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The Politics of Connections: Assessing the Determinants of Social Structure in Policy Networks

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ABSTRACT

This article investigates the role of resource dependence in explaining the social structure of policy networks while controlling for the effects of microstructure, such as the tendency for networks to display reciprocity and/or transitive closure. While previous studies have analyzed resource dependence as a factor in decision making in policy networks, surprisingly little is known about the effects of these social factors on the structure of policy networks due, in part, to the statistical challenges in modeling them precisely. However, the recent development of the exponential random graph model technique, a stochastic method for studying social structure, has made it possible to overcome the statistical hurdles. This study draws on longitudinal data collected from an adult basic education policy network during 1998 and 2005 in a state to which we gave the pseudonym "Newstatia." The findings suggest that decreased resource munificence may cause network segmentation and change the composition and nature of relationships among policy network members. These findings confirm our prior expectation that policy network activity and structure is animated by a desire to control resources. In addition, the observed policy network structure is greatly influenced by balancing operations undertaken by resource holders (e.g., legislators and state agencies) and resource seekers (e.g., service providers) and the generic social pressures for reciprocity and transitivity.

INTRODUCTION

For decades, scholars have recognized that public organizations with an enduring interest in a particular substantive policy area and their senior public managers are enmeshed in informal webs of relationships. More recently termed "policy networks," these webs are an alternate forum for policy deliberation and policy making. Policy networks provide a structure within which senior public managers play a role in guiding decision processes. Numerous studies on policy networks have suggested that resource

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dependence theory (RDT) provides a very useful theoretical framework to understand the nature of policy networks and their structure (Hatmaker and Rethemeyer 2008; Rethemeyer 2007a, 2007b; Rethemeyer and Hatmaker 2008); further, these studies have focused on the necessity of resource seeking and resource gathering as the "glue" that holds policy networks together. Coalitions and elements of hierarchy—some even institutionalized as organizations in the form of industry or interest associations—result from attempts to tame dependence.

Our questions, then, are the following: (1) What role does resource dependence play in explaining the relational structure of a policy network and the behavior of public and private organizations in terms of their relational choice in it? (2) What does this tell us about network management, a task that public managers must increasingly undertake? Numerous studies have explored the answers to these questions. Previous literature, however, has not taken into account the fact that connections between organizations may occur due to larger, structural pressures within a given network. For instance, some networks have a strong tendency toward reciprocity or transitive closure (e.g., a friend of a friend is also a friend). These "network effects" may condition other factors that tend to steer organizations into political connections, such as influence, dependence, or unique access to information.

In an effort to address these questions, we explore these microstructural effects on the presence and/or absence of relational ties among policy network members using an RDT framework. We analyze two sets of data drawn from the same policy network at two points in time—1998 and 2005. The data collections are too far apart to model with longitudinal methods (Steglich, Snijders, and West 2006), so we model each time period using the exponential random graph model (ERGM) implemented in the software Simulation Investigation for Empirical Network Analysis (also known as SIENA), a stochastic social network package developed by Snijders and his associates (Boer et al. 2006; Snijders 2001, 2002b, 2005). From this effort, we draw a series of propositions, both about the general nature of policy network structures and about the dynamics we observe by analyzing changes between two time periods.

This study proceeds in four sections. The first discusses the policy network framework, resource dependence, and network theories of organizational connectedness. The second reviews the cases selected and research methods, including a brief introduction to stochastic social network methods and SIENA. In the third section, we present findings from our longitudinal data on an adult basic education (ABE) policy network between 1998 ("Wave 1") and 2005 ("Wave 2") in a state to which we gave the pseudonym "Newstatia." The last section concludes with a set of propositions regarding policy network structure and evolution.

AN OVERVIEW OF POLICY NETWORKS, RESOURCE DEPENDENCE, AND OTHER FACTORS IN POLITICAL CONNECTIVITY

Policy Networks as Structures for Policy Deliberation, Decision, and Implementation[1]

For at least 40 years (dating from Freeman's [1965] *The Political Process*), scholars have recognized that "policy making" did not fit the textbook model of "politicians

1 For a fuller discussion of policy networks, see Rethemeyer 2007b.

decide and administrators do." As we have argued in our previous work (Hatmaker and Rethemeyer 2008; Rethemeyer 2007a, 2007b; Rethemeyer and Hatmaker 2008), a far messier and, arguably, less democratically legitimate form of governance has emerged, which is organizational in nature (Laumann and Knoke 1987; Rethemeyer 2007b) and driven by mutual dependence across the public–private divide. In this context, policies are the product of networks of organizations that span the public and private sectors (Baumgartner and Jones 1993; Burstein 1991; Freeman 1965; Hanf and Scharf 1978; Heclo 1977, 1978; Knoke et al. 1996; Laumann and Knoke 1987; McCool 1989, 1990; Rhodes 1981; Sabatier and Jenkins-Smith 1993); these organizations may include public agencies, legislative offices, interest groups, corporations, and nonprofits that have a stake in public decisions within a particular policy area. Public decisions affect the ability of all members to continue operations and meet the goals of internal and external stakeholders (Cyert and March 1963). Such organizations constitute a "network" because they communicate intensively about issues they care about and exchange money, political support, and other resources to influence public decisions and survive (Pfeffer 1987; Pfeffer and Salancik 1978). Policy networks are consequential because in our conceptualization, public authority does not rest uncontested with public managers and elected officials but instead may only be effectively used in many (maybe most) instances when members of an affected policy network are supportive or at least nonobstructive.

Policy networks, then, are mechanisms through which policy is debated, decided, and implemented. We assume that participation and structure matter for policy outcomes. However, our study does not reach outcomes. Instead, we focus on process: What are the determinants of network structure? What does that imply for network management?

Resource Dependence as an Explanation for Policy Network Structure[2]

Basically, then, organizations participate in policy networks because they depend on the public sector for key resources. For this reason, the RDT has long provided a primary conceptual framework for studying policy networks (e.g., Knoke 1990; Knoke et al. 1996; Krueathep, Riccucci, and Suwanmala 2010; Laumann and Knoke 1987; Provan and Milward 1995; Rethemeyer 2007a, 2007b; Rethemeyer and Hatmaker 2008; Weible and Sabatier 2005). In most policy networks, the central dependence is on the state for funding, legitimacy, regulatory relief, or protection of rights and obligations (Oliver 1990, 1991; Rethemeyer 2007a, 2007b). Yet, dependence is actually far more complex and multilateral: legislators need executive agencies to perform in order to meet constituent needs, agencies need service providers to perform in order to satisfy legislative overseers, clients rely on agencies and legislators to meet their service needs, and providers need each other to generate political "clout" through pooled resources. Interdependence weaves constituent organizations together in a policy network.

In our framing of RDT and its application to policy networks, there are two primary types of resources that may be converted into influence in the service of

2 For a fuller discussion of these resource dependence concepts, see Hatmaker and Rethemeyer 2008; Rethemeyer 2007b; Rethemeyer and Hatmaker 2008.

furthering organizational goals and survival. We label the first type "material-institutional resources" (MIRs): the set of financial, political, human, informational, and institutional resources and conditions that an organization may deploy in support of its preferred political positions and policy options, which have traditionally been regarded as organizational resources in the existing literature on RDT. MIRs include money, employees, technical and experiential knowledge in substantive areas, state-sanctioned authority, political constituencies, and nonstate sources of funding. As this suggests, some MIRs are inherent in the larger institutional structure (i.e., the governing constitutional and statutory framework). MIR endowments are critical to the exercise of power within a policy network; they create differentials in power that help to explain who gets what outcome and why.

We label the second type of resource "social structural resources" (SSRs). SSRs are resources derived from persistent patterns of interactions between three or more social actors in a network. Actors that gain access to advantageous structural positions in a policy network are able to use their position to further their organization's interests and improve its chances for survival over the long run. This perspective assumes that patterns of communication and resource exchange are not random and not easily changed. Such patterns are created and persist because they generate a sufficient return to those who create and maintain them. In our previous studies (Hatmaker and Rethemeyer 2008; Rethemeyer 2007a, 2007b; Rethemeyer and Hatmaker 2008), we have discussed how SSRs are composed of persistent ties and the informal network roles that actors assume through processes related to resource endowments and grants of authority from the broader network. SSRs include preferential access to those with authority, the right to speak on behalf of informal collectivities, the ability to mobilize resources from other network members due to advantageous relationships with key actors, and the informal roles within networks that allow the role holder to, for instance, discipline other members of the network. SSRs, like MIRs, are used by organizations to advance the interests of the organization, to cope with uncertainty, to gain and secure resources, and to help perpetuate the organization. Ordinarily, SSRs accrue to those who possess valued MIRs.[3] In equilibrium, the two sources of power and influence reinforce one another.

