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PLSC 505

Replication and Extension

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For my term project, I will be working with data from Zachary Neal's set of Congressional cosponsorship networks. The citation for the corresponding article is as follows:

> Neal, Z. P. 2020. A sign of the times? Weak and strong polarization in the U.S. Congress, 1973-2016. *Social Networks.* Doi: 10.1016/j.socnet.2018.07.007

I have stored the article's replication data on my Github, at github.com/sbwarner/PLSC505.

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Overview

Neal creates his networks using a stochastic degree sequence model, which determines whether a dyad of legislators cosponsors significantly more or fewer bills than would be expected at random.

These results, in turn, allow Neal to create "signed" graphs, where positive edges (1) indicate high levels of dyadic cooperation, and negative edges (-1) indicate lower levels.

Neal uses these signs to propose a distinction between weak and strong polarization. "Weak" polarization, he posits, extends from simple homophily, and can be seen in a network when positive ties are concentrated within (as opposed to) between groups. It can be quantified using a modularity statistic.

"Strong" polarization, by contrast, necessitates negative ties between groups. Neal quantifies this by calculating the triangle index for each chamber-session of Congress. A triangle index is the number of balanced (+ + + or + - -) triangles as a proportion of all signed triads in a network. These triads are called "balanced" because, respectively, they indicate groups of friends and friends who hold common enemies.[1]

Reproduction of results

The substantive findings of the paper refer to a rise in both "weak" and "strong" polarization over time. Neal presents strong and significant Spearman correlations between (a) modularity and year, and (b) triangle index and year for both chambers.

To replicate Neal's results, I use R Studio to import his adjacency matrices for one chamber at a time. After cleaning data to ensure that Independent members are assigned to their proper caucuses, I convert the matrices to networks and capture their modularity statistics.

[1] A triangle in the form of (+ + -), by contrast, would indicate that a link exists between unfriendly nodes.

Figure 1 presents the modularity statistic for each chamber over time.[2] When I run the Spearman correlations between modularity and time, my findings fit with the values presented in Neal's article. For the Senate, the match is exact, as we both find ρ = 0.88. At the House level, my finding for ρ is slightly higher than the published value, at 0.90 versus 0.89, but a Fisher's Z test indicates that this difference is not statistically significant.

Figure 1. Modularity of Congressional Networks over Time

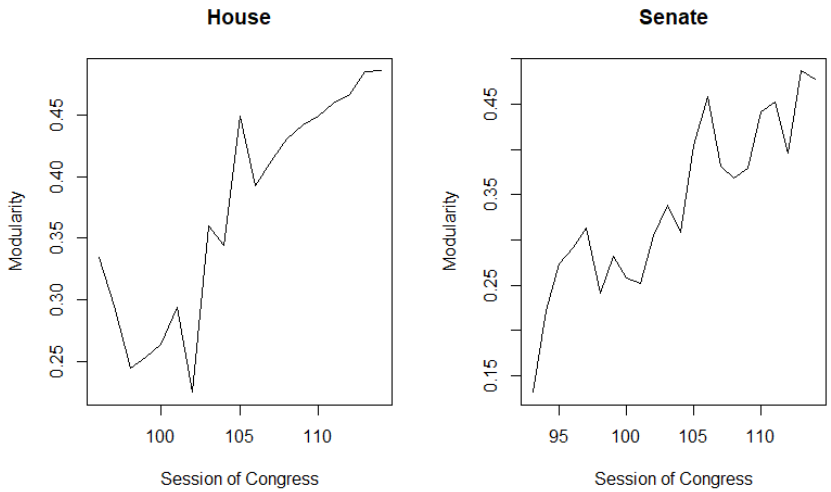
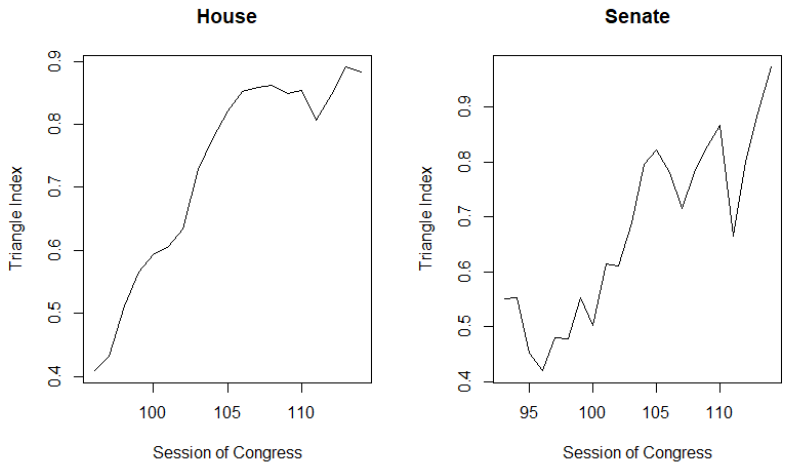


