446 groups, or approximately 10% have no connection to another group between 2000 and 2007. The NACDL illustrates the Leader ideal type well. Table 2 shows that the density measure for this group is 0.127 and clique measure is 0.524, both of which are relatively low. The Women's Legal Defense Fund is a classic example of a Teammate ideal type. The density and clique measures are both 1.000.

As a point of comparison, Table 2, row 1, provides some similar properties for the entire network. The measures of density, clique and centralization help describe the network. The density of the network is the number of edges divided by the number of possible edges in the graph. In substantive terms, we may think about density as the connectedness of the entire network of interest groups. Density measures for each year from 2000 to 2007 range from .011 to .046, but the overall low .006 score for the entire window suggests that many of the interest groups are not connected to as many of the others as they could be. Interest groups do not coordinate with all stake holders. Thus instead of many weak ties, the networks appear comprised largely of factions.

A measure of clique moves us to considerations of indirect relationships. It tells us the extent to which two interest groups that are indirectly linked by a third interest group, are also directly linked themselves. This is almost always the case in the interest group networks, which has a clique value of 0.846. It appears that in interest group networks being a *friend of a friend* also means *you are a friend.* Furthermore, for any single year in the 2000 to 2007 window, the clique score is higher than the that of the full period. Thus as opportunities for interest group coalitions increase, so too does the

Table 2: Interest Group Network Properties

Graph Structure	Density	Clique	Centralization
Full Network	0.006	0.846	0.040
Pure Type			
Clear Leader: NACDL	0.127	0.524	0.896
Teammate: WLDF	1.000	1.000	0.000
Heterogeneous Type			
Leader & Teammate: ACLU	0.137	0.597	0.874
Multiple Teams: NWF	0.295	0.913	0.712

Graph structural properties calculated for the full network, and egocentric networks of the National Association of Criminal Defense Lawyers (NACDL), Women's Legal Defense Fund (WLDF), the American Civil Liberties Union (ACLU), and the National Wildlife Foundation (NWF).

presence of indirect links between groups. In shorter periods, however, we note the greater potential for groups to enter that are part of interconnected relationships.

The general centralization score provides a sort of average value of the centrality of all the interest groups in the network. More formally, it is the difference between the maximum and mean node centrality score conditional on the number of nodes. Here the centrality scores for most of the interest groups are quite similar, resulting in a low centralization index for the total network of .040.[6]

As suggested in Figures 4 and 6, several subnetworks apply a mixed type strategy. The ACLU and the NWF are sometimes part of a team, and other times take the role of a leader. Thus they do not fit easily into our three category typology. Instead they appear to pursue a mixed strategy that employs aspects of both ideal coalition strategies. And looking at the entire network, indeed it appears that most groups pursue such a mixed coalition strategy, though not to the extent of these major players. We also

[6]The slight outlier across the data is the single year of 2007, which has a smaller number of cases and interest group cosignatories ([Box-Steffensmeier & Christenson 2009)see].

compare the subnetworks based on the neighborhood properties in Table 2. The bottom rows report the information for the ACLU and NWF. Comparing across the four measures, we see that the ACLU plays a role closer to that of a Leader than of a Teammate when compared to the NWF.

This look at network and subnetwork structures motivates questions of structural equivalence. To what degree are different interest groups exchangeable in these networks? And how are the positions of different groups in different cases similar? For example, an interest group may have a position in a network on a case involving patents that is quite similar to a group's in a case on free speech. This work allows for structural theories that generalize beyond issues, which we believe to be a contribution to the interest groups literature. We turn next to an examination of the factors that contribute to coalitions among interest groups.

4 Modeling Interest Group Coalitions

Having described the general properties of the interest group network, we move to modeling it. We posit that the homophily principle should apply to interest group networks, or that similarities among interest groups lead to coalitions among them. In other words, we expect that network ties between interest groups will be largely homogenous: having generally similar business characteristics, issue areas and resources help determine coalition formation. Thus we attempt to model the probability of observing this network of relationships conditional on graph-theoretic characteristics and interest group covariates. We seek to answer the question: which factors of these groups lead to the coalition formation seen above?

