Explaining Policy Ties in the Argentine and Chilean Congresses:

A Network Analysis of Bill Initiation Data

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May 2010

Abstract

Policy networks formed by coauthoring and sponsoring bills reflect one of the most important types of connections legislators develop while in office. We expect the probability of a tie between two legislators to be influenced by partisan membership, territorial linkages, and the policy areas in which they develop expertise. Given the complex nature of relational data and the particular characteristics of bill initiation networks, we propose a new approach – bootstrapping an exponential graph model using augmented data reflective of the frequency of ties – to address the challenges of *thinning* dense networks. The empirical analysis focuses on the Congresses of Argentina and Chile.

Social science literature has typically argued that dense social networks with cross-cutting affiliations provide a favorable environment for democracy and consensual politics (Lipset and Rokkan 1967; Putnam 1993; Mutz 2002). Policy networks derived from coauthoring and sponsoring bills reflect one of the most important types of connections legislators develop while in office (Crisp, Kanthak et al. 2004). Prior works focused on bill initiation data have examined how an actor's relative position in the network affects legislative success (Fowler 2006; Tam Cho and Fowler 2010), how variations in ties reflect changes in political polarization (Zhang, Friend et al. 2008; Alemán, Calvo et al. 2009), how networks can be utilized to map actors' policy preferences (Crisp, Escobar-Lemmon et al. 2004; Alemán, Calvo et al. 2009) or to identify programmatic leaders (Panning 1983). While the growing literature on social networks has illuminated some of the partisan and career traits that determine legislators' behavior, there is still relatively little research on the formation of policy networks, and comparative analyses are scant. This paper attempts to fill this gap by examining the main determinants behind the formation of policy networks in two presidential democracies. Given the complex nature of relational data and the particular characteristics of bill initiation networks, the statistical analysis of policy networks raises some interesting methodological questions that our paper also attempts to answer.

Policy networks are formed by purposive legislators, who connect with others with whom they share some commonality of policy preferences as well as an interest in similar policy areas or jurisdictions. We hypothesize that connections are well explained by the institutions structuring legislative behavior in presidential democracies. More specifically, we expect the probability of a tie between two legislators to be influenced by partisan membership, territorial linkages, and the policy jurisdictions or areas in which they develop expertise. That is, we expect

competing principals from the party and the electoral districts to foster collaboration among legislators (Carey 2007), as well as common legislative expertise on issues or areas.

The empirical analysis presented in this paper measures these effects on the networks formed by legislators in Argentina and Chile. We examine these policy networks not only because they allow us to evaluate the implications of our arguments in two different contexts – Chile has a unitary constitution with strong parties, stable coalitions, and a serious committee system; while Argentina has a federal constitution, with a volatile party environment, and a weakly specialized committee system– but also because they allows us to demonstrate how the formation of policy ties provides relevant insights into other substantive questions about legislative behavior. Specifically, the analysis of policy networks allows us to measure the relative cohesion of parties and government coalitions, as well as the presence of territorial effects, which are matters not fully scrutinized by prior empirical examinations of legislative behavior in Argentina and Chile.

The rest of this paper is organized in the following manner. The first section presents our main argument about the formation of policy networks, including implications for legislative behavior in the congresses of Argentina and Chile. The second section proposes some methodological steps to tackle the main challenges facing network analysis of bill initiation data. We use two techniques to uncover the tendencies to form policy ties: an exponential random graph model (ergm) on data measuring the presence or absence of a dyadic tie, and a bootstrapped ergm model using augmented data reflective of the frequency of ties in each Congress. We test for party, territorial, and committee effects, while controlling for other factors like tenure and endogenous traits resulting from transitivity tendencies in social networks. The third section discusses the results from the empirical analysis, while the fourth one concludes.

1. **Legislative Behavior: What explains the likelihood of a policy tie?**

A social network is composed of actors and relations between these actors. We define policy networks as the social networks formed by legislators during the process of initiating bills, and the coauthoring or cosponsoring of a bill by two legislators as a policy tie. Consequently, the relations that make up these networks are joint public stances on policy.

Works focused on the U.S. Congress have stressed that cosponsorship activities carry policy content, revealing legislators' preferences for particular bills over the status quo (Mayhew 1974; Krehbiel 1995; Grant and Pellegrini 1998; Talbert and Potoski 2002). Studies of cosponsoring and coauthoring among legislators in Argentina and Chile have also characterized ties as evidence of commonality in policy preferences (Crisp, Desposato et al. 2005; Alemán 2009; Alemán, Calvo et al. 2009). Because cosponsoring reveals individual preferences, it is often seen as a signaling device used to build reputations (Mayhew 1974; Kessler and Krehbiel 1996; Crisp, Kanthak et al. 2004). It can also serve as a mechanism to build political support. Burkett and Skvoretz (2001), for instance, see cosponsorship activities as indicators of the institutionally structured flow of political support from one legislator to another. Similarly, Fowler (2006) argues that cosponsorship networks contain information about legislators' social support network, likely capturing personal and working relationships and some degree of trust.

We argue that networks formed through bill initiation capture two relevant aspects of the membership of congress: (i) similarity of policy preferences and (ii) intensity of preference over particular policy areas. Because bill initiation is a voluntary strategy that signals both preference and attention to specific issues, bill initiation behavior differs from other legislative strategies such as voting, where legislators are compelled to cast votes on (some of) those bills reaching the floor. Because policy networks capture commonality of preferences as well as shared interest

over policy areas, we expect policy ties to reflect partisan cohesiveness, responsiveness to district level principals, and similar jurisdictional expertise.

Political Parties

Individuals entering a political career are most often drawn into parties that advocate polices and promote interests closest to their own. Self-selection is an important source of party cohesion, not only in the U.S. Congress, but also in most other legislatures. This is particularly true in competitive environments where parties have different and relatively well defined public stances.

Activists and committed party voters are likely to contribute over time to the cohesion of legislative parties. Activists are often motivated to punish politicians consistently advancing positions incongruent with mainstream partisan stances. Antagonizing party activists and important segments of voters by repeatedly adopting non-partisan positions is electorally risky. Thus, overcoming nomination and electoral hurdles is often harder for ideological dissenters, especially if party leaders can influence this process.

In addition to similar preferences regarding what constitutes good public policy, members of the same party also share common political goals in their organized quest for office. If we conceive parties as groups whose members propose to collaborate in the competition for governmental power (Schumpeter 1942; Schlesinger 1966; Schlesinger 1991), then we must also consider the shared goals resulting from this collaborative effort. In the U.S. Congress, a common interest in enhancing the value of the party label is believed to be a powerful motivator for partisan behavior (Cox and McCubbins 2005). Within-party collaboration can also increase as a result of the internal bonds of cliques or factions seeking to showcase their own strengths.