Figure 2 presents the triangle index for the House and Senate over time. Again, my replication of Neal's results is successful. For the Senate, we both find that time and triangle index correlate at ρ = 0.85, and that figure is ρ = 0.91 for the House.

Figure 2. Triangle Index of Congressional Networks over Time



[2] Note that Neal only examines the House from 1979 onward, due to sponsorship rule changes in that year.

Plotting a network

Neal's study derives from a set of 44 networks. Here, I subset and plot one graph to begin my exploration into legislative network dynamics.

Because I am tentatively interested in the role of party unity in Congress, I produce networks of the majority party (Republicans) in each chamber of the 114th Congress (2015-16), the most recent year for which Neal provides data. These networks only include positive ties between members.

Necessarily, these plots will be very crowded, particularly that of the House GOP with its 251-member majority that year. As such, I pay most attention to those vertices on the periphery of the graph.

Figure 3 presents the sponsorship network of House GOP members in the 114th Congress. When we look at the nodes, we notice several isolates. Some are clear anomalies. Alan Nunnelee died two months into the term, and Aaron Schock resigned amid an indictment around the same time. The remainder represent the caucus leadership, who as a means of impartiality may have refrained from cosponsoring legislation.

Looking closer to the center of the cluster, however, we notice Justin Amash with only one link to the rest of his caucus. This fit with his later behavior, as the only sitting Republican MC to leave the party in opposition to President Donald Trump.

A survey of other names on the outside of the main cluster reveals MCs with heterodox views relative to the GOP mainstream. Kalamazoo-based member Fred Upton is chair of the moderate the Tuesday Group caucus. Georgia Congressman Randy Woodall supports gun control and marijuana legalization. And the former California representative, Dana Rohrabacher, was notable for his enthusiastic support for Russia on foreign policy matters, including its annexation of Crimea.

This small sampling of data suggests that a fraction of MCs exist whose ideological "distinctiveness" leads them to be less willing to cosponsor bills with other members of their caucus.

Turning to the Senate, we see a roughly similar effect in Figure 4. While there is ideological heterogeneity on the outside of the (much more slightly) plot of Senators, the names with fewer ties to their caucus read like a "who's who" of legislators who would later express skepticism of or resistance to the presidency of Donald Trump. Lisa Murkowski and Bob Corker have fewest ties to their caucus. Perennial fence-sitter Susan Collins is also placed on the outside, as are libertarian Rand Paul and Trump critic Ben Sasse.

Vertex Attribute: Seniority

Finally, for the Senate GOP network, I added seniority as a vertex attribute. One might suppose that some combination of a legislator's commitment to the institution—proxied by their tenure—combined with their electoral safety (or hopelessness) would affect their willingness to stand out from other members, at least conditionally.

Adding this data to my network was laborious. It involved pulling each Senator's seniority date from Wikipedia, and carefully matching them to the non-alphabetized order of vertex names in my network. (There is a reason I only did the Senate!) As the project continues, I will be looking for more efficient and parsimonious ways of adding data to Congressional networks.