4.1 Graph-theoretic Characteristics

By using graph-theoretic characteristics in our model, we are modeling the structural effects of the network. (Robins, Pattison, Kalish & Lusher 2007) points out that in the ideal case, "we might even hypothesize that the modeled structural effects could *explain* the emergence of the network." Our model focuses on several commonly used graph-theoretic measures.[7] Edges provide a statistic for a mere count of the number of edges in the network.

[7]This is a preliminary model and subsequent models may involve additional ERGM terms

Interpreting this statistic helps us assess if groups are connected and the density of the entire network. Given the strong presence of cliques, we also employ 2-star and 3-star explanatory variables. The k-star refers to the number of nodes in the network with exactly k adjacent edges with unconnected end points. A triangle parameter builds on the k-star configuration by closing the loop between connected individuals. Specifically, it is the number of 3-cycles in the network (Saul & Filkov 2007). Finally, we also employ a control for the isolates in the network. The isolates measure captures an aspect of the network structure by assessing the number of nodes in the network without any connections.

4.2 Interest Group Characteristics

We use a number of interest group characteristics as explanatory variables, i.e., to explain the likelihood of links (or edges) in the network. Table 3 list some descriptive statistics for the covariates in the model. Because various organizations that work to influence the government but do not register as lobbyists, like many in this data set, this precludes using more focused "lobbying databases." Instead, we culled the covariate data from business and association directories. In particular, we relied on the Associations Unlimited (*Associations Unlimited* 2008) and Million Dollar (*Million Dollar Database* 2008) databases for interest group characteristics. These databases contain up-to-date association and business information for thousands of firms, organizations and associations.

In particular, from the databases we coded the *number of employees* for the organizations. The number of employees gets at the general size of the interest group. Similarly, we measure size through the *number of members*, an indicator that may be more reliable than employees for many of the public service associations. We believe that large groups are more likely to work with other large groups. Interest groups may want to display a united front to government on an issue of concern, and are likely to perceive organizations of similar size most necessary and, more importantly, most approachable in coalition building. Of course, the contrary argument is also quite attractive. If large groups are more likely to work with small groups, it suggests a leadership strategy, such that small groups might independently follow the lead of bigger groups.

The *longevity* of the group is also added to the model in the form of year in which the organization was established or founded. Such an indicator of

Table 3: Interest Group Characteristics

Covariates	Mean	Median	Std Dev	Min	Max
SIC	79	86	(16.246)	1	96
Year	1960	1973	(41.153)	1620	2007
Employees	1.20e+10	16	(5.04e+11)	1	2.12e+13
Members	265109	2800	(3678135)	0	1.00e+8
Budget	1.02e+7	2000000	(3.05e+7)	0	4.50e+8
Sales	2.88e+20	1450635	(6.82e+21)	0	2.07e+23
Plant Size	1279396	5685	(4.84e+7)	0	2.01e+9

Interest group characteristics refer to the average and range of the covariates for each interest group in the data set. The data were gathered from the Associations Unlimited (*Associations Unlimited* 2008) and Million Dollar (*Million Dollar Database* 2008) databases.

linkages might suggest that long standing, and perhaps wise, as testified to by their longevity, political groups are sought out.[8] Similarly, the *industry* of the group may help explain interest group linkages. This is essentially a measure of shared interests. We expect groups that share industrial demands to seek out mutually beneficial outcomes via cooperation. We measure the *industry* by using the associated U.S. Standard Industrial Classification (SIC) system. We divide groups according to the SIC Division listed. Figure 1 above uses the SIC covariate to color each of the groups in the full network. It is readily apparent, for example, that the bulk of interest groups were categorized as "service", category values $70 - 89$. This term broadly refers to service industries, including the 86s, which are political, religious and member organizations.[9]

[8]The *geographical region* of the group may be a useful variable, as the regional similarities may help explain why groups are connected. Temporary coding issues led to the exclusion of this variable in the model. We will pursue this in a future iteration.