Common organizational goals usually lead legislators to develop internal rules of procedure and leadership positions that help parties overcome many of the collective action dilemmas they face in congress. Leadership prerogatives, organizational procedures, and legislative rules are tools that parties can use to limit the influence or shorten the careers of ideological outliers. Thus, self-selection effects are reinforced by the intervention of activists and party leaders and the constraints of institutional rules.

Common partisan membership also facilitates communication and coordination, thereby increasing the likelihood that similar preferences and interests lead to policy collaboration (Bernhard and Sulkin 2009). There are many instances where legislators from the same party have to meet face-to-face, and several of these meetings are spent discussing policy issues. The collective action literature, through experiments and other methods, has confirmed the intuitive notion that face-to-face communication produces substantial increases in cooperation that are maintained over time (Ostrom and Walker 1997). Repeated personal interactions provide a favorable context for trust and reciprocity to develop among co-partisans.

For all these reasons, the likelihood of a policy tie between two randomly chosen legislators can provide a very good measure of party cohesion. From a methodological standpoint, policy ties retrieved from bill initiation data are different from the information obtained through the analysis of roll-call data in three relevant aspects: (i) they tend to be unaffected by the gatekeeping behavior of congressional leaders; (ii) they are less likely to be curved by whipping; and (iii) they incorporate relevant information about the intensity of preferences over specific areas of policy.

Because roll-calls often confound partisan effects and policy orientation (both in regards to preferences and attention), as described in Figure 1, the estimates of policy commonalities differ.

In countries where party discipline is very high, as is the case in Argentina and Chile, ideal points derived from roll-call votes are influenced by strong partisan effects, which tends to result in weak within-party discrimination.

[Figure 1, about here]

Territory and Politics

Territory structures electoral competition and legislative representation. Territory also matters because political preferences tend to be geographically clustered and geographical proximity often impacts political behavior.

Voters tend to be clustered into areas with others who hold similar political preferences (Key 1949; Escolar 1996; O' Loughlin 2000; Rodden 2010). This is partly the result of economic activity, residential decisions, transportation, and other types of socialization and segregation processes. It is also the result of historical-geographic processes that frame the range of political behavior in particular places (Agnew 1996). Lispet and Rokkan (1967) long-ago noted salient differences in political preferences between urban and rural constituencies in Western Europe, and similar divisions have been found more recently in many Eastern European countries (Ekman, Berglund et al. 2004). Rodden (2010), in accordance with British political geography, has posited that in industrialized countries, leftist voters are overwhelmingly concentrated in high density industrialized urban or mining districts, which impacts their legislative representation. Several studies have also given support to Key's (1949) finding from politics in the "Old South" of the U.S. that proximity to a candidate's home town impacts political support. Gimpel et al. (2008) argue that this advantage is rooted in the link between physical proximity and familiarity, which induces trust. Using data on U.S. gubernatorial elections, they show significant effects of "distance to candidate's hometown" on vote choice. Similarly, Chen and

Rodden (2009) examine data from registered voters in Florida that show voters who are relatively close in space are more likely to identify with the same party.

Territory should also impact the likelihood of policy collaboration between legislators. Representatives elected from the same geographical areas are likely to share an interest in areas of policy relevant to local constituencies. This may occur because legislators genuinely carry interests similar to those of their constituents, or because their career goals make them focus on those particular areas of policy. The main economic activities of the district (e.g., agriculture, fishing, mining, industry, services), its dominant social composition (e.g., urban poor, wealthy suburban, independent farms), and its geography (e.g., costal region, desert or tropical area), make some mix of policy areas particularly relevant to citizens living in it.

Legislators elected from the same electoral districts are likely to share a preference for distributive policies that target their constituents. Bills establishing targeted subsidies, funding local infrastructure projects, creating tax-free zones, providing relief to specific communities, and promoting cultural events or tourist destinations, are all examples of this type of activity. These bills, which provide direct benefits to district voters and interest groups, allow legislators to claim credit for effective representation. Members of the same district should tend to hold similar preferences with regards to such particularistic bills. Policy ties should also be more likely to develop between legislators that belong to districts that that are geographically closer.

Several studies have emphasized the linkage between representatives and their districts to explain legislative behavior. Mayhew (1974), for instance, saw cosponsorship in the U.S. Congress as a position-taking device with district constituents as the main targets. Other scholars have also associated initiation and cosponsorship activities in the U.S. Congress with issues relevant to a legislator's district (Regens 1989; Balla and Nemacheck 2000; Koger 2003).

Regens (1989) shows that the coal production characteristics of legislators' states significantly impact their probability to cosponsor a major environmental bill; Grant and Pellegrini (1998) show that legislators from the same region are more likely cosponsor bills together; and Caldeira and Patterson (1987) show that distance between districts reduces the probability of developing political friendships in a state legislature.

It must be noted, however, that the influence of a common electoral district in fostering a policy tie between legislators is mediated by the effect of electoral rules and patterns of electoral competition. Some rules foster personal vote-seeking incentives while others foster incentives to act in a partisan manner (Carey and Shugart 1995). In single-member districts, the incentives to cultivate a personal vote by promoting particularistic bills is believed to be very strong, but since there is no other elected member from the same district, all ties are across districts. In proportional representation systems, cross-pressures from voters and national party leaders often have a significant impact in the makeup of the party lists, which is supposed to result in legislators that are less sensitive to the preferences of their local constituents. In an analysis of bill initiation patterns in six presidential democracies, Crisp et al. (2004) found that where electoral rules encourage candidates for office to focus on their personal reputations, legislators devote more attention to targetable bills than in cases where electoral rules reinforce party-centric nominations.

Committee Work

In all presidential democracies the work of legislators is organized around a series of permanent or standing committees that have jurisdiction over well-defined areas of policy. The committee system establishes divisions of labor within congress and fosters the specialization of their members on certain issues or jurisdictions. Committee service allows legislators to develop

expertise on issues that grants them authority among peers. Candidates tend to showcase this expert knowledge on the campaign trail, as they claim ownership over some policy issues and publicize their track record

Committee assignments are, at least partly, the result of self-selection, which suggests that members of the same committee share *a priori* commonalities if not expertise. An interesting debate among US legislative scholars has addressed whether these tendencies lead to committees that are outliers vis-à-vis the median member of Congress. While there is relatively little evidence from roll-call votes in support of the view that US committees hold preferences significantly incongruent with the typical member of the chamber, there is some agreement that legislators have a particular interest in the policy domains of the committee in which they serve (even if this preference intensity is not consequential for voting behavior).

The recurrent contact resulting from common committee service creates many opportunities to share information about preferences and policy interests. Serving in a same committee provides a favorable context to foster the type of political friendship that makes coauthoring and cosponsoring bills more likely. Empirical analysis of social networks have found that the work environment has important influence in the development of friendship ties, and that ties formed among coworkers are more heterogeneous in terms of race and religion (McPherson, Smith-Lovin et al. 2001). Research on management and working relations, for instance, has highlighted how in work units with high interdependence, the likelihood of racially dissimilar coworkers developing supportive relationships is significantly higher than in other types of entities (Bacharach, Bamberger et al. 2005). In regards to legislative committees, Caldeira & Patterson (1987) argue that common service in a committee or subcommittee reflects common substantive interests and a common workload, which increases the likelihood of developing a political

friendship. They confirm this hypothesis in a study of political friendship among Iowa state legislators.

