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The Relational Determinants of Legislative Success: Strong and Weak Ties Between Legislators

Justin H. Kirkland
University of North Carolina Chapel Hill, jhkirkla@email.unc.edu

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Justin H. Kirkland*
jhkirkla@email.unc.edu

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Abstract

In the repeated interactions of a legislative session, legislators develop working relationships that can be used in the pursuit of legislative goals. I develop a theory of influence diffusion across a legislative network of relations based on strategic actors building relationships in order to increase legislative success. Building on sociological theory initially developed by Granovetter, my research indicates that it is the weak ties between legislators that are the most useful in increasing legislative success. I test my theory using state legislative data from eight state legislatures, along with a second analysis of the US House of Representatives. Empirical analysis provides consistent support for the notion that weak ties lead to legislative success.

*Department of Political Science, University of North Carolina Chapel Hill

Legislators are strategic, goal-oriented actors motivated by three main goals: 1) increased institutional prestige, 2) re-election, and 3) good public policy (Fenno 1973). Legislators are also social beings pursuing those goals in a social construction (a legislature) comprised of interdependent relationships (Patterson 1959, Clark, Caldeira and Patterson 1993, Peoples 2008, Fowler 2006a, Fowler 2006b). These two empirical facts beg the question how might a strategic, goal-oriented legislator make use of the relational environment he or she operates within to pursue his or her goals? What good are collaborative relationships to actors motivated by Fenno's trinity of legislative goals, and, by extension how do relationships influence legislative outcomes? Research on relationships in legislatures has uncovered that a link exists between legislative relationships and legislative outcomes (Peoples 2008, Arnold, Deen and Patterson 2000, Tam Cho and Fowler 2010), but the path from relationship to outcome remains hazy at best. My research provides a theoretical framework, based on seminal sociological research (Granovetter 1973, 1983) for understanding how relationships and positions within a relational network influence legislators' goals and thus, legislative outcomes.

I develop a theory of influence diffusion across a legislative network that predicts that weak ties between legislators increase the probability of legislative success while strong ties between them do not. I test the theory using cosponsorship data from the U.S. House of Representatives as well as the lower chambers in eight state legislatures. Using cosponsorship of legislation to measure relationships between legislators has some precedent (Fowler 2006a, Fowler 2006b, Bratton and Rouse 2010), and, while cosponsorship may be a noisy indicator of legislative relationships, there is ample evidence that legislators expend a great deal of effort seeking cosponsors for their bills, and that they carefully weight their own decisions regarding whether to cosponsor the bills introduced by others (Kessler and Krehbiel 1996). Multilevel logit models provide strong support for my theory, indicating that weak ties between legislators are the ones that yield increases in legislative success.

Legislative Relationships

Most early work on relationships between legislators has focused on studying one legislature at a time. Taking advantage of a unique elite level survey of the Iowa legislature from 1965, Patterson and Caldeira (1987) note that political friendships in a legislature are critical avenues of information flow. They find strong evidence supporting both a partisan basis for friendships in a legislature and support for the propinquity model (meaning that legislators who live close to one another geographically are more likely to be friends). Using the same data, Caldeira and Patterson (1988) find that education and legislative experience do not facilitate friendship within the legislature; however, these attributes do facilitate respect. Conversely, geographic proximity and campaign activism promote friendships without promoting respect. In their final piece using this data, Clark, Caldeira and Patterson (1993) note that divergent attitudes strongly predict affect and friendship, but they do not predict respect.

Using 1993 elite level interviews with the Ohio State House of Representatives, Arnold, Deen, and Patterson (2000) find that friendship between two legislators strongly predicts the likelihood of a similar vote at roll call, even when controlling for ideological and partisan similarities. Using the same Ohio data, but with several methodological improvements, Peoples (2008) continues to find that the social relationships between legislators have strong influences on their subsequent behavior at roll call.

A noticeable limitation with all of these studies is their lack of generalizability. Studying elite level surveys in one state prevents researchers from testing a general theory of relational legislating. In order to increase generalizability, some scholars have moved to studying cosponsorship in a legislature as an observable indicator of legislative relationships. Fowler (2006a, 2006b) provides one of the earliest examinations of cosponsorship in a legislature as a social network. By using cosponsorship, Fowler is able to examine several years of the U.S.

House. His work on the U.S. House of Representatives indicates that a legislator's centrality to the social network measured via cosponsorship positively impacts the success of both bills the legislator sponsored and amendments to bills the legislator offered. Gross and Shalizi (2009) also examine the cosponsorship network (in the U.S. Senate rather than the House) and find that subtle social predictors like being from the same state, same region, shared religious denomination and gender predict senators' decisions to cosponsor one another. In other recent work, Bratton and Rouse (2009) study cosponsorship in nine state legislatures and find that gender and ethnicity predict state legislators' decisions about cosponsorship and that there are high levels of clustering amongst legislators across chambers.

While generalizability remains problematic, the more important limitation in the studies of relationships between legislators has been their weak theoretical basis. None of these studies have developed general theoretical accounts of how and why strategic, goal-oriented political actors form relationships and how those same strategic actors might make use of relationships to achieve their own ends. Fenno (1973) notes that the primary goals of legislators are re-election, good public policy and influence within the relevant legislative chamber. Scholars to this point have either treated all ties as equal (Fowler 2006a) or only considered strong ties as important (Bratton and Rouse 2009), without a clear understanding of how tie strength indicates different types of behavior. I address this shortcoming by offering a theory of influence diffusion animated by goal-oriented actors who make use of relationships to achieve legislative success and influence. Additionally, I will overcome problems of generalizability by studying several state legislatures and the US Congress simultaneously.

Ties Between Legislators and the Diffusion of Influence

Legislators are social beings engaged in repeated interactions over the course of a legislative session. This occurs in committees, on the floor, and in informal meetings. Through this interaction, legislators learn the ideological dispositions of their counterparts, but this is not all they learn. Repeated interactions provide legislators with information about a host of other attributes useful for strategic interaction, including who is willing to compromise, who is an effective communicator, who they enjoy working with, etc. Armed with this information, legislators strategically develop their legislative networks with certain outcomes in mind. Studies of legislative networks have thus far ignored this potential strategic positioning by goal-oriented actors, instead focusing largely on descriptive summaries of networks and demographic drivers of relationship formation (for example race or gender).

One implication of the trinity of legislative goals developed by Fenno (1973) is a legislator's desire for legislative success. I define legislative success as bills sponsored by a specific legislator succeeding in surviving two veto points in a legislative chamber (committee deliberation and final passage). Thus, a legislator who sponsors a bill that survives committee deliberation and passes a floor vote is more successful than a legislator whose bill is killed in committee. Bills sponsored by a legislator are, more often than not, bills the legislator believes promote good public policy. Legislative success is also a measure of influence within the chamber. The more often bills sponsored by a specific legislator pass the chamber, the more influential that legislator is on the policy outcomes of the chamber, *ceterus paribus*. So, understanding how a legislator's relational network influences his/her legislative success provides insight into how a strategic legislator makes use of relationships to achieve the most basic goals of legislators. It is important to note that these concepts of interest are legislator-specific, not bill-specific. A legislator's success is determined by how many bills he or she is able to craft that survive the legislative process. A legislator's relational portfolio represents the aggregated support for that individual legislator not for each bill. Thus, this is an account of how an individual legislator's characteristics influence that legislator's success.

To focus on paths through a legislative social network for increasing legislative success, I draw heavily on social networking theory developed by Granovetter (1973, 1983). Granovetter argues that when observing information transmission across a social network, the strength of relational ties is an important consideration. Consider, first the individuals strongly tied in a social network. These actors are generally strongly tied[1] in the network because of latent similarities on important dimensions. In a friendship network for example, strong ties are a result of common interests, activities, and outlooks on life. Those who are weakly tied in the network are tied together as a result of some interactions that lead to an association but they retain important differences on the dimensions that generate strong ties. Thus, weak ties typically occur between individuals with important fundamental differences.

Granovetter's initial work focused on job change. The initial empirical research uncovers that, amongst those individuals who changed jobs, the information about new employment opportunities came from acquaintances rather than close friends. The close friends of job changers (strong ties) are strongly tied because they engage in the same activities and live in the same area. They share important latent similarities that prevent them from having novel information to exchange. They provide no information to the potential job changer that is not already easily accessible. Acquaintances however, interact rarely (though on some occasion) but have access to information the potential job changer cannot gather. Thus, those weakly tied to the job changer provide novel information that strong ties simply cannot provide because of the nature of strong tie development.[2]

Now consider a similar argument within a legislature. Legislators form strong ties with one another because of latent similarities on factors like ideology, party, and demographics. Because of these similarities, strongly tied individuals have the same preferences for good

[1]For Granovetter tie strength is a function of the frequency of interactions. Strong ties are then defined as people who see each other often. Weak ties are acquaintances who rarely interact.