[9]In future work, we intend to use the 2-digit SIC code. This provides further refinement of the industry the group works in. For example, the Division level divides groups into A to K where A is Agricultural Production, B is Mining, C is Construction, and so on. If one uses the 2-digit SIC codes, each Division is broken down further. For example, 01 is Agricultural Production - Crops, 02 is Agricultural Production - Livestock and Animal Specialties, while 08 is Forestry and 09 is Fishing, Hunting, and Trapping (*SIC Code List* N.d.). The refinement logic is that one wants the industries to be similar to assess whether industry explains linkages (Grier & Groseclose 1994, Grier, Munger & Torrent 1990).

In addition, different groups have different access to resources. We believe that many groups will seek out groups that are financially well endowed. To that end we control for both a group's *budget* and *annual sales*.[10]. Budgets indicate the potential influence of an organization. Large budgets signal the opportunity to muster resources, while small budgets suggest limitations in pursuing common goals. Likewise, sales provide some indicator of prior success and thus future expectations.

4.3 Methods

We use a class of models known as exponential random graph models (ERGM) (Wasserman & Pattison 1996). In ERGMs, network analysts examine the probability of relationships between members of a particular network conditional on additional data, in our case, based on interest group characteristics. The general form of the model we use is often referred to as a p-star model, which are used to examine whether particular characteristics of interest groups draw them to form networks.[11] P-star models have developed from the p1 (Holland & Leinhardt 1981) and Markov random graph (Frank & Strauss 1986) models, both of which were based on spatial statistics (Besag 1974, Handcock et al. 2008).

Handcock et al. (2008) provides a useful characterization of the network methodology field by dividing it up into three parts. First, descriptive techniques are used to characterize the network. There a wide variety of measures to characterize networks and enable scholars to compare and contrast the networks, some of which we have employed above (Wasserman & Faust 1994). Second, permutation methods, which use computationally intensive resampling, perform statistical inference while dependence is treated as a nuisance. Third, generative models, in which dependence is important and focus is on

[10]We would like to be able to test whether the *ideology* of a group helps explain linkages as the expectation is that this matters. Unfortunately, we do not yet have a measure of ideology in our data set applicable to all groups. We plan to further investigate data from the Center of Responsive Politics' Open Secrets database to see if construction of such a measure is possible for the $4,000$ plus interest groups we want to study over the last decade. More likely, we will need to consider modeling approaches to account for the fact that this aspect is unmeasurable

[11]P-star models are available for single or multiple networks. While we use it for a single network in this paper, we plan to use it for multiple networks to study the similarities and differences across different policy networks, such as health care and education in future work.

model evaluation and inference. ERGMs fall into the third category.

The foundational model of (Holland & Leinhardt 1981) is built on the idea that a statistical model can be generated by predicting the counts of types of ties, which are symmetric, null, and asymmetric. The log-linear model they develop is equivalent to a logit model of the dyads.

$$logit(X_{ij} = 1) = \alpha_i + \beta_j + \rho(X_{ji})$$

The subscripts imply a different parameter for every node i and j in the model, plus one for reciprocity. The many ERGM extensions are built off this foundational and intuitive equation.[12]

The general goal of network modeling is to "predict the joint probability that a set of edges exists on nodes in a network" (Handcock et al. 2008). The nodes are our interest groups and the edges are the links between them. ERGMs were extensions to explicitly address the fact that the edges are typically not independent. Network statistics are properly regarded as outcomes, and the goal of the [ERG] model is to specify the process that leads to their joint distribution. Both graph-theoretic and interest group characteristics are included as covariates.[13]. Our goal is to shed light on why networks are likely to form between particular units. That is, we expect some assortative mixing of interest groups based on policy area, region, size, and other business characteristics.[14]

We estimate the ERGM with Markov Chain Monte Carlo (MCMC), an important and rather recent innovation that allows for estimation on large, complex networks, arguably like that of interest groups (see Snijders et al. 2006). To simplify, an ERGM uses network statistics and covariates to maximize the likelihood of observing the network. Appropriate fit of the ERGM implies then that the collection of statistics do a better job of creating the network at hand than other possible networks. Unfortunately, for anything but the smallest of networks, the computational demands of the maximization are too great. MCMC provides an alternative by iteratively

[12] Anderson, Wasserman & Crouch (1999) provides a useful primer.