Accrual of SSRs can occur through a set of processes that Emerson (1962, 34) described as "balancing operations." Balancing operations are the means by which those dependent on one or more dominant resource suppliers may seek to counterbalance that power. Emerson outlined four balancing operations: *power network extension*—seeking new sources of supply (e.g., private sector funders); *withdrawal*—seeking to reduce need for the scarce resource (e.g., becoming more efficient; reshaping the organization's mission); *coalition formation*—seeking to work with others in coalitions (including through industry and interest associations); and *emergence of status*—seeking to collectively "grant status" by elevating a dominant player into a collective role (e.g., the president of an industry association) so that the dominant player may lose the collective good if that person's behavior fails to consider collective needs.

Relations in all interorganizational networks, but especially in policy networks, are not a mirror image reflection of dependence (Rethemeyer 2007b). If that were

3 Compare Benson (1975) on social superstructures in "interorganizational political economies."

true, one might expect to see hub-and-spoke arrangements, where the dominant resource holder is the focus of all communication and influences behavior. Instead, more complex patterns emerge from the use of one or more balancing operations by members of the network. It is the nature of these patterns that we seek to better understand.

Beyond Resource Dependence: Social Processes as Sources of Political Connections

Social network analysts have long suggested that "local interactions" or "microprocesses" in substructures have significant effects on global network structure (Johnsen 1986; Pattison and Robins 2002). That is, generic social processes pressure actors to forge ties that may not be formed otherwise. For instance, it is very rare that a friend of a friend is *not* a friend, because such an instance may cause psychological conflict (Granovetter 1973). Similarly, social actors seek to minimize dissonance and stress in relationships through "triadic closure," in which a focal actor's preferences and beliefs are affirmed and reinforced by having two other interlocutors that not only agree with the focal actor but also agree with each other (Heider 1958; Hummon and Doreian 2003; Newcomb 1961). Along with reciprocity, this is one of the most fundamental principles that organizes one's social relationships such that open triads (that is, triads where the focal actor's two interlocutors do not communicate or exchange with each other) are not durable over time. They would either perish or become balanced (e.g., establishing a tie that completes a triadic closure). This tendency essentially results in highly overlapping ties (from Granovetter's (1973) and Burt's (1992, 2002) point of view) in higher-order structures—that is, at the level of the entire network. Thus, although there is very strong evidence suggesting that various forms of homophily define network structure, an introduction of a new tie—locally generated and possibly a random occurrence (for instance, a chance meeting of political actors at a party)—may create unexpected network dynamics and ultimately affect the shape of the network structure (Pattison and Robins 2002).

If the foregoing is true, resource dependence may not fully account for all factors that explain connections. Organizations may have relations with one another because their human "enactors" (Hatmaker and Rethemeyer 2008) are subject to certain social pressures. Suppose two nonprofit service providers depend on a state agency for resources. Each organization is likely to communicate with the agency in an effort to get resources. Based on existing theories on resource dependence and power, the state agency may keep those two providers from communicating with one another in order to maintain control over information and resource flows. However, according to our earlier argument, this agency may, over time, be highly likely to introduce the nonprofit organizations, which may have no intrinsic dependence on one another (all else being equal) because of their relationship to the state agency. The state agency may, for instance, hold coordination meetings among funded organizations, providing an opportunity for otherwise disconnected actors to meet. As a result, ironically, these two service providers (and possibly other actors as well) now may have leverage over the state agency through a coalition. The coalition is itself a new structural feature of the network that the agency's operations helped to create. The previous literature (including our own contributions) failed to account for substructures in analyzing

policy networks. Thus, this work may have attributed too much to dependence and not enough to generic social pressures—whether these pressures are driven by the social norms that relational "enactors" (i.e., humans) observe when doing the organization's business with peers or a desire among organizations to select peers and partners that have similar approaches to policy issues.

Social network researchers have recently made substantial progress in controlling for these microstructural effects so that we can determine whether the effects driven by dependence concerns are so prevalent as to not be the result of chance. We are unaware of any other study that examines the role of resource dependence in a policy network while controlling for substructural effects stochastically. For this reason, we are taking an inductive stance, working from broad research questions rather than testing hypotheses. Using our stochastic approach, this study aims to explore the impacts of resource dependence on policy networks and the potential effects of local interactions on the global network structure. This study will address the following research questions:

RQ1: What role does resource dependence play in fostering connections? How does that role play out in different resource environments?

RQ2: Generally speaking, what factors help to promote or discourage connections between members of a policy network?

RQ3: What role, if any, do broad network properties and substructures play in explaining connections in policy networks?

RQ4: How do participants in a policy network manage dependencies in a resource scarce environment?

RQ5: What do our findings suggest regarding the relational environment of public management?

The next section introduces the data and methods used to examine the degree to which dependence and social effects help to explain social structure.

METHODS[4]

This study draws on longitudinal data collected from an ABE Policy Network in Newstatia,[5] a state in the eastern United States, in 1998 and 2005. For the purposes of this study, the ABE policy is defined as those decisions that affect the funding or regulation of organizations that provide educational services to individuals 16 years of age or

4 This section is derived from similar sections previously published—see Hatmaker and Rethemeyer 2008; Rethemeyer 2007b; Rethemeyer and Hatmaker 2008. There is also a semantic difficulty here in that the first author completed the first data collection alone but the second data collection was completed jointly with another collaborator. For simplicity, we will not dwell on this distinction in the data description.

5 In the text that follows, the state name, organizational names, organizational titles, and genders have been changed, per the requirements of the confidentiality statement imposed by the institutional review boards that have oversight for this project. Some data are reported as ranges or averages to preserve confidentiality.

older who are seeking to raise their reading, writing, and/or computational skills to a level closer to that of a high school graduate (Office of Technology Assessment 1993).

Data Sets

State Selection

Newstatia was originally selected for this study because it was relatively typical in terms of its demand for ABE services but also had a well-funded provider community that was largely dependent on state resources for its continued existence. Newstatia has offered services to adults seeking literacy and numeracy for over a century. Although it ranks in the middle quintile with respect to high school dropouts, Newstatia ranks in the top quintile in immigrant population per capita and per learner expenditures and in total expenditures for ABE. Newstatia has more than ten cities with a population of 50,000, many of which are more than 50 miles from the capital.

Network Selection

As expected, the structure of the ABE network and the nature of dependence were relatively clear-cut in 1998; there were only five types of actors—legislators, state agencies, state-funded providers, state-funded technical assistance provider, and provider associations—in the network, and private sector actors derived between 60% and 80% of total expenditures from state coffers. However, in the 7 years that elapsed between the waves, the network grew substantially in size and became more heterogeneous as five new types of organizations—legislative committee, foundations, business and labor groups, learner advocacy organizations, and consultants—joined. The nonstate actors are all still heavily dependent on the state for financial support (we describe the details in the following section).

Network Specification

To identify the boundary of the ABE network, this study followed a three-step network specification procedure that may be classified as "realist" in nature within Laumann, Marsden, and Prensky's (1989) typology. This method uses network informants for identification of the network members rather than a set of researcher-defined criteria (the "nominalist" approach). A "naïve" universe of potential network members was compiled through searches of the Internet and a review of recent newspaper reports on policy issues in both substantive domains. Three informants from the population of "presumptive" network members were recruited in order to make additions to the naïve list. Next, members of the network were asked to rate the members of the master lists in terms of their influence over policy (seven in 1998 and nine in 2005). Finally, during each interview, the informant was asked if any organizations were omitted from the list. This process yielded consensus network specifications in both cases,[6] with 28 actors in 1998 and 47 in 2005. (In total, 20 out of 47 organizations also participated in the first data collection process in 1998.) The reasons for change in network size will be elaborated later in this article.

6 Because no potential "excluded" organization received nominations from more than 15% of the "included" organizations, the Wave 1 network specification was retained throughout.