[2]This "strength of weak ties" argument has found empirical support in work by Burt (2004), Perry-Smith and Shalley (2003) and Tiegland and Wasko (2000) which indicates that as the number of bridging ties an individual has increases, creativity and performance in the work place increase. Bridging ties, it is argued, provide access to alternative points of view and broader scope than colocated or strongly tied connections provide. These alternative points of view provide increased creativity and help in the diffusion of good ideas once they have been developed.

public policy (one of the three major legislative goals) and commonly support the same pieces of legislation as a result *even if they did not have strong ties amongst them.* Bratton and Rouse (2009), who only examine strong ties, demonstrate that ideology, party, gender and race all play important roles in strong tie formation. I expect that weak ties to be critical for legislative success precisely because weak ties should form between legislators who do not share many other similarities. Establishing relationships with those less similar to themselves allows legislators to expand their potential sphere of influence beyond those who are already predisposed to support them because of some set of shared characteristics.

While not explicitly discussed in Granovetter's original work, or tested in empirical work examining his theory, the initial weak ties argument implies that not all weak ties are equal. The value of weak ties is a result of their novelty of information or influence. By providing access to new resources, weak ties provide something strong ties cannot, thus, the better the information the weak tie provides the more useful the weak tie becomes. If that weak tie leads to many other sources of information because that weak tie has many connections itself, then it is more important than any strong tie. Within a legislature, a weak tie to a member who is not him/herself strongly supported provides an increase in legislative success by gathering increased support, but only a small one. Gaining the support of a legislator who has little influence on other legislators, adds only one legislator's support. However, generating a weak tie to a colleague who is him or herself strongly tied to several other legislators[3] can provide a large increase in the likelihood of bill success. By creating a tie to one legislator who is connected to many others, a legislator can bring entire cliques[4] of novel support into his or her base. These second order connections of a legislator (connections of

[3]That secondary connection must also be of the strong type. Gaining the support of a legislator who is strongly connected to many others, implicitly gathers the support of these others. Gaining the support of a legislator who is weakly connected to many others means the new legislative base provides limited implicit support through the new weak connection.

[4]Bratton and Rouse (2009) also find a high degree of clique like behavior amongst legislators in several chambers that is even more fine grained than a party basis. Legislators seem to separate themselves into small groups of people working together regularly.

those someone is connected to) are referred to as secondary ties or alter ties (the ties of a relational alter).

To further elucidate this argument, consider Figure 1. In the first panel of Figure 1, legislator "d" operates within a clique of strong connections to three other legislators. These strong ties indicate the base of support the legislator would have received on the first day of session simply because of the latent similarities already discussed. Had legislator "d" never formed these ties, the support of legislators "a", "b", and "c" would have still existed because of similar traits like policy preference, gender, party, etc. The existence of these ties has done nothing to assist the legislator in achieving legislative success. In the second panel of Figure 1, legislator "d" has formed a weak tie to a second cluster of legislators. This weak, or bridging, tie has allowed legislator "d" to access a group of legislators whose support was not pre-existent through a connection to legislator "e" (legislators "f" and "g" follow "e"s lead because of their strong ties to each other). Thus, the weak tie has increased the number of supporters legislator "d" has access to in ways strong ties cannot.

[Insert Figure 1 here]

As a more concrete example, we might think of legislator "d" as former Senator Edward Kennedy and "d"s strong ties as the other Democrats in the Senate. More often than not, these other Democrats would have supported Kennedy's legislation whether he had ever built relational connections to them or not, simply because of their shared policy preferences. Instead, we can consider legislator "e" as Orrin Hatch. Kennedy's relationship with Hatch has provided him access to legislators who do not automatically agree with him, but through his connection to Hatch are more willing to consider his legislation as potentially useful. By convincing Hatch that he occasionally has good ideas (and thus convincing Hatch to work with him on some pieces of legislation), Kennedy has gained the opportunity for support with many Republicans. This potential for support or influence would not have existed based on the similarities between Senators, but can exist if Kennedy can form a weak tie to an influential Republican. In fact, every Senator who spoke at Kennedy's memorial service noted his willingness to form unique relationships and alliances as a reason for his remarkable legislative success.

From this basic argument about the paths of influence across a legislative network, I distill four hypotheses. *First, the combined effects of direct weak ties and secondary ties that stem from them will provide increases in the probability of legislative success.* While the coefficients on each variable are important in and of themselves, the argument specifies that success is a result of building bridging ties (direct connections) to novel support clusters. Accordingly, I am more interested in the combined effects of both direct and secondary ties, than either variable alone. *Second, the combined effects of direct strong ties and secondary ties that stem from them will provide no statistically distinguishable increase in the probability of legislative success.* This would indicate that strong ties play little role in shaping legislative influence because those to whom a legislator is strongly tied already support that legislator regularly. Thus, the tie adds nothing to the support for a legislator. *Third, legislators who build weak ties to a legislator with many strong connections are the most successful in passing legislation.* Thus, a conditional relationship emerges in which weak ties to highly central legislators are the most important paths to legislative success. *Finally, pre-existing similarities like race, gender, and party will contribute to the formation of strong ties more than the formation of weak ties.* I have argued that weak ties are formed between legislators who are different from one another. Thus, we should expect that these dimensions will have a more limited influence on the probability of a weak tie being formed.

In order to fully test these predictions, empirical models of legislative success will need to control for potential alternative explanations of bill survival and passage in a chamber. Bill sponsors may have a host of advantages that improve their likelihood of success when proposing legislation. Particularly, committee chairmanship is likely to play a critical role in legislative success (Evans 1991). In many chambers, committee chairman hold power of the sequence of proposals within their committee. Forward looking legislators, realizing that a committee chairman can kill their legislation by never allowing it to come up for committee debate, will be much more likely to support legislation sponsored by that chair. Even in chambers where chairmen lack control of the sequence of proposals, chairmen remain important party players and direct the activities of their committees through conference committee activities and subcommittee appointments.

Additionally, the majority party status of the sponsor is likely to play a critical role in bill success (Cox and McCubbins 1993, Rohde 1991). Membership in the majority party affords a legislator enough partisan support to pass legislation on the floor, as well as ensuring that the chair of potential committees of deliberation will share the party identification of the sponsor. Finally, seniority affords bill sponsors strategic experience in knowing when to propose legislation in order to improve its likelihood of success. Spending time as a legislator brings with it knowledge and experiences (as demonstrated by the term limits literature, see Kousser (2005)), that improve an individual's understanding of when it is best to propose legislation in order to improve the odds of success.

Finally, most of these alternative explanations for bill passage are legislator-specific constructs. The weak ties theory of influence diffusion is itself centered on the legislator as the important unit of change in the network. This is in contrast to previous treatments of cosponsorship (the measurement of tie strength I will use), which focus on bill specific reasons for cosponsorship. Specifically, Wilson and Young (1997) and Kessler and Krehbiel (1996) focus on why an individual legislator would elect to attach him or herself to a specific bill, without any consideration of the legislator-to-legislator relationships that influence these decisions. Nevertheless, there are also likely to be bill specific reasons for legislation to be successful. In order to include and control for the popularity of any individual bill (rather than the cooperative strategies and popularity of the bill's author) I include a measure of the number of cosponsors on each piece of legislation. Accounting for this bill-specific alternative hypothesis means the relational variables in my models will capture only legislator-specific traits, controlling for bill-specific popularity.

Design and Data

I make use of cosponsorships between state legislators in order to measure tie strength. I have measured cosponsorship networks for eight state legislatures in 2007[5]: North Carolina, Alabama, Minnesota, Mississippi, Alaska, Hawaii, Indiana, and Delaware[6]. While there are certainly limitations to the use of cosponsorship as an indicator of the strength of a relationship between two legislators, this approach has some precedent (Fowler 2006a, Fowler 2006b, Bratton and Rouse 2010, Gross and Shalizi 2009). Cosponsorship behavior has been demonstrated to be interdependent (Desmarais et al. 2009), thus justifying its treatment as a network, and a number of studies (Koger 2003, Campbell 1982) have demonstrated that decisions about who and what to cosponsor represent decisions about cooperation and collaboration. Whether one regards cosponsorship as position taking (Mayhew 1974) or as intra-legislative signaling (Kessler and Krehbiel 1996), theoretical treatments of cosponsorship all recognize that the behavior is driven by similarity to other actors and the strategic calculation of the costs of cooperation. While these decisions are not indicative of the entirety of the complex social fabric of a legislature, they do seem to cleanly represent cooperative and collaborative relationships.