There is some evidence that joint committee membership contributes to the development of policy ties. For example, Cook (2000) and Grant and Pellegrini (1998) found evidence that in the U.S. Congress common committee service increases the likelihood of cosponsoring bills.

The relative importance of common committee service to the formation of policy ties can also be constrained by the institutional context. A strong committee system and candidate-centric electoral rules, for example, should increase the importance that committees have for fostering policy ties. By contrast, committees that are not highly specialized provide small returns to legislators that invest in expertise. It is unclear whether committee effects should also be present under other institutional contexts that deter specialization. In many countries, the number of committees varies significantly over time (i.e., jurisdictions are ill defined), and the membership is considerably unstable (i.e., low incentive to specialize), which should tend to reduce the impact of shared committee membership on the likelihood of legislators developing policy ties.

Implications for the Study of Policy Networks in the Argentine and Chilean Congresses

The empirical analysis focuses on policy networks in the congresses of Argentina and Chile. Both countries have had competitive democratic elections for over 20 years, and their national congresses are prominent political institutions. Since many of the insights about legislators' social networks stem from examining the case of the U.S Congress, it is important to see if they also apply to social networks formed in other presidential congresses. After all, generalizing in the social sciences often requires hypothesis testing using data generated from cases different from the one where the main propositions originated.

For the reasons explained in the prior discussion, we expect partisan, territorial, and committee effects to have a significant impact on the likelihood that two legislators develop a policy tie. We expect partisan effects to be strong in both Argentina and Chile. Territorial and committee effects should be present in both countries, but we expect stronger territorial effects in Argentina than Chile, and stronger committee effects in Chile than in Argentina.

The major parties of both countries are regarded as unified. In terms of roll-call votes, Argentine and Chilean parties consistently exhibit higher Rice scores than U.S. parties. Such behavior has generally been explained by reference to party leaders influence over legislators' electoral careers. In Chile, national party leaders through a centralized process of nomination, veto individual candidacies and hand-pick others, while in Argentina, a decentralized nomination process has given overwhelming influence to the provincial party leadership (De Luca, Jones et al. 2002). These activities not only create incentives for legislators to follow the party line when compelled to vote, but as noted before, they also contribute over time to impose an upper limit on the inconsistencies of party preferences.

Argentina's largest and most dominant party since re-democratization has been the Peronist Party (PJ), which usually controls between 40% and 55% of lower-chamber seats. The second largest party has been the historical rival of the Peronists, the Radical Civic Union (UCR). Few parties have performed as consistently as the Peronists, with a multitude of smaller parties rising and falling over short periods of time. Argentine parties tend to be poorly defined ideologically.[1] Yet legislative behavior is typically characterized as highly partisan, as in Chile, where parties are considered to have clear ideological positions. Since the return to democracy in 1990, Chile has had two competing coalitions: the leftist *Concertación*, composed of the Socialist Party (PS), the Party for Democracy (PPD), the Radical Social-Democratic Party (PRSD), and the Christian

Democratic Party (DC), and the conservative *Alianza*, composed of the Independent Democratic Union (UDI), and National Renewal (RN). The stability of the government and opposition coalitions contrasts with Argentina, and more importantly, with the period of fluid alliances that characterized Chilean democracy prior to the military interregnum. Moreover, the reorganization of the Chilean party system has led to a close association between Christian Democrats and the left, in sharp contrast to the pattern of alliances that preceded the military coup of 1973. Hence, the chances of within-coalition ties should be particularly high in Chile.

The territory of both countries suggests strong proximity effects. Both countries extend over large areas that encompass a variety of climates and regionally clustered economic activities. Argentine and Chilean regions are also strikingly different in terms of population density and wealth. Local politics are relevant in both countries. Argentina is a federal country with powerful elected governors and provincial legislatures. Chile is a unitary country, but has municipal elections and a strong historical tradition of active local politics (Valenzuela 1977). Patterns of electoral change underscore the presence of local effects, and available evidence highlights the presence of regional partisan clustering, such as leftist support in urban and mining regions of Chile, and non-Peronist dominance in the cosmopolitan city of Buenos Aires. This suggests that in Argentina and Chile, as in the U.S., voters that are geographically close to each other are more likely to hold similar political preferences. Consequently, Argentine and Chilean legislators from districts that are geographically contiguous should have constituencies with a more congruent set of political preferences than legislators from more distant districts.

The proximity aspect of territorial effects should have a strong effect in the likelihood of policy ties in both Argentina and Chile; however, two legislators from the same electoral districts should be much more likely to develop a policy tie in Argentina than in Chile. The main reason

has to do with the electoral system: the Chilean binomial system lessens the cooperative impact of belonging to the same district.

Argentine electoral districts coincide with the jurisdictions of the 24 provinces and the federal capital (average district magnitude = 5.3), while Chilean electoral districts are small political units gerrymandered at the end of the dictatorship to favor the exiting conservatives. While the small district magnitude in Chile (dm = 2) suggest a strong incentive to attend to district interests, the *binomial* system never leads to two seats for the same party, and only infrequently leads to two seats from the same coalition. This means that the two district representatives are almost always each other's main electoral rival. This scenario is less common in Argentina. There legislators are often part of provincial delegations, and although district magnitude is higher than in Chile, many Argentine legislators pursue a political career at the provincial level after leaving congress, making district politics crucial.

Finally, we expect shared committee work to foster the likelihood of policy ties in both Argentina and Chile, but given the comparatively weaker tendencies towards specialization present in Argentina, we expect this influence to be stronger in Chile. In Argentina permanent committees are weakly professionalized, with a relatively large membership and poorly defined jurisdictions. Over the last twenty five years, the number of standing committees has doubled and the number of members in each committee was also doubled. By contrast, the Chilean Congress has a smaller number of committees with well defined jurisdictions. While the average Argentine legislator serves in five different standing committees, the average Chilean legislator serves in two. The membership of Chilean committees is also more stable, meets more frequently, and exhibits a higher degree of specialization than the membership of Argentine

committees. As a result, we expect common committee membership to exert a greater effect in the Chilean Congress than in the Argentine Congress.