[13] Even though a number of the graph-theoretic characteristics are highly collinear, in practice this does not cause a problem for estimation (Hunter 2007, Robins, Snijders, Wang, Handcock & Pattison 2007)

[14] Longitudinal ERGMs can be used to look at dynamically changing networks. Berardo & Scholz (2007) uses such a model to look at the network formation and selection of partners in the policy area of estuaries. We are collecting interest group network data back to 1955 and will look at network dynamics in future work.

sampling networks from a distribution based on the model maximum likelihood parameters from the previous sample (Geyer & Thompson 1992). The estimates are gathered when the sample iterations can no longer improve on the likelihood.

5 Results

Figure 4 presents the results of the ERGM. To demonstrate the respective power of the graph and covariates, we proceed in steps to model the network. The ERGM is first estimated with the key graph-theoretic characteristics of the network: edges, 2-star, 3-star, triangles, and isolates for our relatively large and complex, nondirected interest group network (see Model I). Interest group characteristics that may play a role in the formation of the network are then added to the model (see Model II). The final step is to simplify by estimating a more restrictive model (which is determined by looking at the statistical significance of the variables) until the simplest model is estimated that does not decrease the fit of the model (Anderson, Wasserman & Crouch 1999) (see Model III). The interpretation of the model coefficients is similar to that of logit models. Thus when an a parameter estimate is positive (negative), the probability of a link between two interest groups is larger (smaller) than the probability they are unlinked (linked), conditional on all other parameters in the model.

The MCMCMLE parameter estimates for the ERGM are presented in Table 4. At first glance, it is clear that the graph-theoretic properties are extremely important, as expected. All of the parameters are statistically significant and quite powerful in terms of the information criterions.[15] Focusing on Model III, The negative density parameter tells us that the edges, which link the groups in this nondirected network, are not common and that when they do occur, they are part of higher order structures such as the stars and triangles. The 2-star parameter is also negative. Similarly, it tells us that interest groups ties between three groups are less likely unless part of a higher order structure, in our case triangles.

[15]While the distribution of the ratio of the estimate to its standard error is not known, literature uses the approximate t-distribution (Robins, Pattison, Kalish & Lusher 2007, Snijders & Van Duijn 2002). In addition, a one-sided test is appropriate for the triangle parameters, re: 1.65 times the standard error at the 5 percent level (Robins, Snijders, Wang, Handcock & Pattison 2007).

Table 4: ERGM of Interest Group Coalitions, 2000-2007

	Model I		Model II		Model III	
Term	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
Edges	-5.329	(0.051)			-5.230	(0.051)
Triangle	0.841	(0.004)			0.820	(0.003)
K-Star 2	-0.110	(0.005)			-0.136	(0.005)
K-Star 3	0.001	(0.000)			0.001	(0.000)
Isolates	2.709	(0.153)			2.629	(0.121)
Budget			-0.308	(0.057)	0.752	(0.062)
Employees			-2.086	(0.016)	0.158	(0.019)
Sales			-2.304	(0.020)	0.315	(0.025)
Founded			-3.499	(0.012)	0.231	(0.021)
SIC			-4.212	(0.008)	0.700	(0.013)
Members			-0.759	(0.040)	0.639	(0.059)
Plant Size			-2.581	(0.019)	0.042	(0.025)
AIC	72340		8556936		70973	
BIC	72410		8557033		71140	

All covariates are coded categorically and result in a uniform homophily stastic when the respective attribute is shared by two edges.

The 3-star parameter is positive, but very close to zero.[16] The triangle parameter is positive and thus tells us that the interest group network structure clearly clusters in cliques. Our pattern of alternate signs on the 2-star versus triangle parameter is a common one. (Robins, Snijders, Wang, Handcock & Pattison 2007) explains that this is interpreted as two countervailing forces. One that is a trianglulated core-periphery structure and one against a degree-based core-periphery structure. Overall, we see that the global outcome is "not a single core of one internally densely connected set of nodes, but several (often connected) smaller regions of overlapping triangles" ([Robins, Snijders, Wang, Handcock & Pattison 2007)205]. Simulations show that if there is a positive fixed value for the triangle parameter and the k-star parameters move from 0 to increasingly negative values, then the overall network moves from centralization to segmentation (Robins, Snijders, Wang, Handcock & Pattison 2007). The last graph-theoretic parameter is for the isolates. For our nondirected network, an isolate is defined to be any node with degree zero. The isolates term captures the network structure by accounting for groups that do not cosign.