Informants

Most informants were chief executives or chief operating officers for their organizations; some were legislative members or staff for legislative committees. Wave 1 data were collected between February and May 1998; Wave 2 data were collected between June 2005 and March 2006. In total, 23 of the 26 "active" nodes in the Wave 1 network participated; 41 of 47 nodes in the Wave 2 specification provided an interview, for an 87% completion rate.[7] For some large organizations, multiple informants participated in the data collection exercise. In these cases, the informants were gathered at the same time and collaboratively answered the questions in the instrument. In each instance, a single, consensus set of answers was used for each organization.

Of the six Wave 2 nodes for which we were not able to collect data, three were legislative members and one was a legislative committee (the House Ways and Means Committee), all of whom we categorize as "policy elites." Access to policy elites can be problematic as multiple gatekeepers erect barriers and the elites themselves may be resistant to the intrusion of social science research (Duke 2002). Of the remaining nodes, the "network liaison" who was to be our informant left the organization and was not replaced. This actor effectively dropped out of the network in mid-2005. However, because our network questionnaire was retrospective, we retained this actor in the network. The sixth actor, an elected local government leader, was unable to meet with us during the study period for personal and professional reasons.

Measurements

The data collection instrument was developed using the questions and methods found in Laumann and Knoke (1987) as a template and field-tested through semi-structured interviews with seven ABE organizations in a neighboring state. The testers were drawn from organizations of the type expected to be in the populations. The initial instrument's language and structure were then revised to make it more sensitive to the ABE context.[8] The instrument was almost wholly unchanged between 1998 and 2005.

Network Ties

Two types of communication ties—routine and confidential—were measured. The distinction between routine and confidential communication has been used in several policy network studies (e.g., Laumann and Knoke 1987; Raab 2002). Routine communication is used primarily to scan the environment to collect what Laumann and Knoke (1987) term "neutral intelligence." This study used the data on confidential communication ties as the dependent network in our ERGMs. Confidential communication was used both to discuss distribution and allocation of resources and to establish meaning, because it often contains sensitive, high-value political and policy material, which fits the purpose of this study.

7 The interviews established conclusively that two members of the Wave 1 ABE network were "social isolates" and thus not relevant to the analysis. Because all 28 organizations were included in the instrument, data for all are presented.

8 The instrument is available for inspection at http://www.albany.edu/faculty/kretheme/Instrument_PoliConn_JPART.pdf.

Communication data were collected using roster methods. Informants were presented "grids" that contained the name and contact person for the organizations. The grids corresponded to the modes of communication types and modes. For each grid, informants were asked (1) whether they or others in their organization communicated with the listed organizations using the type and mode of communication listed at the top of the grid; (2) whether the communication was generally initiated by their organization, the listed organization, or both; and (3) what the monthly frequency of communication was, on average, using a 0–7 scale that was anchored to cues for the number of contacts per month—for instance, "0," "1," "1–2," and "2–3."

Resource Dependence

Resource dependence may be one of the most difficult concepts to examine empirically. In previous studies, it has been measured in a variety of ways (see Casciaro and Piskorski 2005; Hillman, Withers, and Collins 2009; Provan, Beyer, and Kruytbosch 1980). In operationalizing our resource dependence framework, which includes both MIRs (e.g., money, information, and legitimate authority) and SSRs (from structural position within the network), we used both objective (i.e., status as a funder and status as a regulatory organization) and subjective (i.e., perceived influence of other actors) measures to capture how MIRs and SSRs may constrain actors' behaviors in choosing instrumental ties in a policy network.

With respect to objective measures, many studies have suggested that acquisition of funding from internal and external sources may explicitly measure resource dependence patterns (e.g., Casciaro and Piskorski 2005; Provan, Beyer, and Kruytbosch 1980). The information about the amount of funding each service provider in the network has received from the state was originally collected as part of this research. However, the data were not used as a measure of resource dependence for this particular study because of the unique nature of ERGM, which uses a sociomatrix (as opposed to dyads) as a dependent variable (or, more accurately, a dependent network). Using the amount of funding obtained from resource holders as a measure of the power of resource seekers, while coding zeros for corresponding values for resource holders, would not generate statistically precise results. Conceptually, it was also challenging to find a way to use a single variable to consolidate the different needs that motivate resource holders and resource seekers to participate in the network (information for the former versus funding for the latter).

Therefore, we used two measures of *potential power* to operationalize the capacity to control others' behaviors legitimately (see Provan, Beyer, and Kruytbosch 1980). In particular, we collected information on the nature of financial flows and regulation—two measures typically used in a resource scarce environment (see Cho and Wright 2004). Each organizational representative was presented roster grids as described earlier (but without the Likert scale, as the concepts here are dichotomous) and was asked to note (a) which organizations provide them funding, (b) which organizations regulate their activity, and (c) whether they belonged to the industry association (see the following section). Publicly funded service providers were instructed to nominate only the agency that disperses the grant, not the legislative actors that appropriate the funds.

Regulation was defined as follows:

> A relationship where one organization can tell another (a) how to spend money; (b) what type of services to offer; (c) what measures of "quality" or "achievement" the organization or the organization's clients must attain; (d) what criteria must be met for an organization to receive services from that organization; and/or (e) what the content of major programs must be—*and* expect that organization to comply or face formal and/or informal consequences.

Each organization could name as many funders or regulators as they wished from the roster provided.

The participants' subjective evaluation of member influence on decision making in the ABE Policy Network was also used as a measure for each focal actor's dependence on other organizations. Organizations attempt to shape their resource environments in a favorable way by altering the conditions of their external environments through political means (Emerson 1962; Hillman, Withers, and Collins 2009; Pfeffer and Salancik 1978). Actors choose their political actions based on their evaluations of the resources—both MIRs and SSRs—that they and other players in the network possess. The pattern of exchanges in a network clearly differs from that in a dyadic relationship between two individuals (Bonacich and Bienenstock 2009), because power essentially resides in and is constrained by relationships (Emerson 1962). Therefore, actors' perceptions of the influence of others (both resource holders and resource seekers) on allocation of resources in a policy network may largely shape their choice of relational strategies to acquire necessary resources, which fits the purpose of our study. For these reasons, we believe that it is important to include a measure of perceived influence in order to understand how resource dependence (and network members' perceptions of it) constrains tie selections in a policy network.

To measure influence, each informant was asked to rate the "policy influence" of each member of the roster on a scale from zero to seven. Influence was defined as "the ability to get others to believe, think, or act as one prefers with respect to a given policy issue. The more influence an actor has, the more likely it is that policies in line with their preferences will be implemented." To purge the resulting influence scores of raters' tendency to anchor on high or low scores, we converted each raters' scores into deviations from their mean influence score across the 28 or 47 organizations. Essentially, this procedure turns the influence rating into the equivalent of a Z-score.

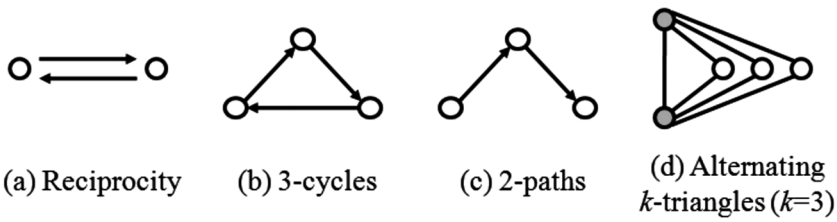
The direction of resource and/or information flow is often critical to understanding the relationship between a resource holder and resource seeker. For this reason, we included three attribute-related parameters for each dependence variable in our model: *ego, alter, and same*. Attribute-ego and attribute-alter parameters are associated with the actor's outdegrees and indegrees, respectively. That is, a positive value for an attribute-ego parameter suggests that actors with higher values on the attribute in question make more ties (i.e., have higher "outdegree"), whereas actors with a positive attribute-alter parameter are likely to receive more ties (i.e., have higher "indegree"; Snijders et al. 2007). Substantively, higher outdegree is associated with actors seeking (and thus claiming) more relationships with others in the network—being more "outgoing" or "expansive." Higher indegree is associated with others in the network claiming more relationships with the focal actor (which is thus characterized as being

more popular; see Snijders 2002a; van Duijn, Snijders, and Zijlstra 2004; Wasserman and Faust 1994). A positive value for attribute-same indicates that actors prefer communication partners that share similar attributes (either in terms of a status or a similar level of a characteristic that is discretely or continuously measurable, such as reputed influence, wealth, and mobilizable supporters). For an in-depth introduction to ERGM parameters and the interpretation of the estimates, see the SIENA Web site and manual (Snijders 2002b; Snijders et al. 2007).