To sum up, the preceding discussion leads us to four main hypotheses regarding the formation of policy networks in the Argentine and Chilean congresses:

Hypothesis 1: *The likelihood of a policy tie between two legislators from the same party should be significantly greater than the likelihood of a tie between two legislators from different parties.*

Hypothesis 2: *The likelihood of a policy tie between two legislators from contiguous electoral districts should be significantly greater than the likelihood of a tie between two legislators from non-contiguous electoral districts.*

Hypothesis 3: *The likelihood of a policy tie between two legislators from the same district should be significantly greater than the likelihood of a tie between two legislators from different districts.*

Hypothesis 4: *The likelihood of a policy tie between two legislators that shared committee assignments should be significantly greater than the likelihood of a tie between two legislators that did not share such work.*

Two additional hypotheses refer to specific differences we expect to find when comparing the policy networks of Argentina and Chile:

Hypothesis 5: *The effects of same-district should be strong in Argentina and weak in Chile.*

Hypothesis 6: *The effects of same-committee should be strong in Chile and weak in Argentina.*

2. Network Analysis of Bill Initiation Data

Our analysis of policy networks uses bill initiation data from Argentina and Chile. We include all bills proposed to the Chilean House in the period 2002-2006 as well as all bill initiatives proposed in the Argentine House in the period 1997-1999. Chilean data includes information on all 493 coauthored bills initiated during the four-year term. The mean number of coauthors per bill in Chile is equal to 6.96.[2] The Argentine data is considerable larger, including 6,253 projects cosponsored during the two year period. The mean number of cosponsors in

Argentina is 4.95 per bill. While in Chile more legislators are linked per bill, the rate of bill initiation in Argentina is much larger. Consequently, we observe higher counts in Argentina: the average cell count in the valued affiliation matrix is 2.87, while in Chile is 1.94.

The density of the Argentine policy network is 0.369 (i.e., the proportion of all possible ties present), while the density of the Chilean policy network is 0.547. The high density reflects not only the existence of significant ties among members but also the large amount of bill initiation data in a given congressional period. In Figures 2 and 3, we plot both policy networks. Each node represents a legislator and a line between them denotes the existence of a policy tie. The color of the nodes distinguishes legislators associated with the government from those associated with the opposition. The figures suggest that legislators sharing relevant traits, such as belonging to the government or the opposition, are more likely to develop policy ties. To examine the influence of partisan, district, and committee effects, we move on to the statistical analysis of network data.

[Figure 2, about here]

[Figure 3, about here]

Network Analyses of Bill Initiation Data

Until recently, most statistical analyses of relational data, such cosponsorship data, would employ generalized linear models to estimate the parameters of interest. Such models, however, cannot properly account for the complex nature of relational data (Cranmer and Desmarais 2009). Recent developments in the analysis of relational data have dramatically altered how we evaluate the determinants of network structure. In particular, the use of exponential random graph models (ERGM) allows researchers to move beyond the dyadic independence assumption of earlier statistical approaches (Handcock, Hunter et al. 2003; Robins, Pattison et al. 2007).

Social networks are typically characterized by local clustering. In the prior section we advanced a series of hypotheses about the tendencies for assortative mixing in the Argentine and Chilean policy networks. But in addition to patterns of selective mixing, studies of social networks have highlighted other propensities for tie formation that are endogenous. One mechanism that plays a prominent role in social network theories is the tendency towards triad closure: triads containing two ties will tend to form the third, creating a triangle where all three nodes are connected (Rapoport 1957). As Goodreau et al. (2009) note, the reasons for such propensity towards triad closure may be due to proximity effects (e.g., two legislators connect to each other through their shared time with a third), or cognitive processes (e.g., two legislators value each other because of their agreement with a third). Thus, the process of triad closure leads to transitivity. Since assortative mixing also induces transitivity (by enhancing the chances of completed triangles within categories), an accurate assessment of the impact of one requires controlling for the impact of the other. ERGMs allow us to evaluate the impact of our propositions on the propensity for tie formation, while controlling for the propensity towards triad closure.

In an exponential random graph model a tie is assumed to be a random variable.[3] For each i and j who are distinct members of a set N of n actors, there is a random variable Y_{ij} where $Y_{ij} = 1$ if there is a network tie from actor i to actor j, and where $Y_{ij} = 0$ if there is no tie. The observed value of the variable Y_{ij} is y_{ij} while the observed network of the Y matrix of all variables is y. The probability of observing a set of network ties is formulated as:

$$P(Y=y|X) = \exp[\theta^T g(y, X)] / k(\theta)$$

Where Y is the random set of relations in a network, y is a particular given set of relations, X is a matrix of attributes associated with the actors in the network (e.g., partisan stripe, etc.), g(y,

X) is a vector of network statistics, θ is a vector of coefficients, and k(θ)is a normalizing constant.[4] So the log-odds that any tie exists given the rest of the network is,

$$\text{logit}(Y_{ij} = 1) = \theta^T \delta\,[g(y, X)]_{ij}$$

where $\delta\,[g(y, X)]_{ij}$ is the change in g(y, X) when the value of y_{ij} is switched from 0 to 1.

When terms capturing endogenous effects are included, estimation is based on Markov Chain Monte Carlo Maximum Likelihood Estimation. A distribution of random graphs is simulated from a starting set of parameter values and the parameter values are subsequently refined by comparing the distribution of graphs against the observed graph with this process repeated until the parameter estimates stabilize (Wasserman and Robins 2005; Hunter, Handcock et al. 2008).

Taking advantage of the valued network nature of bill initiation data

In an ERGM, the sociomatrix capturing policy ties is composed of cells with dichotomous values, indicating whether each pair of legislators is connected. But as described before, cosponsorship information provides researchers with counts of data describing the number of dyadic ties within a given period. Different from other types of relational data such as friendship or group membership, policy networks provide information not only about the existence of a relationship but also about the relative frequency of such relationship (i.e., the intensity of the cosponsorship or coauthoring relation). This implies that the probability of observing policy ties differs across each pair of legislators. Because the counts observed in cosponsorship data are meaningful, it is important to take advantage of such data rather than just assume away differences by reducing all counts to a single value expressing a tie.

Cranmer and Desmarais (2009) describe this problem as one of dealing with "dense" networks and propose "thinning" the cosponsorship data by picking up a threshold to recode the network. For example, the mean number of ties among each pair of legislators in Argentina was

2.8. Cosponsorhip values above the mean could be recoded 1 while values under the threshold take the value of 0. While thinning a network using a threshold offers one way for addressing this challenge, we still want to preserve information about the different intensity or frequency of ties among pairs of legislators.

Rather than thinning the original network data using a threshold, we decided to implement a strategy that preserves meaningful information about the frequency of interaction among legislators by bootstrapping all models on simulated networks with probabilities drawn from the original data. This requires three relatively simple steps: (i) retrieve the probability matrix from the original data; (ii) draw network samples from the original data; and, finally, (iii) run the ERGM specification on the simulated networks and retrieve mean and standard error parameters.

The probability matrix for bootstrapping network graphs of bill initiation data takes as input the original affiliation matrix reporting count events and normalizes by row, dividing the count in each off-diagonal cell (representing the number of ties*[i,j]* between legislator *i* and legislator *j*) by the total count of bills sponsored by legislator i (the diagonal cell for each legislator*[i,i]*).[5] This row normalized data expresses the probability that if legislator i sponsors a bill, it will have legislator *j* as a cosponsor.