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[5]In order to gather cosponsorship data across many states in a timely fashion, I have developed a web-scraping routine that allows for the speedy extractions of instances of cosponsorship from legislative websites. This web-scraper is based on the package RCurl (Lang 2007) in the statistical package R. Example code for this routine can be made available upon request.

[6]These eight states were selected for reasons of data availability. They were the only states in which I could gather all the requisite parts of my model in a reasonable time frame. Though these states represent a convenience sample, they also represent a reasonable distribution of chamber party polarization, professionalism and geographic region.

A network of the counts of cosponsorship as a measure of tie strength[7] has the potential to lead analysis astray. For example, if legislator A has cosponsored legislator B ten times, we might think that is a strong tie. However, if legislator B has sponsored one hundred bills we may think that this connection is notably weaker than we first observed. In order to account for this between-legislator variance in the rate of sponsorship, I have divided the network observations of the instances of cosponsorship by the number of bills each legislator has sponsored. Thus, the observation of tie strength is now a proportion of cosponsorship between legislator i and legislator j.

In order to differentiate between strong and weak ties, the networks of proportions must be further subset into weak tie and strong tie networks. To subset the network I classify any connection between two legislators stronger than the mean plus one standard deviation connection strength for that particular state as a strong tie. Any connection below this threshold but greater than zero is a weak tie. A connection of zero is considered no tie. Thus, in North Carolina, if the average tie strength is 0.2 and the standard deviation of tie strength is 0.1, any connection between legislators that is greater than or equal to 0.3 is considered strong. Any connection between 0 and 0.3 is considered weak. This threshold is to some degree arbitrary, but the appendix to this article provides an alternative operationalization of these concepts in an effort to overcome concerns about the designated threshold I choose. Censoring the networks in this way yields two network matrices, a strong and weak ties matrix, both comprised of ones and zeros.

Having constructed strong and weak tie networks I extract the critical measures of direct and secondary connections between legislators using common social networking statistics. Degree measures of centrality in a social network are count measures of the number of connections a particular actor has in the given social network. The out-degree of legislator i

[7] A cosponsorship network is an adjacency/square matrix where A_{ij} represents the number of times legislator i cosponsors legislator j

in social network A is the number of ties directed away from legislator i in that network. The out-degree of legislator i in the strong ties network then is the number of strong connections legislator i has created to other legislators[8].

Measuring secondary connections is somewhat more challenging. Some social networking statistics are designed to account for secondary and tertiary connections, but in weighted or complex ways (e.g. eigenvector centrality). Rather than use a confusing and potentially ill-designed statistic, I make use of a simple network statistic called "alter degree". Alter degree for legislator i measures the number of connections of every other legislator to whom i is connected. Thus, if A_{ij} equals 1, then $AlterDegree_j = StrongTieOutdegree_i$ for all i. Figure 2 illustrates this relationship more clearly.

[Insert Figure 2 here]

In Figure 2, Panel (a), legislator A has an out-degree of 2, meaning legislator A has two direct connections. Legislator A also has an alter degree of 5, meaning those two legislators A is directly connected to have 5 connections themselves resulting in A's alter degree statistic. In Panel B, legislator A has increased direct connections to other legislators but has not increased secondary connections, meaning legislator A's alter degree will not change. This is referred to as connecting to an "isolate", because legislator I is connected to no one. In panel 3, we see legislator A increase secondary connections without increasing direct connections. By choosing different direct connections, legislator A can increase support for legislation.

When measuring alter degree, I make use of only secondary connections of the strong type. If legislator i is weakly connected to legislator j, then legislator i has built a bridging connection to all those legislators who inherently agree with and support legislator j, those to whom j is strongly connected. Legislator j's weak ties are those who regularly do not support

[8] Recall that the strong and weak ties networks are made up of only ones and zeros, so counting the degree of actor i is equivalent to counting the number of strong ties of actor i

j and, thus, will not support i simply because j does. Using out-degree and alter degree statistics, I can measure direct and secondary connections in order to test my assertions about the nature of tie strength and legislative success. This produces four measures, strong and weak direct connections, secondary connections from weak ties and secondary connections from strong ties. These sets of statistics will be highly collinear (one can only have secondary connections by having direct connections first), but I will provide several model specifications to demonstrate the robustness of my results to this collinearity.

To measure the legislative success, I use a similar web-scraping routine that allows me to gather the author of each bill considered by the eight state legislatures I study and information about the bill's status. I measure legislative success as whether or not a bill sponsored by a legislator has survived potential veto points in the chamber. Thus, a bill surviving committee deliberation has some success over a bill that does not. A bill that passes from the chamber has more success than a bill that survives committee deliberation but does not pass. I make use of two dichotomous variables, committee survival (coded 1 if a bill survives committee deliberation, 0 if not) and bill passage (coded 1 if a bill passes from a chamber, 0 if not). Using these two veto points provides identifiable opportunities for legislation to die across all eight chambers that I study. In all eight states I study, committees kill some bills and allow others to pass and within those that pass from committee, some bills pass at the floor and others do not. This data gathering results in 12,900 bills across 668 legislators, with 4,301 surviving committee deliberation and 2,644 passing out of the chamber[9].

To control for potential alternative explanations, I also measure the seniority of the spon-

[9]My analysis considers every bill introduced in these 8 states. This may lead to some concerns that the weak ties I observe are all on inconsequential bills or all from a particular policy realm. As such, I calculate the average number of weak ties per bill for each committee in each state. The distribution of means in each state was a peaked distribution. This indicates that the average number of weak ties per bill was similar across each committee in a state. Taken further, this means for example that bills sent to local government committees had the same number of weak ties connected to their sponsors as bills sent to the appropriation committees in each state or the agriculture committees in each state.

sor of a bill, the majority party status of the sponsor of a bill, the institutional advantages of the sponsor of a bill (dummy variable coded 1 if the sponsor is a committee chair or speaker of the chamber, 0 if not) and the number of cosponsors on an individual bill. Recall that the network statistics I use are summaries of the entire legislative session, thus any incidental covariance in the network measures I use that results from the number of cosponsors on a specific piece of legislation should be controlled for by accounting for the number of cosponsors on a specific bill as a control. I make use of a multi-level logit model (Gelman and Hill 2005) with varying state level intercepts to test whether network connections have unique impacts on the probability of a bill surviving important veto points.

Results

In testing the hypotheses implied by the weak ties theory, I proceed in reverse order. To establish that weak ties influence outcomes in the ways I have described before investigating the nature of strong and weak tie formation. I begin by creating four multi-level logit models in which the dependent variable is coded 1 if a bill survives committee deliberation and 0 otherwise across eight state legislative lower chambers in 2007. I provide many specifications of the model because the concepts I am interested in present issues of multicollinearity[10]. Thus, I run models with only direct ties, only secondary ties, only weak ties, and a fully specified interactive model. Expectations are that in each model, the effects of weak ties (either direct or secondary ties stemming from weak ties) will produce positive effects on success. The fully specified interactive models should also have a positive interaction term for the interaction between direct weak ties and secondary ties stemming from weak ties. Because the interpretation of conditional or interactive arguments is best presented graph-

[10]Direct weak ties has a variance inflation factor of 12.9 and secondary weak ties has a variance inflation factor of 6.4. No real test exists to determine how much multicollinearity is “too much”. However, cutpoints for VIFs higher than 5 or 10 have been suggested (Gujarati 2003 p.363). Since these two variables are of primary interest it would seem concerns about multicollinearity are warranted.

ically, I focus on using plots to demonstrate the results of my modeling efforts. The tables containing the results of these models are present in Appendix A. In all of the multi-level models I present, the network connection variables are normalized by subtracting out the state mean and dividing by the state standard deviation.

Figure 3 plots the predicted probability of bill survival at the committee stage as a function of both direct and indirect ties and their interaction terms as reported in Table A1, model 4. Strong ties appear in the darker gray with grid lines. Weak ties appear as the light gray with grid lines. The plots are three dimensional, allowing both direct and indirect ties to vary across their respective ranges simultaneously and allowing the marginal effects to also vary as the opposing variable changes values as required by the conditional interactive model. These type of plots are useful for interactive models because they can summarize in one plot information about the conditional and combined effects of two variables. The plots demonstrate that increases in weak ties lead to increases in legislative success. While the coefficient on secondary ties stemming from weak ties is negative, the positive interaction term actually generates a positive change in bill success as secondary ties increase.