Network Structural Variables

To capture structural concepts, our model includes a number of network variables such as reciprocity and several structural configurations (e.g., *preference for higher outdegree nodes*, *preference for higher indegree nodes,*[9] and *alternating* k-*triangles;* see figure 1 for a graphical presentation of these network substructures). Preference for higher outdegree nodes, preference for higher indegree nodes, and alternating *k*-triangles summarize all possible higher-order-degree effects (i.e., outdegree star, indegree star, and triad, respectively). Each is specified with the assumption that there are declining marginal effects for higher-order structures. For instance, in the case of alternating *k*-triangles, the two primary actors (shaded nodes in figure 1d) may benefit from having more mutual ties in the network, but the utility of adding another mutual tie would be suppressed for various reasons (e.g., high cost for maintaining the network) after a certain inflection point. Similarly, an inverted-U-shaped relationship is assumed for having too many incoming and/or outgoing ties (preference for higher outdegree nodes and/or preference for higher indegree nodes). With respect to the interpretation of the parameters, a positive value of the coefficient for preference for higher outdegree (or indegree) nodes would confirm the existence of highly central actors in a given network, and a positive value of the coefficient for alternating *k*-triangles would confirm the preference for network closure. What is more important about these higher-order specifications is that this set of parameters collectively captures the pattern of local interactions that, when taken together, sum to a particular global network structure. For instance, the positive values on all three parameters

Figure 1
Graphical Representations of Structural Network Effects



Note: The figure is based on Snijders et al. (2007); Robins, Pattison, et al. (2007); and Robins, Snijders, et al. (2007).

9 The original parameter specifications of *Preference for higher outdegree nodes* and *Preference for higher indegree nodes* in SIENA are *alternating out*-k-*stars* and *alternating in*-k-*stars*, respectively.

would suggest that a core-periphery structure exists. Thus, the combination of these microstructural parameters provides information that may be used to interpret the structure of a particular network. (For more detailed information about these specifications, see Robins, Snijders, et al. 2007.)

Other Organizational Information

Finally, a great deal of basic information about each organization was captured, including sector membership (public, private), the nature of the organization's interest in ABE (service provider, legislator, and technical assistance organization); the organization's budget and sources of funding; and the organization's places of business. Using these data, we constructed variables for total budget, geographic proximity to the capital city, sector membership, and type of organization.

Analysis

We used an ERGM to analyze our sociometric data in an effort to control microstructural effects driven by broad social pressures more precisely. Our model thus includes both structural variables (e.g., preference for higher in- and outdegree nodes and alternating k-triangles) and those related to resource dependence (e.g., regulation, funding flows, and perceived influence). First, we provide a brief introduction to ERGMs.

ERGM Analysis

The nonindependence of observations in social network data causes conventional statistical techniques to underestimate the true sampling variability (Wasserman and Faust 1994) within network data sets and thus generates parameters that are biased and inefficient. Many researchers have proposed using ERGMs, also known as p^* models, to overcome the inherent issue of dependence (Frank and Strauss 1986; Pattison and Wasserman 1999; Robins, Pattison, et al. 2007; Robins, Pattison, and Wasserman 1999). The specific variant used in our work, a Markov random graph model, is a type of ERGM introduced by Frank and Strauss (1986). This model proposes that a random graph of a particular network follows a Markov graph when the probability of ties between disjoint pairs of actors are random (i.e., independent), given the rest of the graph consists of certain conditionally dependent ties. That is, a tie from i to j is *conditionally dependent* only on other possible ties involving i and/or j (Robins, Pattison, et al. 2007).

Recent advances in Markov chain Monte Carlo maximum likelihood estimation (MCMCMLE) techniques allow us to obtain more accurate parameter estimates through a simulation technique (Robins, Snijders, et al. 2007). For this article, we used SIENA, an open-source software package that relies on the MCMCMLE technique, to analyze our sociometric data (for an introduction to stochastic social network analysis, see Robins, Snijders, et al. 2007; Snijders 2001, 2002a, 2005; Snijders and Duijn 2002). We also used UCINET (Borgatti, Everett, and Freeman 2002) to calculate deterministic statistics and NetDraw (Borgatti 2002) to create network visualizations.

Modeling Procedure

After the parameters are generated, t-ratios for each are calculated to assess the degree of fit between the model and the actual data. A sufficient model has little or no

divergence from the actual data, so we actually wish to find *t*-ratios that are as close to zero as possible (i.e., the actual value and the modeled value should be statistically not different from one another). If the *t*-ratios of the model parameters approach zero, then the model is said to have "converged" sufficiently to trust the results. The models reported in tables 2 and 3 have *t*-ratios less than 0.1, which experience indicates is an acceptable degree of convergence (Snijders et al. 2007).

Second, the goodness-of-fit of each model is examined using SIENA (for more detailed information about interpretation of goodness-of-fit of an ERGM, see Snijders et al. 2007). The joint goodness-of-fit tests for all models in tables 2 and 3 were significant at the 1% level, which indicates that these models fit the ABE policy networks very well.

Third, each parameter is then assessed as to whether each variable has explanatory power in the model. Here, a series of goodness-of-fit tests with one degree of freedom are run for each parameter. The threshold of significance is the standard 5% or 10% level. Variables were repeatedly added and removed through an exploratory and iterative model-selection process. The final models are presented in table 2. The procedure also generates a set of standard errors that allow for calculation of "traditional" *t*-ratios to assess the statistical significance of each variable.

It is important to note as a final caveat that our stochastic findings are not generalizable to all policy networks. We will be able to demonstrate some effects that are so prevalent or strong that they could not have been generated by random chance *in these networks*. The results are thus generalizable to current and potentially future states of *these networks* but not necessarily others. These results are only *suggestive* of what we would find in other networks.

FINDINGS

Weathering a Fiscal Catastrophe: The ABE Policy Network 1998–2005[10]

The ABE network experienced dramatic changes between the two data collection periods (see figures 2 and 3). The interview data provide at least four complementary explanations. First, Newstatia faced a sudden and sharp reversal in fiscal fortunes over the 6 months following September 11, 2001. As the budget went into free fall, one expedient that the governor and legislature put on the table was a series of across-the-board cuts to programs. In ABE, the proposed cut was so severe that a large proportion of the state-funded providers would have faced shutdown for at least 6 months, which functionally would have meant extinction.

Second, in the face of this existential threat, the industry association (to which we give the pseudonym pseudonym NAABE, for Newstatia Alliance for Adult Basic Education) initiated a massive, coordinated, state-wide mobilization to preserve funding. NAABE relied on two existing structures to initiate this effort: its public policy committee, which was composed of large, well-connected organizations, and an associated e-mail–based "alert system." While parts of this mechanism existed before the fiscal crisis, its function and organization were perfected in this crucible. The system worked: the cuts were completely rolled back. As one key legislator noted, [paraphrasing] "for a

10 This section is derived from similar sections previously published—see Hatmaker and Rethemeyer 2008; Rethemeyer and Hatmaker 2008.

time, adult basic education was on par with abortion, stem cell research, and crime as an issue. Every member got hundreds, if not thousands of calls."

Third, under the pressure of a massive resource crisis, the network also changed. A number of the new members are legislative. Legislative committees and members now comprise 25% of the membership, up from 14%, whereas providers have actually dropped from 54% to 24% of the total. This may reflect NAABE's desire to speak with one voice—an organizational imperative that was established well before the budget implosion of 2001–2. Why the increase in legislative participation? The answer is not methodological: the initial network specification questionnaire in 1998 included the Senate Ways and Means Committee and a much larger array of legislators than appears in the 1998 network map. Instead, in a more munificent environment in the late 1990s, there simply was no reason for a large set of legislative actors to be involved in the policy network. A simple, efficient advocacy structure focused on a key set of legislative "champions" was sufficient. The budget cataclysm drove network change.