We then simulate 1000 symmetric and undirected network graphs with cell probabilities drawn from the row normalized affiliation matrix described before.[6] Network graphs were drawn with the function *rgraph* from the library SNA in R 2.9.2, which allows researchers to provide cell specific probabilities. An alternative to our strategy would be to simulate these networks with some parametric form derived from the original data. Because we do not want to impose any structure onto the original data, we instead opted for non-parametric simulations.

Finally, we run ERGM on each of the 1000 simulated networks.[7] The mean of the parameter estimates and the mean of the standard errors are then reported. Notice that, because the probability of observing a tie among each pair of legislators differs across networks according to the frequency of their interaction, the bootstrapped estimates of ERGM carry information about the intensity of each tie. Consequently, our strategy for thinning out the data is sensitive to the actual frequencies reported in the counts of our valued network.

The Proposed Models and Variables

To test the hypotheses associated with the formation of policy networks in Argentina and Chile, we proceed in the following manner. First, we run a series of ERGMs on the original networks, which allow us to evaluate the proposed effects on the presence or absence of a tie. These models do not consider the frequency of ties among legislators, but just whether each pair is connected or not. Second, we run ERGMs that control for endogenous tendencies in network formation. More specifically, we account for transitivity effects by including a term capturing the propensity towards triad closure. Finally, we run bootstrapped ERGMs on thinned networks, as described before. These specifications replicate the first ERGMs but with our simulated networks as dependent variables. We expect these last specifications to provide estimates that are weighted by the frequency of interaction among pairs of legislators.

The dependent variables in the analysis are (i) the original policy network, reporting the presence or absence of a tie between each pair of legislators (ERGM); and (ii) 1,000 bootstrapped networks, with dyadic ties drawn from the original probability matrix of the valued network (bootstrapped ERGM).

The model includes a series of vectors and networks as explanatory variables. First, we include variables indicating party membership. For Argentina, we include variables identifying

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the two main parties, PJ and UCR, and the category "others." For Chile we include variables for all six parties. Second, we include a variable indicating whether the legislator belongs to a government party or an opposition party. In Chile there was a multiparty coalition, as noted before, while in Argentina there was single-party government. Third, we include a variable indicating common electoral districts. In addition, we include two networks as independent variables: one is a matrix capturing contiguous districts, while the second is a matrix capturing shared committee membership.

We also include two control variables. The first is a variable indicating whether the legislator is in his first term in office (freshman). This control is not meant to capture within freshmen ties, but whether freshmen are more active than non-freshmen, as some of the literature from the US Congress suggests. The second is an endogenous term capturing the tendencies for triad closure. The endogenous term utilized is the geometrically weighted edgewise shared partner distribution (GWESP) (Hunter 2007, Hunter and Handcock 2006, Snijders et al. 2006), which is an alternative approach to counting triangles. The shared partner count is taken on each edge, producing a distribution of counts. The GWESP statistic defines a parametric form of this count distribution that gives each additional shared partner a declining positive impact on the probability of two persons forming a tie (Goodreau et al. 2009).

3. Results

Tables 1 and 2 present several different specifications of the statistical models described in the previous section. The first four utilize the existing policy network (ERGM) and the other three are based on the 1,000 simulated networks (ERGM bootstrapped). The first specification includes the government and opposition variables, while the second specification includes party

variables. The third specification is designed to capture tendencies for cross-partisan ties. The fourth specification is the same as the first one, but with the endogenous term. Finally, the three ERGM bootstrapped specifications replicate the first three ERGM specifications using the thinned networks.

[Table 1, about here]

The results show strong partisan and government effects that are robust to different model specifications. In both Argentina and Chile, government (opposition) legislators are significantly more likely to develop ties with other government (opposition) legislators than with members of the opposition (government). Similarly, legislators are significantly more likely to develop within-partisan ties than cross partisan ties.

[Table 2, about here]

For example, the results for the first specification tell us that the probability of a tie between two government (PJ) legislators in Argentina is 36%, which is significantly higher than the likelihood of a tie between a government legislator and an opposition legislator, which is 19% (assuming no shared committee, different non-contiguous provinces, and non-freshmen status). The government and opposition coefficients remain significant after controlling for the endogenous tendency towards triad closure (specification #4), and when utilizing the simulated networks (specification #5). In Chile, the probability of a tie between two government (*Concertación*) legislators is 65%, while the likelihood of a tie between a government legislator and an opposition legislator is 33% (assuming no shared committee, different non-contiguous districts, and a non-freshmen). In Chile, the tendency towards intra-coalition ties is equally strong for government and opposition legislators, and both coefficients remain significant when

we include an endogenous parameter (specification #4), and utilize the simulated networks (specification #5).

The results highlight differences in partisan cohesion. For example, while all Argentine legislators show a tendency for intra-partisan connections, legislators from the UCR are much more likely to develop within-party ties than Peronist legislators (67% versus 36%, specification #2). This reflects the divergence of positions within Peronism that is usually highlighted in the qualitative literature, and the specific factional divisions associated with that time period (i.e., the split between those supporting the Peronist President Carlos Menem, and those supporting his rival and presidential hopeful Eduardo Duhalde, then governor of the Buenos Aires Province). The results using the simulated networks still show differences in the tendency of PJ and UCR legislators to develop intra-partisan ties, but the magnitude of this difference is clearly smaller.

The most cohesive Chilean parties are ideological opposites. According to specification #2, the probability of an intra-partisan tie is virtually guaranteed in the case of PS (93%) and UDI legislators (97%). The chances are somewhat lower for RN (82%), PPD (80%), and DC (70%) legislators. Legislators belonging to the smallest partner in the government coalition, the PRSD, are not more likely to develop intra-partisan ties than cross-partisan ties. This is mainly due to their high tendency to develop ties with other coalition members (to the detriment of their fellow partisans). These tendencies are maintained in the analysis of simulated networks (specification #6) but, as in the Argentine case, the magnitudes of the inter-partisan differences are reduced.

The results also highlight patterns of cross-partisan commonalties. In Argentina, small parties appear more likely to develop policy ties with the UCR (38%) than with Peronist legislators (21%), according to specification #3. Still, the least likely policy tie is between a UCR and a PJ legislator, 16% (again, assuming no shared committee, different non-contiguous provinces, and

non-freshmen status). In Chile, the model capturing cross-group ties differentiates between leftists (social-democrats in PPD and PRSD, and socialists in PS), Christian Democrats (DC), and rightists (RN and UDI). Since the left out category in these specifications is a tie between DC and rightists, the results show that a Christian Democrat legislator is significantly more likely to develop ties with a leftist legislator (58%) than with rightist legislators (38%), according to specification #3. The probability of a leftist legislator developing a policy tie with a rightist legislator is somewhat lower (30%). For both countries, cross-partisan tendencies are maintained when we use the bootstrapped technique on simulated networks (specification #7).