In addition, several of the interest group covariates appear statistically significant and in the appropriate direction in the final model, Model III. Interest groups with similar budgets are more likely to be linked to one another, as are interest groups with similar sales. Thus, the wealthy and profitable organizations work with each other to accomplish their goals. In addition, the large employers work with other large employers more often than not, as do large membership organizations. Finally, interest groups that work in the same industry also influence the formation of the network. More established groups tend to form coalitions as well. Only size of the operating plant showed little to no significant impact on network formation.[17]

A minimum criteria for a model to fit well is parameter convergence and to be nondegenerate. For a model to be nondegenerate, it should not place all of the probability on a few networks that are unlike the observed network, such as a full or empty network. Beyond this, the information criterions, AIC and BIC, can be compared with the lower values showing an increase in the model fit. Looking again at Table 4, we see the preferred model is Model III in the last two columns, which contains both the graph-theoretic and

[16]Note that 1-star is simply the number of edges in a nondirected network such as ours.

[17]The likelihood of the model and overall results are virtually untouched by removing the insignificant variable. They are left in for illustrative purposes.

interest group characteristics as covariates. While the information criterions have been shown to be consistent with model fit, because the appropriate sample size is unknown and because the observations are not iid, they are not completely appropriate (Hunter & Handcock 2006). To that end, we also tested goodness of fit with post estimation graphical plots. The trace plots show that the models converge with a 1,000 burnin and 10,000 iterations. The fit of the simulation results for dependence show that the model, while not perfect, does a respectable job of reproducing this very complex network.

6 Discussion

The project aims to make both theoretical and empirical contributions to the study of political behavior and network analysis.[18] By applying an ERGM, we gain some understanding into underlying social processes that could (or could not) have generated the interest group network structure. The illuminated structures lend some insight into the central players and overall formation of the network from $2000 - 2007$. Factions of interest groups are tied together by central players, who act as hubs, leaving a disparate collection of organizations that work alone. A mixed strategy between acting as an efficient leader or a team player is pursued by many of the groups.

This model moves us toward a more focused examination of the multitude of factors that have created the current network of interest groups. In short, the overall structure of the network revealed a pattern of alternate signs on the 2-star versus triangle parameter that results in many, often connected, regions of tight association rather than a single core of densely connected groups. The overall network is better characterized as segmented than centralized. The interest group covariates shows that policy interest, organizational structure of the groups, and resources all matter in choosing partners. Graph-theoretic and shared interest group attributes both help to recreate and characterize this large, complex interest group network.

[18] Additional work in the project examines the impact of interest group networks, including an analysis of how interest group network measures affect Supreme Court decision making. That is, there is an extensive literature on explaining the ideological direction of individual justices' votes and the decision to author an opinion (e.g., Rohde & Spaeth 1976, Segal & Spaeth 1993, Segal & Spaeth 2002, Sunstein et al. 2006). Interest groups are posited to have a major role. Our interest group network measures offer an improvement on the operationalization of the posited influence.

The state of our democracy depends on the ability of individuals and organizations to find representation for their respective values in the bodies of government. Organizations, however, do not simply attempt to influence government alone. Instead, as network and interest group theories suggest, organizations typically collaborate. Combining forces is a time-honored tradition in the pursuit of political ends, and yet there is much to still learn about the gamut of networks in our political system and how they operate.

Our work helps provide additional information about interest group networks, which contributes to a fuller understanding of key political players and the behavior of those players, while also addressing the alternative theoretical perspectives on interest group coalition ideal types. While informative work has focused on understanding the network of interest groups across issue areas, we still have much to learn about purposive network formation.

References

Almeida, Richard A. 2004. "Interest Group Coalitions and the Spatial Theory of Choice: A Spatial Model of Group Participation on Amicus Curiae Briefs." Paper prepared for the Annual Meeting of the Midwest Political Science Association.

Anderson, C.J., S. Wasserman & B. Crouch. 1999. "A P* Primer: Logit Models for Social Networks." *Social Networks* 21(1):37–66.

Associations Unlimited. 2008.