Figure 3. House GOP Network (114th Congress)

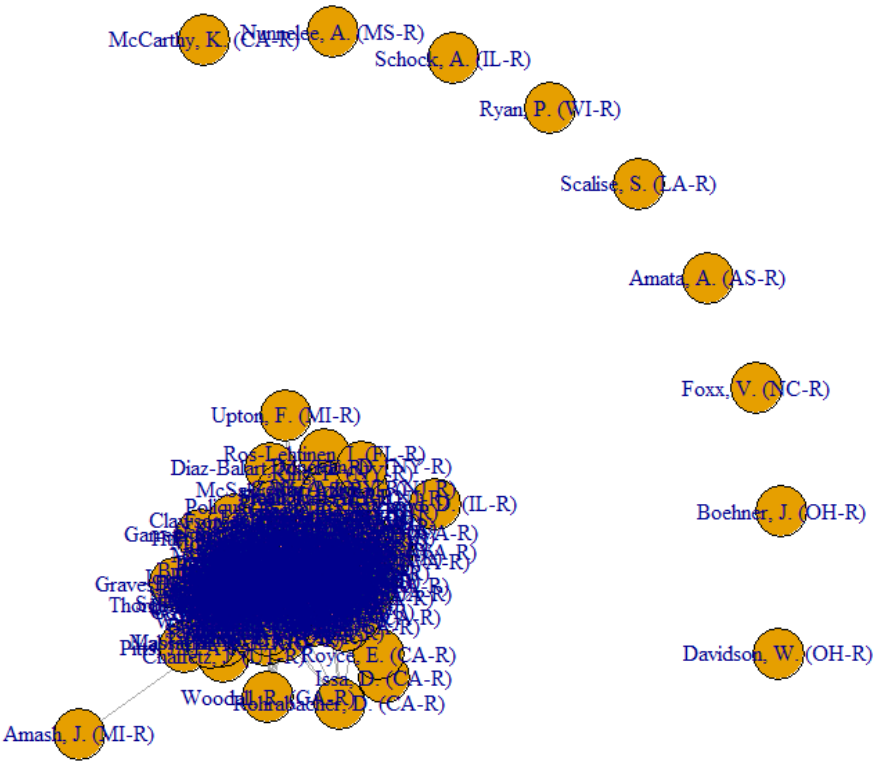
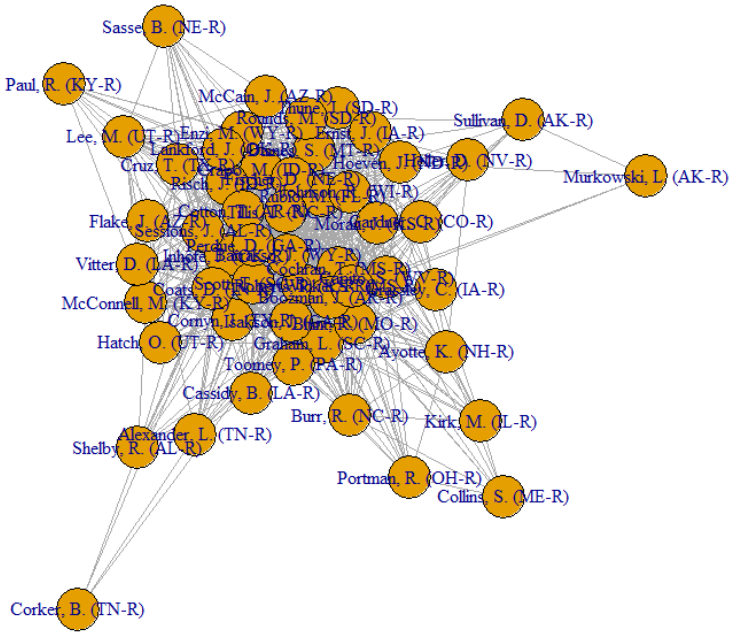


Figure 4. Senate GOP Network (114th Congress)



In the meantime, Figure 5 presents the seniority of Republican members of the U.S. Senate at the beginning of the 114th Congress. We notice that slightly more than half of the 54-member caucus has less than five years of seniority, indicating that they had been elected that cycle or in one of the two cycles prior.

From there, ample numbers of legislators appear to have completed one, two, or three terms, but far fewer GOP senators had been in the chamber for the "long haul," with Orin Hatch being the longest-serving at what was then a 38-year tenure.

Figure 5. Seniority of GOP Senators (114th Congress)