The results also convey the relevance of territorial effects. In Argentina, a policy tie between two legislators coming from the same province and from provinces that are contiguous is significantly more likely to develop than a policy tie between two legislators who do not share these territorial traits. The impact of contiguous province appears as the strongest predictor in the Argentine network. For example, according specification #1, the probability of a tie between a government and an opposition legislator from contiguous provinces is an impressive 87%, which is around 68 percentage points higher than for similar legislators from non-contiguous provinces (assuming no shared committee and non-freshmen status). The coefficients for same-province and contiguous-province remain significant when we include the endogenous control variable, and when we use the simulated networks, although in the latter instances the greater impact of contiguity vis-à-vis shared-province is reduced.

While territorial effects are also present in Chile, they are less consequential than in Argentina. The coefficient for contiguous district is significant and robust to alternative specifications, but its impact is substantively modest. For example, according specification #1, the probability of a tie between a government and an opposition legislator from contiguous

districts is 39%, which is just 6 percentage points higher than for similar legislators from non-contiguous districts (assuming no shared committee and non-freshmen status). The results for the coefficient for same-district appear to be less robust. The variable is significant in only three of the seven specifications. It is borderline significant when we include the endogenous term as control (specification #4), and is not significant in any of the bootstrapped ERGMs (specifications #5 to #7).

Committee effects are evident in the policy networks of both countries. Two legislators sharing committee assignments always are significantly more likely to develop a policy tie than two legislators that have not shared such work. These results are robust to the inclusion of the endogenous control and the incorporation of information about the frequencies of ties. In the Argentine network, the relative impact of shared committee membership is reduced in the latter specifications. Yet after controlling for endogenous influences and addressing the frequency of counts through bootstrapping, the results still reveal that committee effects are at least as robust in Argentina as in Chile.

Finally, the results for the control variables reveal other interesting results. The coefficient for first-time legislators captures the tendency towards tie formation, not a tendency for within-group ties, as with the other variables. The results show that in the Chilean policy network, first time legislators are not more likely to coauthor bills than more senior legislators. In the Argentine policy network, the results for the first four specifications show that first-time legislators are significantly more likely to cosponsor bills than more senior legislators, but such differences become insignificant in the last three ERGM bootstrapped specifications designed to incorporate information about the frequency of dyadic ties.

The term introduced to control for endogenous tendencies is significant in both policy networks, revealing a common tendency towards triad closure. While the endogenous term GWESP (specification #4) is positive and significant in both cases, its impact appears to be much greater in the Chilean policy network than in the Argentine one. Interpreting the results for the GWESP parameter is complex. Consider two Chilean legislators that differ from each other on all other traits. If they have no shared partners, then the probability of them developing a policy tie is about zero (specification #4). If they have any positive number of partners in common, and each of them is in at least one other triangle with each of these partners, then the probability of them developing a policy tie is 34%. If some of the two legislators' common partners were not already in other triangles with each of them, then the probability rises even more.[8]

To sum up, the results are consistent with most of our hypotheses. The likelihood of two legislators developing policy ties is significantly higher if these legislators are from the same party, from contiguous electoral districts, or have been assigned to work in the same congressional committee. As expected, belonging to the same electoral district has a major impact on the likelihood of developing a policy tie in Argentina, and only a weak effect in Chile. Unexpected, however, were the results for shared-committee work in Argentina, where a weakly institutionalized committee system had suggested a weaker effect. This implies that even in the context of weakly institutionalized committee systems, shared policy interests and frequency of interaction can make policy ties between committee members highly likely

The results also informed us about the relative cohesion of parties, the unity of governing coalitions, and the likelihood of cross-partisan ties. In Chile, the tendency towards cross-partisan ties follows coalition attachments and a clear ideological ordering. In contrast, the pattern of cross-partisan ties in Argentina highlights the division between the two major parties and

contenders for the presidency, the Peronists on the one hand and the UCR on the other, both typically espousing rather undefined centrist catch-all policies.

An important implication from our analysis is that accounting for the frequency with which ties are observed is important. As shown, ERGM estimates of the non-weighted dense network of cosponsorship overstate the importance of districts in Chile and understate the importance of province in Argentina. Both the specification that accounts for endogeneity in the data structure – using geometrically weighted shared partners – and the bootstrapped results provide similar (and more reasonable) standard errors. When comparing both models, bootstrapped results are resilient to degeneracy problems (i.e., convergence failures). Models that explicitly account for structure in the network, however, allow researchers to evaluate whether hypothesized effects are robust to the inclusion of endogenous tie-formation tendencies.

4. Conclusion

This paper provides a number of insights of theoretical, methodological, and empirical importance. We begin making the case that institutional incentives (partisan, territorial, and organizational) influence the formation of policy ties. Furthermore, we explain why bill initiation data has advantages over plenary votes when it comes to measuring party cohesion. We argued that value networks carry relevant information about tie formation, and offered a strategy to weight ERGM estimates by the frequency of observed ties, with few assumptions and without imposing a parametric form that may bias our estimates. The results suggest that the intensity of the interaction between representatives provides insights on which legislators' traits are important for tie formation and which ones are more marginal.

The paper also contributed to the empirical analysis of legislative behavior by providing the first cross-national analysis of policy networks (and their determinants) in Latin America. The results offered clear evidence of systematic influences on legislative behavior and measure the different partisan, territorial, and organizational determinants of policy ties.

In contrast to prior research in Argentina, which has had difficulties assessing the importance of provincial politics in the policy-making process, we showed territoriality to be one of the most important determinants of policy affinity. This finding complements other non-legislative research that has deemed inter-province coalitions critical for explaining voting patterns in Argentina (Gibson 1997; Calvo and Murillo 2004; Calvo and Escolar 2005). Results from the Chilean policy network confirm the findings from prior works showing high levels of coalition unity and an ideological alignment of parties (Carey 2002; Alemán and Saiegh 2007), and provide new insights into the legislative consequences of committee work and territorial proximity.

To conclude, the study of social networks derived from bill initiation data offers one important, yet seldom utilized approach to learn about legislators' policy positions. For scholars interested in comparative legislative analysis, the greater availability of bill initiation data with respect to roll call data should be welcomed news. Many theoretical and methodological questions remain to be answered, and cross-national empirical evidence is still scarce. We expect this paper to contribute to the development of this legislative research field.