Bacheller, John. 1977. "Lobbyists and the Legislative Process: The Impact of Environmental Constraints." *American Political Science Review* 71(1):242–263.

Barabási, Albert-László. 2002. *Linked: The New Science of Networks*. New York: Perseus.

Berardo, R. & J.T. Scholz. 2007. Self-Organizing Policy Networks: Risk, Partner Selection and Cooperation in Estuaries. In *Conference on Advanced Political Network Modelling, Mannheim, Germany.*

Berry, Jeffrey M. 1977. *Lobbying for the People: The Political Behavior of Public Interest Groups*. Princeton University Press.

Berry, Jeffrey M. & Clyde Wilcox. 1989. *The Interest Group Society.* Longman.

Besag, J. 1974. "Spatial Interaction and the Statistical Analysis of Lattice Systems." *Journal of the Royal Statistical Society. Series B (Methodological)* 36(2):192–236.

Box-Steffensmeier, Janet M. & Dino P. Christenson. 2009. "Amicus Curiae Networks: Lobbying the Supreme Court.". Paper prepared for presentation at the Annual Meeting of the Southern Political Science Association: Atlanta, GA.

Burt, Ronald S. 2000. "Decay Functions." *Social Networks* 22:1–28.

Burt, Ronald S. 2001. Structural Holes versus Network Closure as Social Capital. In *Social Capital: Theory and Research*, ed. Nan Lin, Karen Cook & Ronald S. Burt. Aldine Transaction chapter 2.

Caldeira, Gregory A. & John R. Wright. 1990. "Amici Curiae before the Supreme Court: Who Participates, When, and How Much?" *The Journal of Politics* 52(3):782–806.

Carpenter, Daniel, Kevin M. Esterling & David M. J. Lazer. 1998*a*. "The Strength of Strong Ties: A Model of Contact-Making in Policy Networks with Evidence from U.S. Health Politics." *The Journal of Politics* 10(4):417–444.

Carpenter, Daniel, Kevin M. Esterling & David M. J. Lazer. 1998*b*. "The Strength of Weak Ties in Lobbying Networks." *Journal of Theoretical Politics* 10(4):417–444.

Carpenter, Daniel P., Kevin M. Esterling & David M. J. Lazer. 1998*c*. "The Strength of Weak Ties in Lobbying Networks: Evidence from Health Care Politics." *Journal of Theoretical Politics* 10:417–444.

Christakis, Nicholas A. & James H. Fowler. 2007. "The Spread of Obesity in a Large Social Network over 32 Years." *New England Journal of Medicine* 358:2249–2258.

Cigler, Allan J. & Burdett A. Loomis. 1991. Organized Interests and the Search for Certainty. In *Interest Group Politics*, ed. Cigler & Lewis. 3 ed. Washington DC: Congressional Quarterly Press.

Clark, Peter B. & James Q. Wilson. 1961. "Incentive Systems: A Theory of Organizations." *Administrative Science Quarterly* 6(2):129–166.

Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94(s1):95–120.

Collins, Paul M. 2008. *Friends of the Supreme Court: Interest Groups and Judicial Decision Making*. Oxford University Press.

Cummings, Jeanne. 2008. "New Disclosure Reports Lack Clarity.".

Esterling, Kevin M. 2004. *The Political Economy of Expertise: Information and Efficiency in American National Politics*. Ann Arbor: University of Michigan Press.

Frank, O. & D. Strauss. 1986. "Markov Graphs." *Journal of the American Statistical Association* 81(395):832–842.

Freeman, Linton C. 1979. "Centrality in Social Networks, Conceptual Clarification." *Social Networks* 1(3):215–239.

Geyer, C.J. & E.A. Thompson. 1992. "Constrained Monte Carlo maximum likelihood for dependent data." *Journal of the Royal Statistical Society. Series B (Methodological)* 54(3):657–699.

Gibson, James L. 1997. *United States Supreme Court Judicial Data Base, Phase ll: User's Guide*.

Gilsing, Victor A. 2005. *The Dynamics of Innovation and Interfirm Networks: Exploration, Exploitation and Co-evolution*. Edward Elgar.