At least as importantly, a previously moribund group, the Providers Council, became substantially more active. The Providers Council represents the interests of state-funded providers. Concurrently, more state agencies became involved, partly reflecting (1) the growing importance of correctional literacy and workplace literacy efforts, (2) the reorganization within the Department of Education to accommodate family literacy programs, and (3) the legislature's reorganization of committee responsibilities. The budget debacle of 2001–2 was centered in the two Ways and Means Committees because the cuts were comprehensive. The network grew to include these committees in the aftermath of this crisis. As we shall see, this led to measurable changes in factors that helped to explain relationships.

Fourth, a group of technical assistance organizations emerged as major players in the network over the 7 years. Three new members of the 2005 network were drawn from workforce/workplace literacy initiatives. These initiatives were linked to the greater awareness that poor literacy and numeracy skills have a negative effect on the business climate in Newstatia. Two prominent "think tanks" with ties to the corporate community have helped to promote this new construction of ABE.

To get a sense of the communication networks in existence in 1998 and 2005, see figures 2 and 3, respectively. Figure 3 (table 1 provides the "key" needed to interpret the shapes and shades) reports confidential communications that occur between the members of the network at a frequency of "2–3 times a month or higher." Thicker lines mean more frequent communications; larger nodes mean more influence.[11] The confidential network was roughly bifurcated into two groups: legislators (with a few government agencies and think tanks) and everyone else. The primary interlocutor for the legislators was the Senate Ways and Means Committee (label "Sen W & M"). The policy network contains six primary communication brokers: NAABE, the Department of Education's Adult Basic Education Service (labeled "DoED"), the president of NAABE (labeled "CFA/Pres NAABE"), a representative of the Providers Council (labeled "Prov.

11 Lack of tie does not indicate that no relationship exists (e.g., a low-frequency tie exists between the industry association [g35] and the most important legislator [g14]); however, it is just not one that results in frequent communications).

Table 1
Color Codes for Actor Types

Shape	Actor Type
●	Legislative committee
■	Legislator
▲	State agencies
□	State-funded provider (private and municipal)
◇	State-funded technical assistance provider
△	Provider association (NAABE and Providers Council)
▽	Foundations
⊞	Business and labor groups
◘	Learner advocacy organization
⧖	Consultant

Note: Public sector actors are in gray.

Council"), and two representatives of the "economic/workforce development" movement (labeled "Workforce Dev") that gained traction in ABE over the last 7 years.

It turns out that a similar pattern existed in the 1998 data: the network was divided into a set of connected legislators and everyone else (see figure 2 and table 1 again for the symbolic keys). However, far fewer legislators participated in the network in 1998. During the 1990s and the first 2 years of the 20th century, the budget for ABE had grown fairly steadily (as had all state expenditures). There was no existential threat to providers that required massive mobilization for political action. In 1998, one state representative (Actor 12 in figure 2) brokered deals with two committee chairmen (Actors 27 and 28 in figure 2) to assure state funding. The Department of Education's Adult Basic Education Service (labeled "DoED") and NAABE's President (labeled "VBE/Pres. NAABE") were the primary interlocutors for this legislative "champion." They brokered relations between the legislators and the rest of the network. The brokerage structure matters because it helps to explain the importance of our second finding on personnel movements described later. We now turn to a stochastic analysis of the relationships depicted in figures 2 and 3.

Impacts of Financial Shock on Policy Network Structure

Table 2 reports the final models resulting from our analysis. This table presents a reduced set of variables that were found to have significant coefficients in at least one model. The full set of variables tested may be found in the downloadable Appendix (tables A1 and A2 are available at http://www.albany.edu/faculty/kretheme/PoliConnect_Tables_BPP.pdf), as well as a model for each wave that contains no structural controls.

Turning first to the structural effects, our findings suggest a shift from a core–periphery structure based on dyadic reciprocity to a segmented structure based on network closure and trust at the local level from Wave 1 to Wave 2 (see changes in the pattern of significance in the first five variables in table 2). The most salient observation in the Wave 1 data is the existence of core players in the ABE Policy Network. As measured by the coefficient on "preference for higher outdegree

Figure 2
Map of Confidential Nonelectronic Communication in 1998

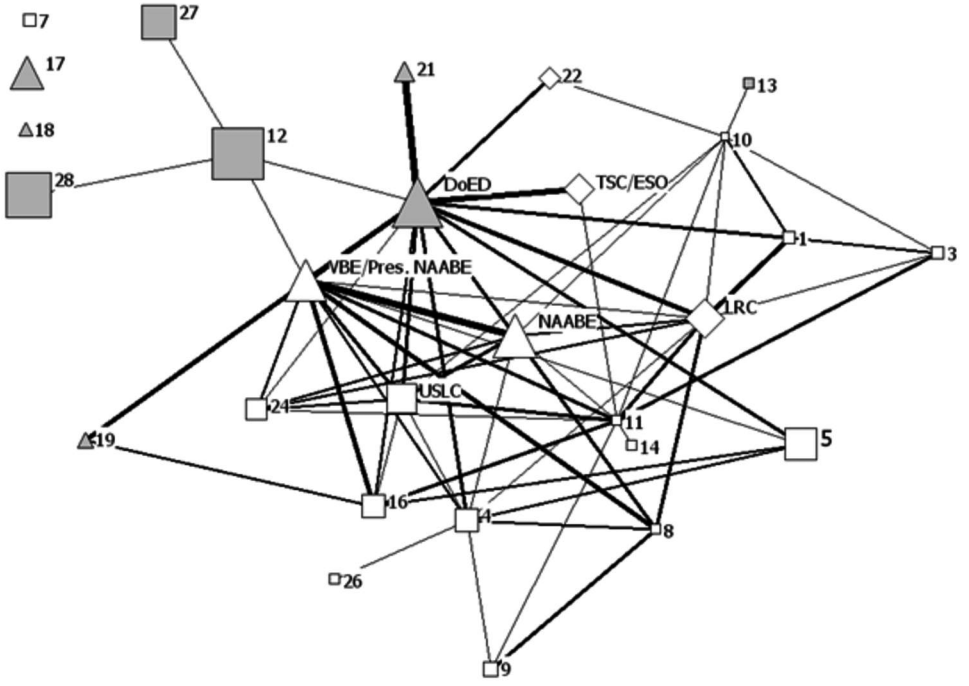


Figure 3
Map of Confidential Nonelectronic Communication in 2005

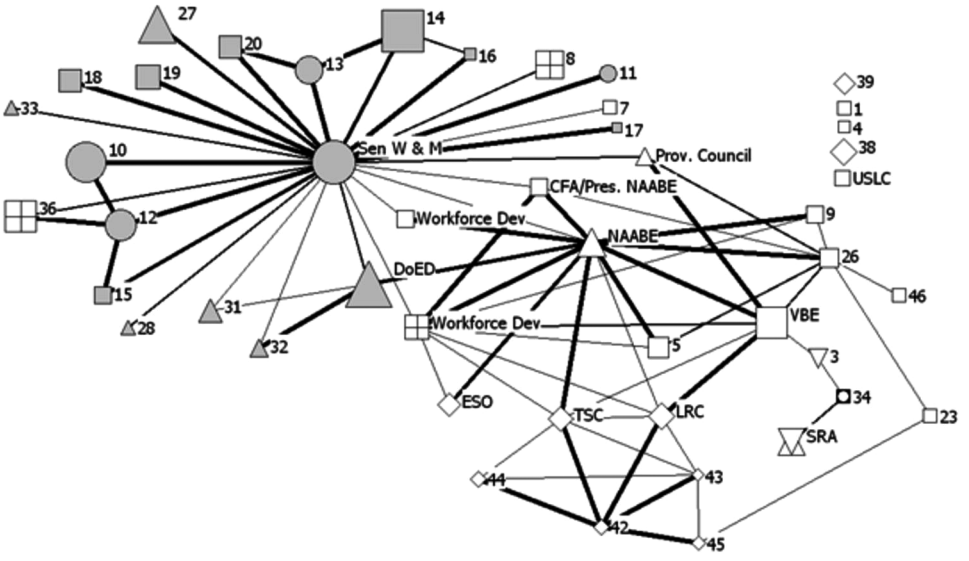


Table 2
MCMCMLE of the ABE Policy Network

	Parameters	Wave 1	Wave 2
Structural configuration	Reciprocity	2.503*** (0.678)	0.407* (0.224)
	2-paths	–0.073 (0.077)	–0.059*** (0.018)
	Alternating *k*-triangles	0.556** (0.271)	1.636*** (0.231)
	Preference for higher outdegree nodes	1.479*** (0.426)	–0.845** (0.349)
	Preference for higher indegree nodes	–0.497 (0.516)	–6.242** (2.934)
Alternative financial resource	Public funders ego	1.624** (0.757)	
	Private funders ego		1.689*** (0.262)
	Funded solely by state alter	0.918** (0.416)	–0.428 (0.385)
	Funding source other than state or solely others ego	0.975*** (0.371)	0.038 (0.336)
Sectoral influence	Private × influence alter	0.899*** (0.224)	0.365*** (0.088)
	Public × influence ego	0.142 (0.161)	0.561*** (0.112)
	Public × influence alter	0.700*** (0.175)	0.219*** (0.072)
Collaborators in the ABE industry	Same state		0.346** (0.156)
	Same legislature	1.564** (0.618)	
	Technical support organization alter		0.827*** (0.201)
	Same technical support organization		0.630*** (0.125)
	Private organization other than technical support ego		1.175*** (0.28)
	Member of an industry association ego	0.617 (0.402)	–1.200*** (0.298)
	Same membership of an industry association ego	–0.087 (0.317)	0.438*** (0.126)