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Table 1: Explaining Bill Initiation in the Argentine Congress, 1997-1999

Variables	ERGM (#1)	ERGM (#2)	ERGM (#3)	ERGM (#4)	ERGM-B (#5)	ERGM-B (#6)	ERGM-B (#7)
Edges	-1.48 ***	-1.25 ***	-0.59 ***	-2.12 ***	-4.63 ***	-4.54 ***	-3.41 ***
	0.02	0.02	0.03	0.02	0.08	0.07	0.07
Same Committee	1.15 ***	1.10 ***	1.17 ***	1.15 ***	0.59 ***	0.59 ***	0.60 ***
	0.03	0.03	0.03	0.03	0.07	0.07	0.07
Same Province	0.64 ***	0.63 ***	0.65 ***	0.64 ***	0.98 ***	0.99 ***	0.99 ***
	0.04	0.04	0.04	0.04	0.08	0.08	0.08
Contiguous Province	3.34 ***	3.24 ***	3.40 ***	3.33 ***	1.59 ***	1.58 ***	1.62 ***
	0.61	0.60	0.61	0.48	0.44	0.44	0.44
Freshman	0.04 **	0.04 **	0.05 ***	0.04 **	0.07	0.07	0.07
	0.02	0.02	0.02	0.02	0.04	0.04	0.04
Government	0.90 ***			0.90 ***	1.22 ***		
	0.03			0.03	0.08		
Opposition	1.44 ***			1.43 ***	1.36 ***		
	0.03			0.03	0.08		
Party PJ		0.68 ***				1.13 ***	
		0.03				0.08	
PJ with UCR			-1.05 ***				-1.35 ***
			0.03				0.11
PJ with Other Parties			-0.74 ***				-1.08 ***
			0.03				0.10
Party UCR		1.98 ***	1.30 ***			1.76 ***	0.63 ***
		0.05	0.05			0.09	0.09
UCR with Other Parties			0.08 **				-0.81 ***
			0.04				0.12
Other Parties		1.35 ***	0.68 ***			1.79 ***	0.67 ***
		0.05	0.05			0.10	0.10
GWSEP				0.65 ***			
				0.01			
AIC	44222	44407	43589	44123	9752	9574	9560
BIC	44282	44282	44282	44282	9811	9642	9645
n	37128	37128	37128	37128	37128	37128	37128

Table 2: Explaining Bill Initiation in the Chilean Congress, 2002-2006

Variables	ERGM (#1)	ERGM (#2)	ERGM (#3)	ERGM (#4)	ERGM-B (#5)	ERGM-B (#6)	ERGM-B (#7)
Edges	-0.69 ***	-0.38 ***	-0.47 ***	-11.93 ***	-3.57 ***	-3.15 ***	-3.38 ***
	0.05	0.04	0.06	0.12	0.11	0.09	0.15
Same Committee	0.52 ***	0.55 ***	0.53 ***	0.53 ***	0.35 ***	0.40 ***	0.35 ***
	0.05	0.05	0.05	0.06	0.09	0.09	0.09
Same District	0.62 **	0.43	0.65 **	0.62 *	-0.13	-0.33	-0.09
	0.28	0.27	0.28	0.33	5.21	6.30	6.33
Contiguous District	0.23 ***	0.21 ***	0.22 ***	0.23 ***	0.22 **	0.21 *	0.23 **
	0.07	0.07	0.07	0.07	0.11	0.12	0.11
Freshman	0.03	0.01	0.04	0.04	0.10	0.07	0.10
	0.04	0.04	0.04	0.03	0.07	0.07	0.07
Government	1.30 ***			1.30 ***	1.37 ***		
	0.06			0.06	0.12		
Opposition	1.37 ***			1.36 ***	1.56 ***		
	0.06			0.07	0.12		
Party PS		2.95 ***				1.63 ***	
		0.52				0.32	
Party PPD		1.77 ***				1.37 ***	
		0.18				0.20	
Party PRSD		0.68					
		0.53					
Party DC		1.25 ***	1.33 ***			1.30 ***	1.52 ***
		0.14	0.15			0.18	0.22
Party RN		1.92 ***				1.61 ***	
		0.19				0.17	
Party UDI		3.91 ***				1.84 ***	
		0.26				0.11	
Leftist Bloc (PS-PPD-PRSD)			1.37 ***				1.35 ***
			0.10				0.17
Leftist Bloc with DC			0.80 ***				0.89 ***
			0.09				0.18
Leftist with Rightist			-0.37 ***				-0.34 *
			0.07				0.18
Rightist Bloc (RN-UDI)			1.14 ***				1.37 ***
			0.08				0.15
GWSEP				11.25 ***			
				0.10			
AIC		44407	43589	44123	9752	9574	9560
BIC		44282	44282	44282	9811	9642	9645
n		37128	37128	37128	37128	37128	37128