The plane created by the marginal effects of strong ties from a fully specified, interactive model is much flatter, indicating that strong ties (both direct and secondary) produce little net effect on bill survival. In fact, moving from the minimum on both direct and secondary weak ties to the maximum on both of these variables produces a change in the probability of bill survival from 0.35 to 0.66. The same jump from minimum to maximum on direct and secondary strong ties produces a decrease in the probability of bill survival from 0.51 to 0.49. These predicted probability plots also show the shift in the conditional value of direct weak ties as the secondary ties they lead to changes. The gridlines along the direct weak ties axis become increasingly steep as secondary ties increase, indicating that the conditional hypothesis (that direct weak ties become more important as the secondary ties stemming from them increase) is also supported.

[Insert Figure 3 here]

Next, I move to an analysis of the effects of strong and weak ties on bill passage from state lower chambers. Unfortunately, there is a significant sample selection problem that must be confronted. Bills that pass on the floor face a selection bias from survival at the committee stage. No bills across all eight legislatures that I study manage to pass from the chamber without being reported out by a committee (the US House of Representatives has procedural shortcuts that allow for passage from the chamber without a committee report). I control for this potential sample selection bias using the one stage extension of Heckman (1979).

Table 1 reports the results of a single stage sample selection model in which the selection equation predicts bill survival at the committee stage and the outcome equation predicts bill passage from state legislatures. Column 1 reports the selection results while column 2 reports the outcome results of purely additive models. The single stage Maximum Likelihood approach to sample selection is more efficient than the two stage approach initially devised by Heckman (1979), because it is estimating in a single stage rather than two separate equations. Thus, rather than calculating the inverse Mill's ratio and executing a two stage multi-level sample selection model, I simply use the single stage sample selection model with state dummy variables. The selection model results appear to be in keeping with the models produce in Table A1. The outcome model has far fewer significant results indicating that the independent variables do most of their work at the committee stage rather than on the floor of legislatures. Differences include the coefficient on the number of cosponsors on a particular bill changing signs and tenure becoming statistically significant.

[Insert Table 1 here]

Despite the fact that analysis of bill passage presents less support for the theory of weak ties, the expectation that weak ties and their subsequent secondary connections produce increased legislative success receives support at the committee stage and strong ties provide no increase in success at the committee stage or at the passage stage. This is strong support for the weak ties theory as I have outlined it. State legislators wishing to increase their own influence over the legislation their chamber produces receive considerable increases in success by building bridging connections to legislators that they do no regularly work along side. Legislators who attempt to increase their own legislative success by reinforcing the clusters they have always operated within do themselves little good.

Weak Ties and the US House of Representatives

As an alternative test, both to ensure generality and to cross-check my results with independently gathered data, I test the weak ties theory over time on the U.S. House of Representatives. Cosponsorship network data has been gathered and maintained by James Fowler (2006a, 2006b). I merged this with data from the Congressional Bills Project (Adler and Wilkinson 1991-2008). These two independently collected data sources provide all of the requisite variables needed to test the theory of weak ties in the U.S. House. Additionally, analysis of the U.S. House also allows me to include estimates of legislator ideology through the inclusion of DW NOMINATE scores, an option not readily available at the state legislative level.[11]

The construction of network measures for the U.S. House works exactly as it did for state legislatures. I examine the 102nd through 108th U.S. Houses (1991-2004), providing me with two sessions of the House before the Republican take over of the mid 1990's. This includes a sample of 37,056 bills, of which 3,925 eventually passed and 3,650 were reported out by a committee. The unique procedures of the US House do allow for some bills to pass from the

[11] There is considerable danger in equating NOMINATE scores to ideology or preferences. My own analysis has shown that examining floor voting alone overlooks much of the strategic interplay within a legislature. Nevertheless, NOMINATE provides a reasonable estimate, widely used across the field with high face validity.

chamber without ever having been reported out by committee, thus sample selection at the bill passage stage is less of a concern. The results from a logit model predicting bill survival at the committee stage in the US House are presented in the Appendix, in Table A2. The analysis in this table mirrors the analysis of bill survival in state legislatures, except in this model I am able to include NOMINATE scores for legislators.

Once again, because the interpretation of conditional models is best done graphically I focus the presentation of the model's results in plots. Figure 4 plots the estimated probability of bill survival in the U.S. House as both direct and secondary ties increase simultaneously from the coefficients in Table A2, Column 2 (located in the Appendix). The marginal impact of the variables is also allowed to vary as indicated by the interactive terms in Column 2. We see a similar pattern in Congress to we saw in the states. There is a positive change in probability of survival over the increasing values of direct and secondary weak ties. The plane representing increases in strong ties actually indicates a significant decrease in the probability of survival as direct and secondary ties increase. This indicates that weak ties produce success at the committee stage in both state legislatures and in the U.S. House. A move from the minimum number of weak direct ties and the minimum number of secondary ties stemming from them to the maximum on both values changes the probability of bill survival from 0.46 to 0.54. The corresponding shift in number of strong ties produces a decrease in the probability of bill survival from 0.84 to 0.14. The interactive effect is once again positive indicating that weak ties become increasingly important as they lead to more and more secondary ties.

[Insert Figure 4 here]

Because bills in the US House can pass from the chamber without having been reported out by committee, sample selection is less of a concern here. Of the 37,056 bills in the data set 1,163 passed without ever having been reported out by committee (out of the

3,925 bills that passed in total). Sample selection estimators are not designed to capture selection effects from imperfectly censored data. Thus, I report two multi-level models with varying intercepts by Congress, but without a control for sample selection bias in Appendix A, Table A3. These models are identical to the models presented in Table A2, except the dependent variable is a dichotomous variable coded 1 if a bill passes from the US House and 0 otherwise[12]. Figure 5 presents the predicted probability of bill passage as strong and weak ties vary, and their marginal effects vary, as reported in Table A3. The continued consistent pattern emerges. The predicted probability of bill passage increases dramatically as the combination of direct and secondary weak ties increases. The reverse is true for strong ties. Utilizing the same jump from the minimum on both direct ties and secondary ties stemming from them, weak ties produce a positive change in the predicted probability of bill passage from 0.44 to 0.57. Strong ties, alternatively produce a decrease in the probability of bill passage from 0.68 to 0.30.

[Insert Figure 5 here]

Predicting the Formation of Ties

The analysis of legislative success in these eight state legislatures and the US House provides clear empirical support for the notion that weak ties generate increases in legislative success and, thus, are the most useful paths to achieving legislative goals. However, this argument about the best paths of influence rests on expectations about the nature of tie formation and tie strength itself. Weak ties are the best paths for increasing influence across a social network because weak ties occur between individuals who are dissimilar on important

[12]Because sample selection remains a concern on some level, I have also specified a model for bill passage that includes bill survival at committee as an independent variable in an effort to control for committee deliberation as a censoring point even though it is not a perfect censor. The results from this specification indicate that bill survival in committee is a significant positive predictor of bill passage, but its inclusion does not alter the substantive results of my models. All the significant variables remain significant and in the same direction and the interpretation of the three dimensional plots remains the same.

dimensions. Strong ties are very nearly incidental, resulting from similarity between actors that existed before the actors ever met one another.

To provide further evidence that strong tie formation occurs between actors with preexisting similarities, and that the formation of weak ties is driven by these factors to a much weaker degree, I make use of the social network summary statistic known as modularity (Newman 2006, Waugh et al 2010). Modularity quantifies the quality of a researcher defined community or division within a social network by measuring the degree to which connections in a social network remain within a cluster versus the degree to which connections cut across a cluster. For example, if a researcher believed a legislature was extremely polarized along party lines then the expectation would be that a network had a high modularity score for partisan divisions. This would indicate that the connections within the legislature occur mostly within party with very few connections across party lines. A low modularity score would indicate that there are many ties across party lines and that the user selected partition of party identification was a relatively poor partition of the network. This is precisely the analysis Waugh at al. (2010) employ in their study of congressional polarization in the cosponsorship network.

Table 2 provides a comparison of modularity statistics between the strong and weak networks in my eight state legislatures along three dimensions: party, race, and gender. All three of these dimensions have been the subject of social network analysis for legislatures (Desmarais, Cranmer and Fowler 2010, Bratton and Rouse 2010) and are also latent similarities which should drive the creation of strong ties. I expect that modularity statistics for the strong ties network will be higher in each state than along the weak ties network for each dimension. This would indicate that strong ties commonly form amongst legislators of the same race, gender, and party while weak ties do not commonly form along these dimensions. I operationalize race as a partition between African American and non-African American legislators. Because Alaska and Hawaii have no African American state representatives and

Minnesota had only one African American state representative (2008 Directory of African American State Legislators), no modularity estimates exist for these three states along this dimension.