*$p < .1$; **$p < .05$; ***$p < .01$.

nodes," there is greater disparity in the number of connections the actor chooses to initiate with others. Taken together with the coefficients on "reciprocity" (a proxy measure for trust) and "alternating *k*-triangles" (a tendency for a friend of a friend to be a friend; for more detailed discussion about interpretation on the combination of coefficients, see Robins, Snijders, et al. 2007), the Wave 1 data clearly show a typical core-periphery structure with the core members who control crucial information and the allocation of resources in the policy network. This finding is consistent with our previous analysis (Rethemeyer 2007b) that found clear evidence for relatively closed, core-periphery structures in these networks of the sort found in other policy network research (cf. Heinz et al. 1990 and their concept of the "hollow core"; Knoke et al. 1996; Laumann and Knoke 1987; Laumann and Pappi 1976). The effect of trust and mutual deal making (often known as "log rolling") is most prevalent in the core of the network, which includes actors such as DoED, NAABE, VBE, and others who have better access to resources. Among less central actors, relationships tend to be dyadic rather than multilateral, in part because there is no strong basis for trust.

By contrast, analysis of the Wave 2 data suggests that there are multiple cores in the network. On average, organizations with high indegree or outdegree values were less likely to add additional ties if an opportunity presented itself to make a new relationship (see the negative, significant coefficients on preference for higher outdegree nodes and preference for higher indegree nodes), which indicates that there is a strain toward relative parity in indegree and outdegree (for more detailed discussion about preference for higher outdegree or indegree nodes, see Robins, Snijders, et al. 2007). We cannot be sure with the data on hand the extent to which actors seek less relationally "busy" people (which may be the case among private sector actors) or are pushed away by powerful actors who refuse connections (as may happen among high-prestige public sector actors). At the same time, there is a stronger tendency toward transitive closure in Wave 2 than in Wave 1 (see the positive coefficient on alternating *k*-triangles) and a preference for direct interaction (see the negative estimate on *2-paths*). These structural configurations, which seem contradictory, suggest that the core–periphery structure became looser in Wave 2. Instead, there are more local interactions within transitive triangles, which accords with our earlier finding that multiple cores exist (compare figures 2 and 3).

Discussion

These findings suggest three things. First, broadly speaking, competition facilitates local concentration but dismantles centralization. When resources are relatively abundant, the coalition pattern and brokerage structure between the providers and legislature is relatively simple and sparse, as seen in figure 2. Three legislative champions handled resource advocacy in the legislature. The pattern became more complex, elaborated, and "crowded" as the munificence of the environment wanes (figure 3). More legislative actors were pulled into the network. Resource distributors such as Senate Ways and Means became more influential as a group when they had fewer resources to distribute. At the same time, the coalition of resource seekers became segmented into specialized groups, as one can see in figure 3. Note also that there are larger number of brokers between the provider community and legislative actors—from two in 1998 to five in 2005. The monopoly on legislative brokerage held by the Department of Education and the industry association was thus diluted. Interview data suggest that the reanimation of the Providers Council and its elevation to broker status was at least partially driven by the realization that the Department of Education had higher-priority items (especially K–12 funding levels) that it would seek to protect at the expense of ABE.

Second, the price of admission to the network is higher in 2005 than in 1998. The amount of relational work needed to gain access is higher because of the stronger preference for closure. This may explain why the network lost many private sector actors: they could not pay the relational price needed to participate and were not politically "weighty" enough to merit efforts to retain them. The existential crisis may also explain this pattern: influential actors were simply not willing to share information as broadly when faced with existential threat.

Third, trust has become a multilateral process. Closed triads are, in social network terms, durable because they foster reciprocity, common information, common heuristics for evaluating actions and reactions, common norms, and mechanisms for social control (Brown 1986; Hackman 1992; Isett and Provan 2005; Jackson 1965). Trust often

forms within such small groups because there are opportunities for repeated "safe" interactions in the context of the social control mechanisms provided by the group. The stakes were higher, so the bases of trust became more solid—triads rather than dyads.

Balancing Operations: Strategies to Manage Dependence in the ABE Policy Network

In the face of severe budget cuts, ABE service providers needed to take urgent action to ensure survival. Earlier, we argued that there may be two types of resources: MIRs and SSRs. Based on the preceding discussion, these providers' efforts to secure resources may fall into two types of actions: finding alternative sources of MIRs directly and/or utilizing SSRs (influence and connections in this particular study) to get access to MIRs from the state. The first strategy involved securing new or increased private sector funding. The second strategy involved use of relationships in the network. Organizations mobilized connections they had established with other service providers, industry associations, state agencies, and legislators over the years to safeguard existing state grants through political action targeted at both the executive and legislative branches. Both strategies relied on existing MIR and SSR endowments, but in different mixes. The following section will present our findings on strategies that ABE service providers deployed in order to manage resource dependence and on the outcomes of these actions in terms of network structure and composition. Table 3 summarizes these findings.

Alternative Financial Resources

As expected, we found financial resources to be an important shaper of communication patterns. However, the pattern changed substantially between Waves 1 and 2.

Table 3
Network Members' Strategies and Outcomes in the ABE Policy Network

Available Resources	Coping Strategy	Outcomes in ABE Policy Network
Alternative financial resources	Power network extension	• Emergence of private funders
Sectoral influence	Status granting	• Role of NAABE and a few other representative industrial organizations in controlling information flow • Role of legislators and committees as active participants in gathering information and decision making • Intensive communication within the same sector but less cross-sectoral communication
Collaborators in the ABE industry	Coalitions	• Emergence of subgroups • Specialization • Intensive communication within their own subgroup

The most significant change is the emergence of private funders in the Wave 2 data, which were collected in the aftermath of the September 11 financial crisis. The Wave 1 data contained no private sector funders, whereas they were present and highly outgoing in 2005 (see the coefficient on *Private funder ego*). On the other hand, public funders (i.e., agencies that provided funding to service providers in the network) actively sought information only in Wave 1 (see the coefficient on *Public funders ego*). Service providers also changed their pattern of communications. Organizations funded solely by the state were more popular (meaning they were sought out more often) than organizations funded by diversified sources in Wave 1, but this is not true in Wave 2 (see the coefficient on *Funded solely by state alter*). Similarly, those that had alternative sources of funding were more actively seeking relationships in Wave 1 but not in Wave 2 (see the coefficient on *Funding source other than state or solely others ego*).

Discussion

What caused the substantial change in pattern? Our leading hypothesis is that the financial shock changed the composition of the network and nature of relationships among members. In 1998, the state administration was relatively interested in funding ABE as state revenues rose during the 1990s. It was possible to "live off the state" without external sources of funding. Organizations that were funded solely by the state were popular because they were successful at tapping the richest, most stable funding source at that time. Organizations using other funding sources were outgoing, we hypothesize, because they were seeking relationships with organizations that built successful state funding portfolios. Such relationships might confer legitimacy (working with those already trusted with state funds) or useful information (how to compete for state contracts).