Figure 1

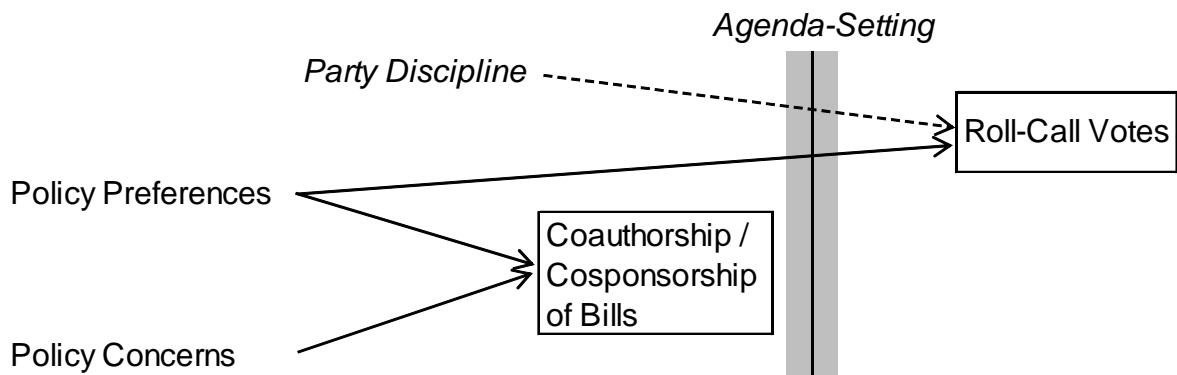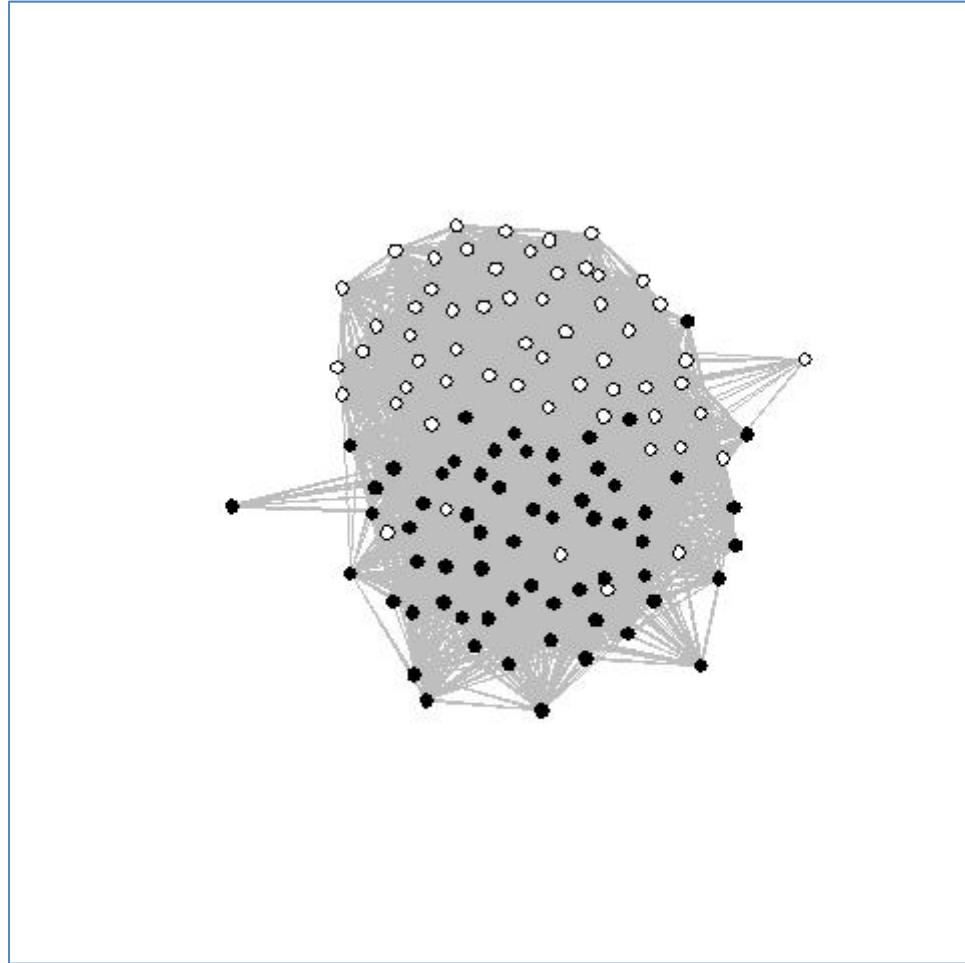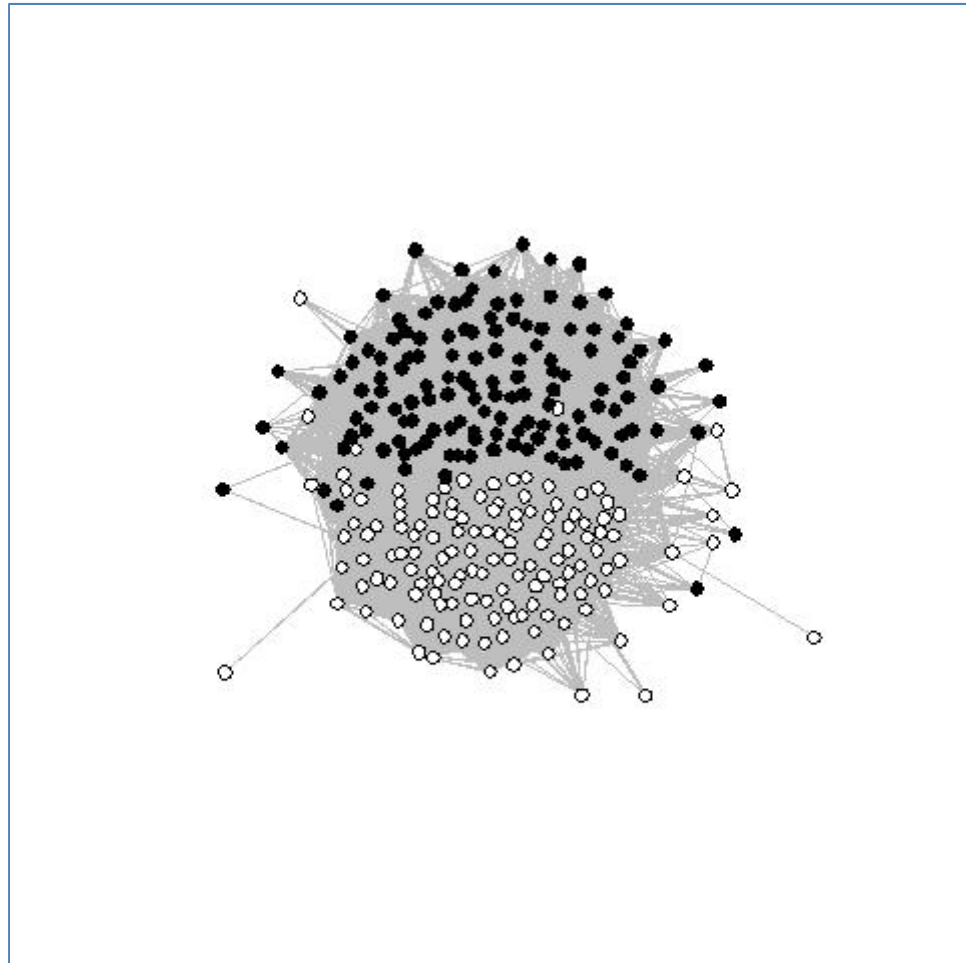**Measures of Individual Preferences, Cosponsorship and Roll-Call Votes**

Figure 2

Government (black) and Opposition (white) in Chile, 2002-2006

Note: Distances estimated using Kamada-Kawai force-directed placement algorithm.

Figure 3

Government (black) and Opposition (white) in Argentina, 1997-1999

Note: Distances estimated using Kamada-Kawai force-directed
placement algorithm.

Endnotes

[1] Very high turnover rates in the Argentine Congress have lead to a membership characterized by what Jones et. al. Jones, M. P., S. Saiegh, et al. (2002). "Amateur Legislators -- Professional Politicians: The Consequences of Party-Centered Electoral Rules in a Federal System." American Journal of Political Science **46**(3): 656-669. call *professional politicians and amateur legislators*.

[2] The mean number of cosponsors is similar to the one observed in the US House, although the Chilean House has only a fourth as many members Alemán, E., E. Calvo, et al. (2009). "Comparing Cosponsorship and Roll-Call Ideal Points: Evidence from the U.S. House of Representatives and the Argentina Chamber of Deputies." Legislative Studies Quarterly **XXXIV**(1): 87-116..

[3] This summary of ERGM modeling is based on Robins et al. (2007) and Handcock et al. (2008)

[4] See Goodreau et al. (2008, pp. 7-8).

[5] Notice that full simulation of the original data would require normalizing off-diagonal cells by the total number of ties in the original network. This would be equivalent to running ERGM on each bill in the original data. However, given that the each individual level bill is saturated with zeros, the probability of observing a tie in each individual cell would be too small. Consequently, most terms would be dropped. Our strategy, by contrast, respects the original probabilities of observing a tie between each pair of legislators without producing graphs that are saturated with zeros.

[6] To ensure that the network is symmetric and takes advantage of the information contained in the affiliation matrix, we simulate 500 network graphs from the lower triangle and 500 network graphs from the upper triangle of the original affiliation matrix.

[7] We use the statnet package for all ergm analyses (Handcock et al. 2003)

[8] The log-odds rise by an additional 11.25 for each edge that is not in any triangle but that enters one when the two actors develop a policy tie.