Gilsing, Victor, Bart Nooteboom, Wim Vanhaverbeke, Geert Duysters & Ad van den Oord. 2008. "Network embeddedness and the exploration of novel technologies: Technological distance, betweenness centrality and density." *Research Policy* 37(10):1717–1731.

Granovetter, Mark S. 1973. "The Strength of Weak Ties." *The American Journal of Sociology* 78(6):1360–1380.

Gray, V. & D. Lowery. 1998. "To lobby alone or in a flock: foraging behavior among organized interests." *American Politics Research* 26(1):5.

Grier, K.B., M.C. Munger & G.M. Torrent. 1990. "Allocation Patterns of PAC Monies: The US Senate." *Public Choice* 67(2):111–128.

Grier, Kevin & Tim Groseclose. 1994. "Maximizing Electoral Votes vs. Maximizing the Probability of Re-Election: Competing Influences on Presidential Vetos." 999:Apsa, 1994.

Hagedoorn, John. 1993. "Understanding the Rationale of Strategic Technology Partnering: Interorganization Modes of Cooperation and Sectoral Differences." *Strategic Management Journal* 14(5):371–385.

Hamel, Gary. 1991. "Competition for Competence and Inter-Partner Learning Within International Strategic Alliances." *Strategic Management Journal* 12:83–103. Special Issue: Global Strategy.

Handcock, M.S., D.R. Hunter, C.T. Butts, S.M. Goodreau & M. Morris. 2008. "statnet: Software Tools for the Representation, Visualization, Analysis and Simulation of Network Data." *Journal of Statistical Software* 24(1):1548.

Hanneman, Robert A. & Mark Riddle. 2005. "Introduction to Social Network Methods." University of California, Riverside: Online.

Heinz, John P., Edward O. Laumann, Robert L. Nelson & Robert H. Salisbury. 1993. *The Hollow Core. Private Interests in National Policy Making*. Harvard University Press.

Hojnacki, Marie. 1998. "Organized Interests' Advocacy Behavior in Alliances." *Political Research Quarterly* 51(2):473–459.

Holland, P.W. & S. Leinhardt. 1981. "An Exponential Family of Probability Distributions for Directed Graphs." *Journal of the American Statistical Association* 76(373):33–50.

Hula, Kevin. 1995. Rounding Up the Usual Suspects: Forging Interest Group Coalitions. In *Interest Group Politics*, ed. Allan J. Cigler & Burdett A. Loomis. 4 ed. CQ Press.

Hula, Kevin W. 1999. *Lobbying Together: Interest Group Coalitions in Legislative Politics*. Gerogetown University Press.

Hunter, D.R. 2007. "Curved exponential family models for social networks." *Social Networks* 29(2):216–230.

Hunter, D.R. & M.S. Handcock. 2006. "Inference in curved exponential family models for networks." *Journal of Computational and Graphical Statistics* 15(3):565–583.

Iida, Rentaro. 2010. "Interest Group Network in Judicial Decision Making: Does Brokerage Bring Success to Interest Groups?" Paper Presented at the Annual Meeting of the Midwest Political Science Association.

Kearney, Joseph D. & Thomas W. Merrill. 2000. "The Influence of Amicus Curiae Briefs on the Supreme Court." *University of Pennsylvania Law Review* 148(3):743–855.

Kingdon, John W. 1981. *Congressmen's Voting Decisions*. 2 ed. New York: Harper &Row.

Knoke, D. 1990. *Political Networks: The Structural Perspective*. Cambridge: Cambridge Univ Press.

Krebs, Valdis. 2004. "Power in Networks." *orgnet.com* .

Loomis, Burdett A. 1986. Coalition of Interest: Building Bridges in the Balkanized State. In *Interest Group Politics*, ed. Cigler & Lewis. Washington DC: Congressional Quarterly Press.

Mahoney, Christine. 2004. "The Power of Institutions: State and Interest-Group Activity in the European Union Politics." *European Union Politics* 5(4):441–466.

Mahoney, Christine. 2007. "Networking vs. Allying: The Decision of Interest Groups to Join Coalitions in the US and the EU." *Journal of European Public Policy* 14(3):366–383.

Marsden, Peter V. 1990. "Network Data and Measurement." *Annual Review of Sociology* 25:1–16.