After the funding crisis, organizations that relied solely on state funds looked particularly vulnerable, and private funders became sought-after network members because they offered alternatives to vulnerable state resources (a classic example of Emerson's [1962] "power network extension" balancing operation). Organizations with access to private funding were no longer the "lesser" organizations seeking to "break in" but were potentially more secure enterprises that no longer needed extraordinary access through the policy network.

Sector-based Influence

Initially we expected to find that influence and sector membership would be significant predictors of connections, independent of one another. However, what we actually found was that influence matters and sector matters, but only in a certain combination. To examine this interaction, we created interactive variables by multiplying the influence metric by a sector dummy. Using these variables we found that (1) more influential public sector organizations tend to be more popular in both Waves (see the coefficients on *Public* × *influence alter*) and more actively participate in communication with other members of the network in Wave 2 (see the coefficients on *Public* × *influence ego*) and that (2) influential private sector organizations were more popular in general (see the coefficients on *Private* × *influence alter*).

Discussion

What caused the disparity in connectivity? Our leading hypothesis is that resource seekers and resource holders format their interactions in policy networks differently. Public sector actors hold the key financial resource, while others are trying to secure access to those resources. Thus, it is not surprising that public sector actors are popular, because they have money and the authority to allocate it. An unexpected change in their behavior is that policy makers became very active participants in gathering reliable information—tacit, technical, or proprietary in nature and thus hard to transmit without personal contact (Gulati and Singh 1998; Powell 1990; Powell, Koput, and Smith-Doerr 1996)—in order to make better decisions about resource allocation. Thus, policy networks exist in part to help funnel information from those who would know the current state on the ground—service providers—to key decision makers in the public sector.

By contrast, private sector organizations have a very limited number of resource providers from which to choose, and the money is essential for their survival. In such a resource scarce environment, influential private sector actors may have an incentive to control information flow by gathering information from other actors—including contacts that may be mobilized for political action in the future—but keeping key information more closely held among a set of similarly powerful peers. Moreover, there is greater influence if a few organizations (e.g., an industry association) speak on behalf of all private sector members. During the interviews, private sector respondents often noted a need to maintain a united front. This is precisely the "status granting" balancing operation that Emerson (1962) identified before.

Potential Coalitions: Collaborators in the ABE industry

Of Emerson's (1962) four balancing operations, coalition processes are the most familiar to political analysts. The data from both waves demonstrate this process at work, but with much more pronounced effect by 2005. First, the differentiation in communication patterns by organizational type grew. In 1998, only one subgroup effect was found: legislators had a tendency to choose to connect with one another at an above-average rate (see *Same legislature*). By 2005, several subgroups, such as state agencies, technical support organizations, and private organizations, developed differential connection patterns (see the coefficients under *Collaborators in the ABE industry* in table 2).[12]

Second, the role of NAABE changed dramatically between the two Waves. As noted before, NAABE played a central role in Newstatia's ABE policy deliberation for many years. In 1998, however, the level of participation among NAABE members was no different than that of other members of the network (see the coefficient on *Member of an industry association ego*). The network at this time was dominated by private sector service providers who loosely worked together. Most of the ties were between these providers; there were only a few public sector actors. The most significant relational "action" was in a small core that contained a mix of public

12 For the full set of coefficients on subgroup process, please see table A2.

(including three legislators) and private actors. As the need for political coalitions among service organizations grew after the financial shock, NAABE became a hub that connected both private and public organizations in the ABE network (figure 3). At the same time, as a representative of industry interests, NAABE members became far less likely to communicate within the network (see the negative coefficient on *Member of an industry association ego*), except among themselves (see the coefficient on *Same membership of an industry association*).

Third, the role of technical support organizations greatly grew. In 1998, there were only two technical support units in the network, whereas there were nine in 2005. The number increased because Newstatia's technical support system for ABE was still being built in 1998; it was completed in 2000. Once completed, these organizations' role in the network became much more substantial. As noted before, in the face of the September 11 crisis, NAABE perfected a system of policy mobilization to head off the existential crisis. A key component of that system was the technical support units. Each was regionally based, so each had a natural constituency of service providers it could mobilize, the vast majority of which did not participate in the policy network. Each technical support unit sat on top of a mobilization pyramid that could be used for political purposes. Not surprisingly, these units became more popular (see the coefficient on *Technical support organization alter*) and also communicated intensely among one another (see the coefficient on *Same technical support organization*), although we hasten to add that internal communication may not have been solely about policy matters.

Discussion

What caused the change? Our leading hypothesis focuses on conflict. In the face of fiscal stress that increased conflict, key subsectors of the network turned inward but had differing stances toward the rest of the network. Members of NAABE communicated with one another intensively but drew back from other policy network contacts in favor of allowing NAABE to communicate for all. Our structural variables (see the earlier discussion) and interview data confirm this interpretation of the data. As a result, the macro structure became divided into a large cluster of private sector actors (in the lower right quadrant of figure 3) and a large cluster of public sector organizations (in the upper left quadrant of figure 3).

A similar logic may be used to explain the behavior of state actors. State actors began to communicate more intensively internally but continued to seek external relationships in order to gather critical information needed to exercise their authority. Regulators no longer needed to seek relationships with organizations that they funded. Instead, by 2005, they were sought out by private sector actors in order to better stabilize resource flows.

PROPOSITIONS AND IMPLICATIONS

Our analysis of the data suggests that the structure of policy networks does, indeed, relate to underlying resource dependencies. However, as we noted in the first section of this article, resource dependence alone does not allow us to draw straight, neat lines from resource holder to resource seeker. Instead, resource dependence drives a series of balancing operations that instantiate themselves into the relational structure

that results. Moreover, our analysis also finds several sources of dynamism (e.g., the financial shock of the September 11 budget crisis), at least in this network during 1998–2005. Based on these findings, we derive several propositions about the relational structure of policy networks from what we have learned from our "comparative ERGM" approach used in this case.

Proposition 1: Change in dependence configurations changes network structure.

Proposition 1a: Dependence, coupled with power imbalances, causes network segmentation, particularly sectoral and subsectoral relational polarization.

The 1998 network and interview data suggest a looser, "clubby" set of relationships, in which a few public sector actors were involved and policy compromises were made among a set of influential individuals. The economic crash after September 11 placed formerly amiable partners in conflict, because the private sector coalition needed to alter the announced policy preference of the public agencies and leaders in order to ward off severe budget cuts. All else being equal, each sector tended to turn inward by creating more relationships with others of the same sector and fewer cross-sector relationships.

As a result, by 2005, the network was transformed, with a clear public–private split, much greater political mobilization, and cooptation of the state-funded technical assistance network for advocacy purposes. The power imbalance between resource holders and resource seekers increased, whereas the state legislature came to rely more on both state agencies and service providers to obtain the information necessary to allocate scarce resources appropriately. The need for information and the monopoly that providers held on useful information provided a counterbalance to the fiscal dominance of public sector actors. Increased mutual dependence between the sectors contributed to polarization into two distinct groups of actors (i.e., resource holders and resource seekers), each working to advocate their interests. (For a more detailed discussion on mutual dependence and power imbalance, please see Casciaro and Piskorski [2005].)

This observation adds a unique contribution to previous literature on interorganizational relationships by providing insights into the relationship between resource dependence and its impact on network structure. Extant studies have suggested that interdependent actors may develop trust, collaboration, and influence over time and may share goals, identities, and institutional and political resources in their efforts to offset their dependence on resource holders (e.g., Huang and Provan 2007; Provan, Huang, and Milward 2009; Provan, Isett, and Milward 2004; Saz-Carranza and Ospina 2011). However, the existing literature has paid little attention to how network structures emerges over time—especially, how such structures are shaped by underlying resource dependence and the reactions of social actors to that configuration (for exceptions to this observation, see Huang and Provan 2007; Provan, Huang, and Milward 2009). The present study highlights the malleability of the dependence structure, the sensitivity of social actors to changes in resource dependencies, and the contribution of responses to dependence in shaping new configurations.

Our findings on network segmentation also suggest that network structure may impose conditions on the network management strategies that participant

organizations implement. That is, in a core-periphery structure (such as that observed in our Wave 1 data), the key connections are to central decision makers—the group of five to eight actors from across various sectors that collectively discuss and adjudicate claims on public resources (see Meier and O'Toole 2003; O'Toole 1997). On the other hand, by Wave 2, resource scarcity drove the network toward a segmented structure reflective of the existential conflict over resource allocation. In the face of conflict, embedding in one's "home" segment through coalition processes may be a better strategy for political action (see Schalk, Torenvlied, and Allen 2010). Providers facing scarcity are more likely to gain a "survivable" resource allocation if they work together as a coalition in confronting public sector funders (Garrow 2011).