Modularity as a statistic is bounded between negative one and one, and because the distribution of modularity has yet to be explored, I have a limited ability to draw inferences about the magnitude of the differences between the strong and weak ties networks. In order to provide some intuition about the statistical magnitude of these differences in modularity, I have simulated a distribution of modularity statistics for a given state's strong ties network. To do this, I take a particular state's strong ties network, randomly draw 25,000 partitions of that network and record the modularity of that randomly drawn partition on the strong ties network[13]. This creates a distribution of modularity for potential random partitions, and 95% of the density of this distribution centered around the mean can inform us of the degree to which the observed modularity score is likely at random. While this is not a perfect approach to drawing inferences about the magnitude of differences of these statistics, it does provide some empirical ground for asserting that these similarity partitions are more effective at separating actors in the strong ties network than in the weak ties network.

[Insert Table 2 here]

The empirically derived distributions for each state indicate that party is a better than expected partition of the strong ties network in North Carolina, Minnesota, Mississippi, Hawaii, Alabama and Alaska, while party is only a better than expected partition of the weak ties in Minnesota and Alabama. Gender is a better than expected partition of the strong ties network in North Carolina, Minnesota, Mississippi, Hawaii, and Alabama, while it is never a better than expected partition of the weak ties network. Race is a better

[13]Because the strong ties network has some effective partitions in it, the standard deviation of modularity from randomly drawn partitions in the strong ties network is higher than the standard deviation of modularity from randomly drawn partitions in the weak ties network. Thus, the standard deviation of the strong ties network represents the more conservative estimate.

partition of the strong ties network than expected at random in North Carolina, Mississippi, and Alabama and is also never a better than random partition of the weak ties network. Using the range of 95% of the density of the simulated distribution as a mark of statistical difference between the modularity of the strong and weak ties networks, party always creates statistically larger modularity scores in the strong ties network than in the weak ties network. Gender creates larger modularity scores in North Carolina, Minnesota, Mississippi, and Hawaii, while gender fails to partition the strong ties network better than the weak ties network in Indiana, Delaware, Alabama, and Alaska. Race creates larger modularity scores in North Carolina, Mississippi and Alabama. These results demonstrate that strong ties are in large part driven by the latent, pre-existing similarities between legislators while weak ties are not driven by these similarities. Coupled with the empirically supported notion that weak ties are also the ties which lead to increased legislative success, this would seem to be strong evidence in support of the weak ties theory of influence diffusion in a legislative network.

Discussion

Network studies of legislative behavior have taken the important step of acknowledging and accounting for interdependence in behavior amongst legislators. This research has taken the next step in this enterprise by developing a theory for how and why that interdependence is used by strategic legislators and influences legislative outcomes. The strong connections we observe between legislators are a result of their latent similarities on dimensions that drive their preferences for policy. Legislators of the same party, the same gender and the same race will often form strong relationships that are essentially incidental. The support these legislators have for one another would have existed whether the tie between the two was ever actually formed, because their latent similarities generate similar policy goals. The weak ties we observe between legislators are strategic attempts by legislators to alter their base level of support and increase their legislative success.

Empirical evidence from a wide range of legislative networks provides support for this perspective. My results demonstrate that consistent with theory, weak ties occur between legislators quite different on important pre-existing dimensions, where strong ties are defined by these similarities. Additionally, the strong ties between these similar legislators contribute nothing to a legislator's level of success when controlling for partisanship, seniority and institutional position. Instead it is the weak ties (which are intentional attempts to generate support) that increase the likelihood of legislative success. By generating ties to legislators with dissimilar qualities, new avenues of influence and support can be created. This suggests that legislative scholars taking a social networks based approach carefully consider which types of ties they wish to study. If scholarship is interested in what causes certain kinds of connections then pre-existing similarities like race, party, and gender are important elements, but if scholarship is interested in how individual connections influence legislative outcomes than understanding that legislators form different kinds of connections as a result of different circumstances is particularly important.

This research paints an interesting normative picture also. Legislators interested in increasing their chances of achieving their own agendas best accomplish this through cooperation with legislators unlike themselves. Highly clustered or polarized chambers provide little opportunity for the bridging ties necessary for legislative success. Thus, there seems to be a genuine empirical reason for legislators to seek increased cooperation and decreased polarization within their own chamber. Cooperation across latent similarities (which would drive up the number of weak ties a legislator has) would seem to be a reliable way to reduce uncertainty about policy outcomes in ways similar to those described by Krehbiel (1991) in the information theory of legislative organization. By demonstrating diverse support for his or her bills, a legislator may be able to assuage chamber level concerns about the anticipated outcomes of legislative decisions. Additionally, while scholars have rightly bemoaned the increasing polarization in legislative chambers it is possible that a broad, polarized distribution of ideal policy points can be over come and legislation can move forward if legislators are willing to cooperate with those dissimilar from themselves.

A Appendices

Appendix A - Model Results for the analysis of Weak Ties and Legislative Success

In Table A1, I present four models in which the dependent variable is a dichotomous outcome coded 1 if a bill survives committee deliberation in a state and 0 otherwise. The graphical analysis presented earlier provides easier interpretation of these highly conditional results and demonstrates strong support for the weak ties theory of influence diffusion. Within the table itself, the results indicate that strong ties produce negative insignificant effects on the probability a bill will survive at the committee stage in both models 1 (direct connections) and 2 (secondary connections). The results also show a consistent positive effect for direct weak ties. Additionally, models 3 and 4 show a positive interaction term indicating that the marginal effect of direct weak ties increases as the weak ties lead to larger and larger secondary connections. Recall, however that the individual coefficients on ties are less important than their combined effects. The path to individual success should be through a combination of weak ties to secondary connections. Model 3 shows a positive effect for both direct and secondary weak ties and a positive interaction term and Model 4 shows a positive effect for direct weak ties and a positive interaction term. Thus, it would seem that the combined effects of these variables produce increased legislative success for individuals.

[Insert Table 3 here]

Table A2 mirrors the analysis from Column 3 and 4 performed in Table A1, this time using data from the US House. The dependent variable is dichotomous, coded 1 if a bill was reported out by a committee and 0 otherwise. Rather than allowing for varying state intercepts, I allow for intercepts to vary by Congress. I have included the absolute value of the bill author's DW Nominate score in order to control for the possibility that members closer to the median ideologically experience more legislative success because they generate more palatable legislation to both sides of the ideological spectrum. Interestingly, the replicated analysis in Table A2 from Columns 1 and 2, do not demonstrate the same relationship as we see in Table A1. Instead of having positive effects felt through direct connections, the models demonstrate that legislative success through weak ties plays out through a positive coefficient on secondary connections and a positive interaction term between direct connections and secondary connections. Both models in Table A2 present negative and significant coefficients on direct weak ties, but as with the state analysis the more important test of the weak ties theory lies in the combined effects of direct and secondary connections which is presented in the graphical analyses in Figures 4.

[Insert Table 4 here]

In the final table in this appendix, I present two interactive models of bill passage on the floor of the US House. The dependent variable is dichotomous, coded 1 if a bill passes on the floor and 0 otherwise. While sample selection may be a small concern here, many more bills pass without being reported out by a committee in the US House than in the states, alleviating the need for a selection model to some degree. Once again, the models in Table A3, Columns 1 and 2 report negative coefficients on direct weak ties, but positive coefficients on secondary ties and on the interaction term between direct and secondary weak ties. This positive interactive effect is responsible for the increases in bill passage as direct and secondary weak ties increase observed in Figure 5, in spite of the negative coefficient on direct weak ties presented in the model.

[Insert Table 5 here]

Appendix B - An Alternative Approach to the Measurement of Weak Ties

In my analysis of the impact of relational determinants of legislative success, I differentiate between the impact of strong and weak relational ties arguing that strong ties provide little opportunity for influence. The empirical analysis I employ to test the hypotheses that result from my weak ties theory are based on the admittedly arbitrary (though not without precedent) distinction between strong and weak ties occurring at the mean level of connectivity in a social network, plus one standard deviation. While to my mind standard deviations exist for just this purpose (to identify unusually high or low positions in a distribution) I understand that some readers may be skeptical of analysis confirming my theory based on an arbitrary censoring rule. Accordingly, I offer a sensitivity analysis in Table A4. This sensitivity analysis re-examines the analysis presented in Table A1, this time using alternative cutpoints to distinguish between strong and weak ties. The first two results in Table A4 make use of the mean plus 0.75 standard deviations as a cutpoint between strong and weak ties. The second two models present an analysis using the mean plus 1.25 standard deviations. I only present the fully specified additive and analogous interactive models from Table A1.