Mayer, Lindsay R. 2007. "Under the Radar." Published online at OpenSecrets: Capital Eye Blog.

Mayhew, David R. 1974. *Congress: The Electoral Connection.* New Haven: Yale University Press.

Million Dollar Database. 2008.

Powell, Walter W., Kenneth W. Koput & Laurel Smith-Doerr. 1996. "Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology." *Administrative Science Quarterly* 41(1):116–145.

Robins, G., P. Pattison, Y. Kalish & D. Lusher. 2007. "An introduction to exponential random graph (p*) models for social networks." *Social Networks* 29(2):173–191.

Robins, Gary, Tom Snijders, Peng Wang, Mark Handcock & Philippa Pattison. 2007. "Recent developments in exponential random graph (p*) models for social networks." *Social Networks* 29:192–215.

Rogers, Everett M. 1987. "Progress, Problems and Prospects for Network Research: Investigating Relationships in the Age of Electronic Communication Technologies." *Social Networks* 9:285–310.

Rohde, David W. & Harold J. Spaeth. 1976. *Supreme Court Decision Making.* W.H.Freeman & Co Ltd.

Saul, Z.M. & V. Filkov. 2007. "Exploring biological network structure using exponential random graph models." *Bioinformatics* 23(19):2604.

Scheppele, Kim L. & Jack L. Walker. 1991. Litigation Strategies of Interest Groups. In *Mobilizing Interests Groups in America: Patrons, Professions, and Social Movements*, ed. Jack L. Walker. Ann Arbor: University of Michigan Press.

Schlozman, Kay L. & John T. Tierney. 1986. *Organized Interests and American Democracy.* Harper and Row.

Segal, Jeffrey A. & Harold J. Spaeth. 1993. *The Supreme Court and the Attitudinal Model.* New York: Cambridge University Press.

Segal, Jeffrey A. & Harold J. Spaeth. 2002. *The Supreme Court and the Attitudinal Model Revisited.* New York: Cambridge University Press.

SIC Code List. N.d. Online. Copyright 2010 Benivia LLC All rights reserved. Revised: 2010-Jan-29.

Snijders, T.A.B. & M.A.J. Van Duijn. 2002. "Conditional maximum likelihood estimation under various specifications of exponential random graph models." *Contributions to Social Network Analysis, Information Theory, and Other Topics in Statistics; A Festschrift in honour of Ove Frank. University of Stockholm: Department of Statistics* pp. 117–134.

Snijders, T.A.B., P.E. Pattison, G.L. Robins & M.S. Handcock. 2006. "New specifications for exponential random graph models." *Sociological Methodology* 36(1):99–153.

Solberg, Rorie Spill & Eric N. Waltenburg. 2006. "Why Do Interest Groups Engage the Judiciary? Policy Wishes and Structural Needs." *Social Science Quarterly* 87(3):558–572.

Spaeth, Harold J. 1953. *United States Supreme Court Judicial Database.* 1953–2007 ed. ICPSR.

Stuart, Toby E. 1998. "Network Positions and Propensities to Collaborate: An Investigation of Strategic Alliance Formation in a High-Technology Industry." *Administrative Science Quarterly* 43(3):668–698.

Sunstein, C.R., D. Schkade, L.M. Ellman & A. Sawicki. 2006. *Are Judges Political?: An Empirical Analysis of the Federal Judiciary.* Brookings Institution Press.

Teece, D. J. 1986. "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy." *Research Policy* 15(6):286–305.

Wasserman, S. & K. Faust. 1994. *Social Network Analysis: Methods and Applications.* Cambridge Univ Pr.

Wasserman, Stanley & Philippa Pattison. 1996. "Logit Models and Logistic Regressions for Social Networks: An Introduction to Markov Graphs and P*." *Psychometrika* 61(3):401–425.

Whitford, Andrew B. 2003. "The Structures of Interest Coalitions: Evidence from Environmental Litigation." *Business and Politics* 5(1):45–64.

Yates, Stephanie. 2010. "Which Role for Which Organization? A Model to Predict Organizations' Role and Place Within Coalitions." Paper presented at the 2010 Annual Meeting of the Midwest Political Science Association, Chicago, IL.