Proposition 2: Influence and sector are not independent drivers of relational structure but interact with each other.

This finding is perhaps the most surprising, because there appears to be no independent main effect from either influence or sector, but only through their interaction. In a polarized network, the influence of an organization may not be an absolute organizational characteristic that attracts other organizations and controls their decisions but may be more powerful within the organization's own subgroup (i.e., either the public or the private sector). This finding strongly suggests that relational structure is driven by dependence considerations, as discussed in the first proposition. Private and public sector actors have very different dependence profiles. In this particular network, the divide is comparatively clean, with public sector actors serving as resource providers and private sector actors serving as resource seekers. The differential is explained by how each reacts to the other's actions. Private sector actors have an interest in coalition processes and status granting as a way to consolidate resources and confront public sector actors who hold the financial cards. Public sector actors have an interest in overcoming isolation in order to secure the information they need to use their authority efficiently and effectively, but they also seek to diminish the political potency of the coalitions that result. If public sector actors can make useful relationships with key private sector players, the private sector coalition has more difficulty maintaining its united front.

Proposition 3: Crisis sweeps away the weaker, less connected players.

Although the 2005 network was larger, it contained far fewer private sector actors, as the process of polarization alters sectoral connections and prunes the network. Only thoroughly connected organizations survived in the network; the organizations that left the network were almost uniformly the least connected. In periods when resources are flush, expending some relational energy on keeping marginal players "in the loop" can be financed out of slack resources. In crisis, however, organizations are far more ruthless with their relational decisions; the less connected organizations (those who lack "SSRs," in our terms) could not forestall removal from the network.

This proposition is not entirely surprising, because many studies have reported that the structural embeddedness of organizations is positively associated with organizational effectiveness and survival (e.g., Baum and Oliver 1991, 1992; Schalk, Torenvlied, and Allen 2010). The present study, however, may provide useful insights into the

critical role of embeddedness in organizational survival during a "crisis," which also supports our argument on the importance of SSRs. As seen in this study, a crisis often leads to modifications of priorities in the allocation of state budget resources. In a turbulent period, well-embedded organizations are able to acquire necessary information to make timely strategic decisions for their survival (Baum and Oliver 1991, 1992; Sosin et al. 2010; Villadsen 2011). At the same time, highly embedded organizations have usually earned trust and reputation over an extended period, which can be converted into legitimate influence on decision making regarding reprioritizing agendas related to state budget allocations (see Huang and Provan 2007; Provan, Huang, and Milward 2009). Arguably, because human services often use ambiguous technologies and generate outputs that are difficult to measure and value (Garrow 2011), the structural embeddedness of organizations may be more relevant among service providers in the public sector than, for instance, organizations that provide concrete services like trash removal or road construction. For this reason, an organization's reputation as a high-quality service provider may be perceived as the only reliable and legitimate criterion on which to base resource allocation decisions. Thus, less-embedded and less well-known organizations are more likely than those that are better known and better embedded to perish in the face of crisis or a sudden environmental change.

Proposition 4: Broad social pressures, such as reciprocity and transitivity, affect interorganizational resource dependence.

As we suggested in the first section, one of the missing components in previous analyses of policy networks is an appreciation of the importance of social pressures as an explanation for certain structural regularities, such as reciprocity and closure. Our analysis has demonstrated that this network's structure was subject to those pressures, although the question concerning how to interpret what we found remains. Is it that structural pressures originate in interorganizational resource dependence (through, for instance, organizational preference for political partners that can trade political resources as equals), or do they derive from interpersonal pressures that act upon those who "enact" the relationships (Hatmaker and Rethemeyer 2008; Juenke 2005)? Our previous work (Hatmaker and Rethemeyer 2008) suggests the latter, but we suspect that future research will be able to disentangle this issue by controlling for the tenure of the "boundary spanners" (Friedman and Podolny 1992; Katz and Kahn 1978) who interact with other members of the network. If the presence or absence of a long-tenured boundary spanner helps to explain the relational structure, then interpersonal effects may be the root cause of our findings related to reciprocity and alternating k-triangles. Another possible explanation is that the underlying dynamism is compounded by both organizational and interpersonal factors, which may be tested by appropriate interactions in future research. That is, generic social pressure on organizations' relational choices may be conditioned by relational opportunities that the individual network members have enjoyed as well as the environmental pressures the organization faces (see also the discussion on "conversion" in Ashworth, Boyne, and Delbridge [2009]).

Nevertheless, our current work suggests that resource dependence is central to our understanding of network structure. The structural changes we observed in the face of a massive change in the availability of resources are precisely what one would expect

if organizations are actively managing their levels of dependence. Unfortunately, our current data do not allow us to tease out the relative contribution of dependence and interpersonal relationships.

Proposition 5: Material resources affect relational structure but more through resource seeking and resource preservation strategies than through their direct transfer potential.

The most simplistic form of RDT suggests that resource seekers will create relationships with resource providers in order to maintain key resource flows—the "hub-and-spoke" arrangement to which we referred in the first section of this article. That may happen to some extent, but our analysis suggests a much more complex pattern of dynamics that focuses on balancing operations. Organizations make contacts in the policy network to offset their dependence through "power network extension," rather than by attempting to manipulate the central supplier. The network is indeed configured to help control the central resource supplier (here, the major public sector organizations and the legislators who provide the resource flows to them) *and* to ameliorate uncertainty by cultivating alternative sources of financial support. In 1998, public resources were plentiful and private resources relatively scarce, so the network connection matrix suggests an attempt by those without state resources to gain access to those who had successfully obtained state grants. By 2005, state resources looked less certain, so the network was configured to help organizations gain access to private resources. Again, the primary purpose of the structure is to cope with the hegemony of state contracts, but it is also configured to provide alternatives.

LIMITATIONS

Several study limitations should be noted. First, although we believe our interview data support our assertions, the 7-year interval between the two data collection periods may introduce additional covariates that we could not adequately control. Second, some of the findings may result from our choice of the measurements, which may limit the generalizability of this study. For instance, our findings do not show whether (or how much) service providers' participation in the ABE Policy Network actually contributed to securing funding from the state government, because this study did not use objective indicators of funding as resource dependence variables. More importantly, the use of the subjective measure of influence may have introduced unknown biases to the study results. Third, although we believe that this network is sufficiently representative of other policy networks to use it as a prototype, we have not confirmed our findings in multiple networks. Therefore, one might find substantially different results from other networks. Finally, it should be noted that the data used in this study did not have sufficient information about the individuals to control for the nature and tenure of the person who enacts the interorganizational relationships.

Ideally, future work would (1) reduce the interval between waves to the point where longitudinal analysis using a more rigorous technique is possible, (2) include networks from more diverse social service arenas; and (3) include collection of personal covariates so that the social effects of person and organization might be jointly controlled.

CONCLUSION

The purpose of this study was to explore the determinants of the social structure of policy networks, focusing on resource dependence relationships and local interactions within a network. We believe our work contributes to the study of policy networks in several important ways. First, our findings suggest that policy networks are animated by a desire to control resource dependence. But (1) the observed tie structure is greatly influenced by balancing operations undertaken by network members; and (2) the generic social pressures for reciprocity and transitive closure also play a role. Neither of these findings has been addressed in the previous literature. Second, this study demonstrates the potential and power of stochastic social network methods, which enables us to control for the effects of microstructures. Third, our findings emphasize the importance of interorganizational relationships as valuable resources (SSRs in our terms). SSRs are related to MIRs in that organizations can use their structural position to help secure material and institutional resources that are needed to maintain operations. Our findings also point to the importance of understanding policy network structure as a social system. The network structure evolves over time, responding to the availability of resources and the consequent changes in resource dependence relationships. These conditions reorganize and reconstitute roles within policy networks. The findings on the emergence of subgroups are particularly useful for network managers, who need to understand how their relationships should be managed and how they should be understood in the broader context of overall network structure.

Fundamentally, resource dependence plays the central role that most research has suggested in structuring policy networks, but through complex and often indirect channels that challenge network managers to think more creatively about the short- and long-term consequences of their relational and institutional choices.

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