[Insert Table 6 here]

While the interactive effects in these models have become negative and very near to zero, the general finding that weak ties lead to increases in bill survival and thus legislative success remains consistent across disturbances to the cutpoint distinguishing strong and weak ties. In all four models presented above, increasing direct weak ties leads to increases in bill survival controlling for the other variables in the model. The interaction terms are so small that their negative conditioning effects never bring the marginal effect of direct ties back down to zero/statistically insignificant. This analysis provides more robust support for for the overall conclusion that the most efficient paths to legislative success remain weak ties rather than strong ties.

Appendix C - Matching to Reduce Model Dependence

To test my hypotheses about weak ties leading to legislative success, I have made heavy use of hierarchical or multi-level logit models. While hierarchical models were designed with this sort of multi-level data in mind, they come with two limitations. First, they are most useful in datasets with many small clusters whereas this state level data is the reverse, a few very large clusters. Secondly they are rather sensitive to multicollinearity, requiring collinear variables to be centered or normalized in order to reach convergence. This creates some concerns about the level of model dependence in my results. In other words, I am imposing a number of parametric assumptions on data and violations of these parametric assumptions may be driving results. Ho et al. (2007) suggest making use of matching techniques to limit model dependence and more clearly estimate robust results.

In Table A5 I present four logit models, in which the dependent variable is bill survival at the committee stage in state legislatures. Unlike the analysis in Table A1, these data have been matched using the "MatchIt" package in R, treating direct weak ties, direct strong ties, secondary weak ties, and secondary strong ties as treatments, respectively. Because matching software has yet to successfully implement continuous treatments (though the statistics for such an algorithm have been developed, see Hirano and Imbens (2004)), matching requires a dichotomous treatment variable. In order create this dichotomous treatment, I take each of the four continuous treatments I wish to study and code them one if the variable is above its own median and zero otherwise. This forced choice is less preferable than matching on a continuous treatment would otherwise be, but matching in this way does limit the impact of model dependence on the outcomes observed even if it obscures information about the important treatment variables. I use nearest neighbor matching to produce the matched data and summary statistics indicate that balance is always improved in the matched sample over the unmatched samples. Because these data have been matched and standard logit models are used, the data have not been normalized explaining the differences in the magnitudes of the coefficients from Table A1.

[Insert Table 7 here]

Table A5 is presented using all of the matched data set, thus the treatment variable coefficients represent the average treatment effect (ATE) for the entire sample of moving from below the median on the treatment variable to above the median on the treatment variable. In all four models presented direct weak ties have a positive coefficient and in three of the four models presented the interaction between direct and secondary ties is positive. Additionally, in all four models direct strong ties and secondary strong ties have a negative effect on bill passage and in two of the four models the interaction between direct and secondary strong ties is negative. This is strong evidence that even when the data are matched on several different potential treatment variables and model dependence is reduced using a matching approach, the most efficient path to increased bill success remains through weak ties.

While the matching approach presented above forces different choices on a researcher interested in a continuous treatment, it can represent a nice robustness check by ensuring that the influence of the parametric assumptions in a model are wreaking as little damage as is possible. By reducing model dependence through matching and pairing this with highly parametrized multi-level models, the case for the weak ties theory is made even stronger.

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Table 1: Heckman Probit Model Predicting Bill Passage in State Legislatures

Variable	Column 1	Column 2
Sponsor Institutionally Advantaged	0.175 *	-0.087
	(0.029)	(0.048)
Sponsor Tenure	0.001	0.010 *
	(0.002)	(0.003)
Sponsor Majority Party	0.234 *	0.078
	(0.029)	(0.069)
Number of Cosponsors on Specific Bill	0.018 *	-0.009 *
	(0.002)	(0.002)
Direct Weak Ties	0.090 *	-0.022
	(0.041)	(0.064)
Direct Strong Ties	0.007	0.001
	(0.018)	(0.028)
Secondary Connections from Weak Ties	0.001	-0.039
	(0.028)	(0.044)
Secondary Connections from Strong Ties	-0.029	-0.046
	(0.019)	(0.031)
Intercept	-1.034 *	1.503 *
	(0.070)	(0.194)
N		12900
LogLik		-9799.72
ρ		-0.819

Note: Columns (1) and (2) report the results of a Heckman sample selection model. Column (1) reports the selection equation and column (2) reports the outcome equation. The dependent variable of the outcome equation is a dichotomous measure of bill passage from lower state legislative chambers. Models have standard errors in parentheses. Maximum Likelihood is the method used to estimate the model. State level dummy variables are estimated but not reported for space considerations. * $p < 0.05$.

Table 2: Modularity on Three Pre-Existing Dimensions in State Legislatures

	Party		Race		Gender		
Variable	Strong Ties	Weak Ties	Strong Ties	Weak Ties	Strong Ties	Weak Ties	95% Uncertainty Region
North Carolina	0.28	-0.028	0.058	-0.0062	0.051	-0.015	-0.017, 0.011
Minnesota	0.18	0.016	—	—	0.045	0.011	-0.022, 0.015
Mississippi	0.12	0.023	0.11	0.011	0.039	-0.029	-0.033, 0.026
Indiana	-0.043	-0.15	0.013	0.001	0.012	-0.0078	-0.037, 0.026
Hawaii	0.022	-0.035	—	—	0.023	-0.026	-0.025, 0.0049
Delaware	0.012	-0.018	0.020	-0.0029	-0.0052	-0.012	-0.052, 0.036
Alabama	0.14	0.09	0.14	0.013	0.034	0.011	-0.023, 0.014
Alaska	0.14	0.010	—	—	-0.0030	-0.012	-0.046, 0.020

Note: Columns (1)-(6) report modularity statistics across eight state legislatures along three sociological dimensions for both the strong and weak ties network. Columns (1) and (2) measure modularity along party lines. Columns (3) and (4) measure modularity along racial lines. Columns (5) and (6) measure modularity along gender lines. Modularity estimates along the Race dimension for Alaska and Hawaii are absent because there were no African American state representatives in these two states in 2007. Column (7) reports the 95% density region of a simulated distribution of modularity using randomly drawn partitions for a given state.

Table A1: Logistic Regression Models Predicting Bill Survival at Committee Stages in State Legislatures

Variable	Model 1	Model 2	Model 3	Model 4
Sponsor Institutionally Advantaged	0.289 *	0.294 *	0.294 *	0.302 *
	(0.048)	(0.048)	(0.048)	(0.049)
Sponsor Tenure	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.003)	(0.002)
Sponsor Majority Party	0.386 *	0.391 *	0.384 *	0.398 *
	(0.052)	(0.051)	(0.051)	(0.052)
Number of Cosponsors on Specific Bill	0.032 *	0.031 *	0.031 *	0.032 *
	(0.003)	(0.003)	(0.003)	(0.002)
Direct Weak Ties	—	0.111	0.081	0.146 *
	(—)	(0.061)	(0.058)	(0.073)
Direct Strong Ties	—	-0.004	—	0.004
	(—)	(0.026)	(—)	(0.031)
Secondary Connections from Weak Ties	0.028	—	0.011	-0.014
	(0.044)	(—)	(0.045)	(0.051)
Secondary Connections from Strong Ties	-0.039	—	—	-0.060
	(0.031)	(—)	(—)	(0.034)
*Direct * Secondary Weak Ties*	—	—	0.036	0.018
	(—)	(—)	(0.034)	(0.038)
*Direct * Secondary Strong Ties*	—	—	—	0.022
	(—)	(—)	(—)	(0.019)
Intercept	-0.942*	-0.900*	-0.934 *	-0.944 *
	(0.243)	(0.257)	(0.261)	(0.260)
$\widehat{\sigma}_{\text{state}}$	0.443	0.502	0.501	0.493
N	12900	12900	12900	12900
LogLik	-7663	-7663	-7661	-7659

Note: Columns (1), (2), (3), and (4) report multi-level logistic regression coefficients with varying intercepts by state. The dependent variable is a dichotomous measure of bill passage from committee. Models have standard errors in parentheses. Varying intercepts are not reported, but anova tests indicate that state level intercepts significantly improve model fit. Higher Log Likelihood indicates better model fit. * $p < 0.05$.

Table A2: Logistic Regression Models Predicting Bill Survival at Committee Stages in the US House (1991-2005)

Variable	Model 1	Model 2
Sponsor Institutionally Advantaged	1.052 *	1.048 *
	(0.052)	(0.053)
Sponsor Tenure	0.020 *	0.023 *
	(0.004)	(0.004)
Sponsor Majority Party	-0.004 *	-0.0041
	(0.002)	(0.0022)
Number of Cosponsors on Specific Bill	0.003 *	0.003 *
	(0.0004)	(0.0004)
Absolute Value of DW Nominate Score	-0.595 *	-0.275 *
	(0.118)	(0.125)
Direct Weak Ties	-0.338 *	-0.160 *
	(0.018)	(0.027)
Direct Strong Ties	—	-0.261 *
	(—)	(0.032)
Secondary Connections from Weak Ties	0.115 *	0.096 *
	(0.019)	(0.019)
Secondary Connections from Strong Ties	—	-0.046 *
	(—)	(0.022)
*Direct * Secondary Weak Ties*	0.043 *	0.048 *
	(0.015)	(0.015)
*Direct * Secondary Strong Ties*	—	-0.034
	(—)	(0.019)
Intercept	-2.387 *	-2.551 *
	(0.063)	(0.071)
$\widehat{\sigma}_{\text{Congress}}$	0.007	0.012
N	37056	37056
LogLik	-11285	-11233

Note: Columns (1) and (2) report multi-level logistic regression coefficients with varying intercepts by Congress. The dependent variable is a dichotomous measure of bill passage from committee. Models have standard errors in parentheses. Varying intercepts are not reported, but anova tests indicate that Congress level intercepts significantly improve model fit. Higher Log Likelihood indicates better model fit. * $p < 0.05$.

Table A3: Logistic Regression Models Predicting Bill Passage in the US House (1991-2005)

Variable	Model 1	Model 2
Sponsor Institutionally Advantaged	1.127 *	1.117 *
	(0.052)	(0.052)
Sponsor Tenure	0.011 *	0.015 *
	(0.004)	(0.004)
Sponsor Majority Party	-0.005 *	-0.004 *
	(0.002)	(0.002)
Number of Cosponsors on Specific Bill	0.004 *	0.004 *
	(0.0003)	(0.0003)
Absolute Value of DW Nominate Score	-0.784 *	-0.436 *
	(0.117)	(0.122)
Direct Weak Ties	-0.310 *	-0.122 *
	(0.018)	(0.026)
Direct Strong Ties	—	-0.274 *
	(—)	(0.031)
Secondary Connections from Weak Ties	0.080 *	0.064 *
	(0.019)	(0.019)
Secondary Connections from Strong Ties	—	-0.041
	(—)	(0.021)
*Direct * Secondary Weak Ties*	0.042 *	0.046 *
	(0.015)	(0.015)
*Direct * Secondary Strong Ties*	—	0.014 *
	(—)	(0.019)
Intercept	-2.209 *	-2.379 *
	(0.077)	(0.079)
$\widehat{\sigma}_{\text{Congress}}$	0.0221	0.0216
N	37056	37056
LogLik	-11881	-11825

Note: Columns (1) and (2) report multi-level logistic regression coefficients with varying intercepts by Congress. The dependent variable is a dichotomous measure of bill passage from committee. Models have standard errors in parentheses. Varying intercepts are not reported, but anova tests indicate that Congress level intercepts significantly improve model fit. Higher Log Likelihood indicates better model fit. * $p < 0.05$.

Table A4: Logistic Regression Models Predicting Bill Survival at Committee Stages in State Legislatures

	.75 Standard Deviations		1.25 Standard Deviations	
Variable	Model 1	Model 2	Model 1	Model 2
Sponsor Institutionally Advantaged	0.311 *	0.312 *	0.307 *	0.305 *
	(0.048)	(0.049)	(0.049)	(0.049)
Sponsor Tenure	0.001	0.001	0.001	0.001
	(0.003)	(0.002)	(0.002)	(0.003)
Sponsor Majority Party	0.419 *	0.417 *	0.404 *	0.404 *
	(0.052)	(0.052)	(0.051)	(0.052)
Number of Cosponsors on Specific Bill	0.030 *	0.030 *	0.030 *	0.030 *
	(0.002)	(0.002)	(0.003)	(0.002)
Direct Weak Ties	0.141 *	0.149 *	0.151 *	0.166 *
	(0.057)	(0.068)	(0.066)	(0.068)
Direct Strong Ties	—	0.002	-0.006	-0.018
	(—)	(0.034)	(0.026)	(0.029)
Secondary Connections from Weak Ties	-0.091	-0.088	-0.069	-0.048
	(0.049)	(0.054)	(0.050)	(0.055)
Secondary Connections from Strong Ties	—	0.018	0.004	-0.0003
	(—)	(0.028)	(0.026)	(0.027)
*Direct * Secondary Weak Ties*	-0.008	-0.004	—	-0.038
	(0.034)	(0.039)	(—)	(0.042)
*Direct * Secondary Strong Ties*	—	0.014	—	0.014
	(—)	(0.023)	(—)	(0.021)
Intercept	-0.841 *	-0.942 *	-0.926 *	-0.883 *
	(0.252)	(0.257)	(0.252)	(0.259)
$\widehat{\sigma}_{\text{state}}$	0.468	0.483	0.494	0.490
N	12900	12900	12900	12900
LogLik	-7659	-7569	-7659	-7659

Note: Columns (1)-(4) report multi-level logistic regression coefficients with varying intercepts. The dependent variable is a dichotomous measure of bill passage from committee. Models have standard errors in parentheses. Varying intercepts are not reported, but anova tests indicate that state level intercepts significantly improve model fit. Higher Log Likelihood indicates better model fit. * $p < 0.05$.

Table A5: Matched Logistic Regression Models Predicting Bill Survival at Committee Stages in State Legislatures

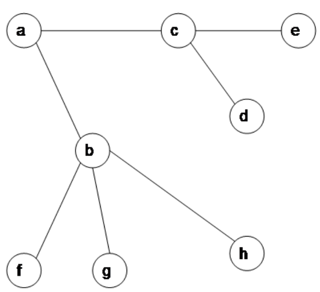
Variable	Model 1	Model 2	Model 3	Model 4
Sponsor Institutionally Advantaged	0.300 *	0.329 *	0.289 *	0.293 *
	(0.049)	(0.049)	(0.049)	(0.049)
Sponsor Tenure	-0.001	0.005	0.001	0.001
	(0.003)	(0.003)	(0.002)	(0.002)
Sponsor Majority Party	0.368 *	0.396 *	0.395 *	0.366 *
	(0.052)	(0.052)	(0.053)	(0.052)
Number of Cosponsors on Specific Bill	0.031 *	0.031 *	0.031 *	0.031 *
	(0.003)	(0.003)	(0.003)	(0.003)
Direct Weak Ties	0.145	0.008 *	0.000	0.004
	(0.139)	(0.003)	(0.004)	(0.003)
Direct Strong Ties	-0.002	-0.119	-0.001	-0.004
	(0.003)	(0.085)	(0.003)	(0.003)
Secondary Connections from Weak Ties	-0.000	-0.000	-0.236	0.000
	(0.000)	(0.000)	(0.136)	(0.0001)
Secondary Connections from Strong Ties	-0.0002	-0.0005 *	-0.0002 *	-0.131
	(0.0001)	(0.0001)	(0.0001)	(0.081)
*Direct * Secondary Weak Ties*	0.0001	-0.000	0.009 *	0.000
	(0.0001)	(0.000)	(0.003)	(0.000)
*Direct * Secondary Strong Ties*	-0.000	0.0004 *	-0.000	0.006
	(0.000)	(0.0001)	(0.000)	(0.003)
Intercept	-0.711 *	-0.840 *	-0.730 *	-0.785 *
	(0.120)	(0.129)	(0.133)	(0.130)
N	12790	12776	12782	12760
LogLik	-7553	-7551	-7560	-7568

Note: Columns (1), (2), (3), and (4) report logistic regression coefficients with unreported dummy variables by state. The dependent variable is a dichotomous measure of bill passage from committee. Models have standard errors in parentheses. State level dummy variables are not reported but anova testing indicates that they significantly improve model fit. In Column (1) direct weak ties are considered the treatment (and are thus matched on in the matching stage). In Column (2) direct strong ties are considered the treatment. In Column (3) secondary weak ties are considered the treatment. In Column (4) secondary strong ties are considered the treatment. Higher Log Likelihood indicates better model fit. * $p < 0.05$.

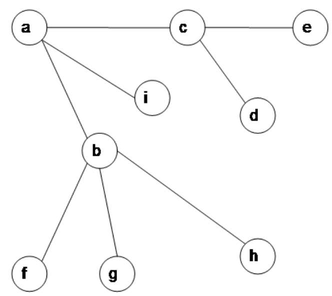
(a) No Weak Ties between Legislators

(b) Legislator "d" forms a Weak Tie

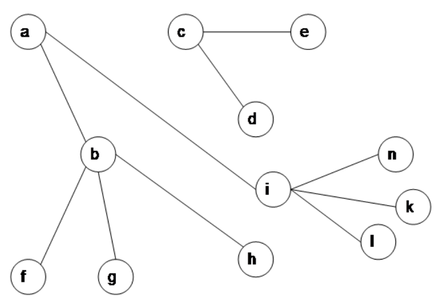
Figure 1: Legislator "d" builds a Bridging Tie to a new cluster of Legislators



(a) Legislator "a" with alter degree 5

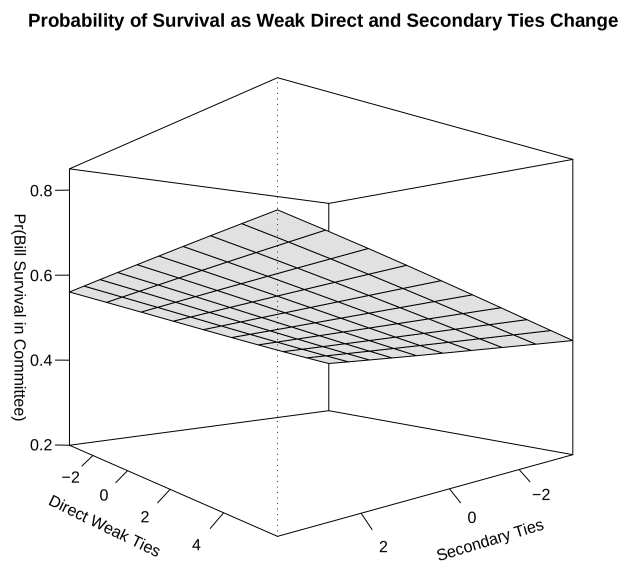


(b) Legislator "a" with alter degree 5, but increasing direct ties

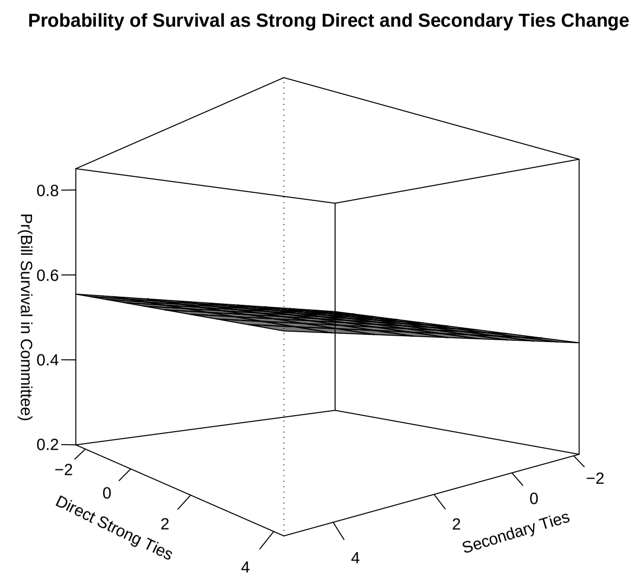


(c) Legislator "a" with alter degree 6, without increasing direct ties

Figure 2: Legislator A changes direct and indirect connections

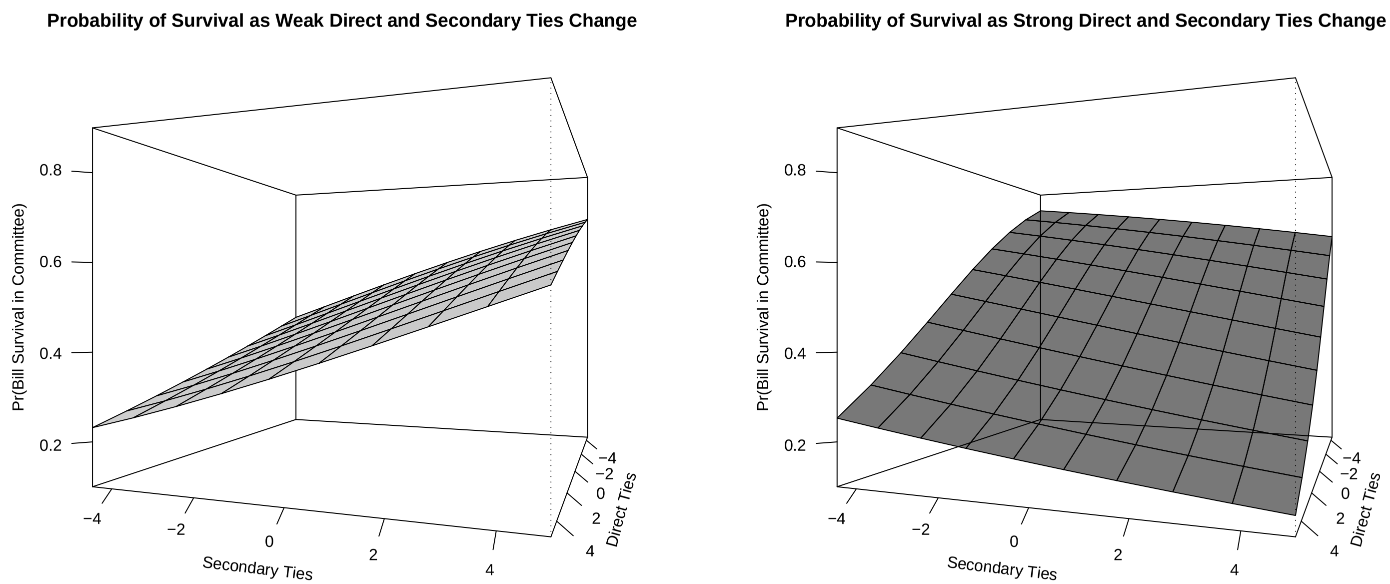


(a) Weak Ties



(b) StrongTies

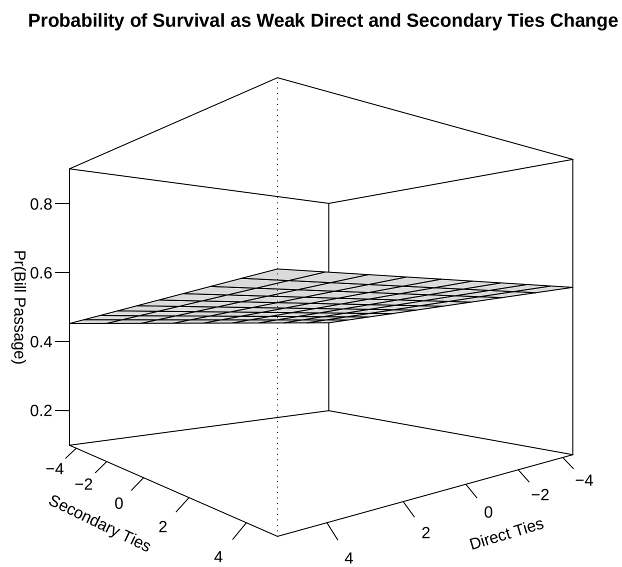
Figure 3: Probability of Bill Survival in State Legislatures as Direct and Indirect Ties Increase: Lighter Gray Represents Weak Ties, Darker Gray Represents Strong Ties.



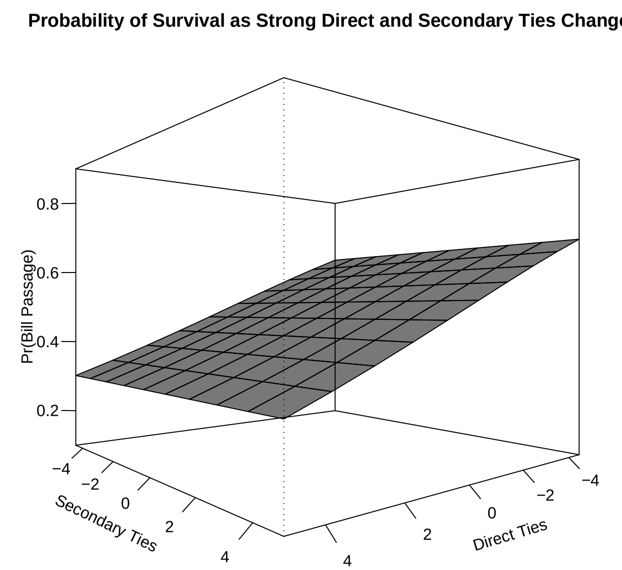
(a) Weak Ties

(b) Strong Ties

Figure 4: Predicted Probability of Bill Survival in the US House as Direct and Indirect Ties Increase: Lighter Gray Represents Weak Ties, Darker Gray Represents Strong Ties.



(a) Weak Ties



(b) Strong Ties

Figure 5: Predicted Probability of Bill Passage in the US House as Direct and Indirect Ties Increase: Lighter Gray Represents Weak Ties, Darker Gray Represents Strong Ties.