Cosponsorship patterns in the US Senate

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1 Introduction

In the US Congress, each bill is sponsored by a single legislator who takes ownership for it. However, additional legislators can cosponsor a bill after it is presented, signaling support and sometimes partial ownership for it. There may be many reasons a legislator chooses to cosponsor a bill. Indeed, Clark (2013) in an article for Salon documents that legislators expend much energy finding cosponsors for their bills. Significant research has been done investigating *which bills* a legislator is willing to cosponsor. We consider *with whom* a legislator is willing to cosponsor.

Cosponsoring relationships form a social network, analogous to friendship links at school or interactions in an online platform. I use data on the Senate from 1975 – 2022, analyzing all roughly 88,000 bills proposed and 498 unique Senators.[1] Statistical measures of centrality on a network, including Google's PageRank algorithm, identify Senators widely regarded as influential and quantify their influence. I also document patterns of cosponsorship over time – bipartisanship has declined in favor of intra-partisanship. This work follows up from Fowler (2006), updating some results and incorporating new statistical techniques for networks.

2 Influential Senators

I quantify the influence of Senators using network measures of "centrality". Each time Senator A cosponsors Senator B's bill, a link is formed from A to B. Aggregated over the 88,000 bills, we have a large network among Senators. We might expect bills sponsored by influential Senators to attract many cosponsors. Conversely, we might also expect such Senators to be desirable cosponsors. This suggests that statistics quantifying Senators' importance in the network can tease out and quantify their influence.

Google's PageRank algorithm (which was originally used to order search results) ranks Senators on their relative influence. Senators who receive many cosponsorships receive a high ranking. This

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[1]The number of Senators who actually sponsored or cosponsored any bill is around 400. The remaining Senators were mostly "caretakers" who served partial terms.

Table 1: Top 20 Senators by PageRank, in descending order

Name	Party	State
GRASSLEY, Charles (Chuck)	R	IA
HATCH, Orrin	R	UT
KENNEDY, Edward (Ted)	D	MA
INOUYE, Daniel	D	HI
DURBIN, Richard (Dick)	D	IL
McCAIN, John, III	R	AZ
BINGAMAN, Jesse, Jr. (Jeff)	D	NM
FEINSTEIN, Dianne	D	CA
LEAHY, Patrick	D	VT
MOYNIHAN, Daniel	D	NY
DOMENICI, Pete	R	NM
LAUTENBERG, Frank	D	NJ
THURMOND, J. Strom	R	SC
DOLE, Robert (Bob)	R	KS
CASEY, Robert, Jr. (Bob)	D	PA
KLOBUCHAR, Amy	D	MN
CRANSTON, Alan	D	CA
WYDEN, Ronald	D	OR
KERRY, John	D	MA
BAUCUS, Max	D	MT

is magnified if those cosponsors are *also* influential. The formula for PageRank (PR) is given by

$$PR(i) \propto \sum_{j \in N(i)} \frac{PR(j)}{L(j)}$$

where $N(i)$ are Senators who cosponsor one of i's bills and $L(j)$ is the number of total cosponsorship signatures received by j's bills. Intuitively, a Senator that receives cosponsorships from many other influential senators is also influential.

Figure 1 shows the network of Senators and cosponsorship relationships from 1975 – 2022. The figure is quite dense, making some labels difficult to see. The point of the figure is to illustrate the structure of the network and its complexity. The size of each vertex is proportional to the Senator's PageRank score, and the width of each arrow is proportional to the number of cosponsorships between each pair. For clarity, only links with at least 10 bills are shown. The top 20 Senators by PageRank are labeled. Table 1 also lists the top 20 Senators by PageRank.

3 Patterns over time

I also document a recent and increasing phenomenon – the replacement of bipartisanship with "intra-partisanship". Since the 2010s, cosponsorship across party lines has become increasingly rare. Indeed, voting across party lines has become much rarer. Instead of gathering at least some support

from both parties, legislators are increasingly signaling support across the ideological spectrum of their own party.

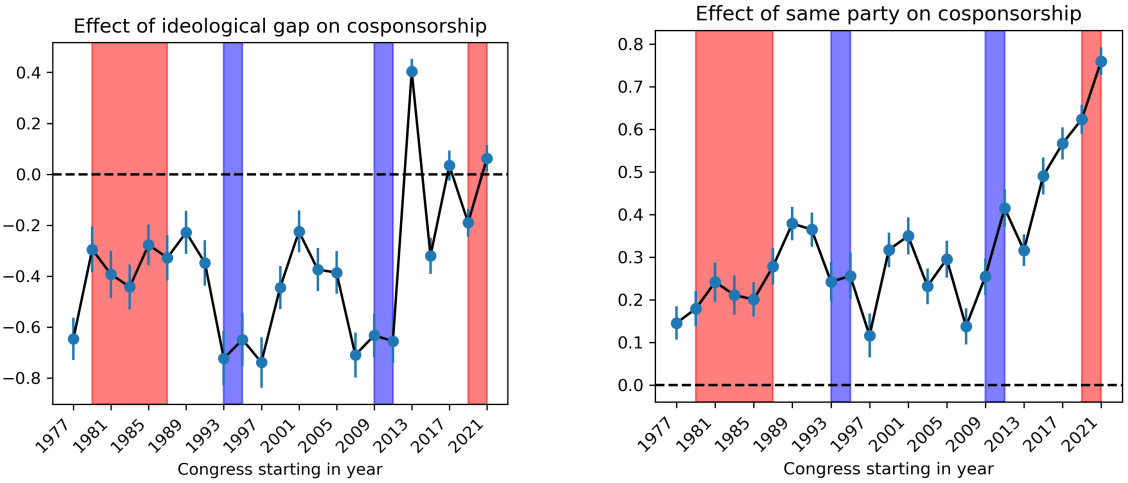
To quantify this, I estimate network regressions, called ERGMs ("exponential random graph models"). These are network analogues of multinomial regressions. I estimate ERGMs on the number of links between Senators against the difference in their ideological scores and an indicator for being in the same party in each two-year cycle. Ideological scores are quantified using the Nominate scores from Lewis, Poole, Rosenthal, Boche, Rudkin, and Sonnet (2025), which estimates a left-right score of legislators' ideology.

Let $L(i,j)$ be the number of cosponsorship links from i to j; let $I(i)$ denote i's ideology score; and let $P(i)$ denote i's party. The specification is given by

$$L(i,j) \sim \beta_0 + \beta_1 |I(i) - I(j)| + \beta_2 1\{P(i) = P(j)\} + \beta_3 \cdot X$$

where $1\{P(i) = P(j)\} = 1$ if i and j belong to the same party. X is a vector of controls of Senator characteristics, including party and ideology score. So β_1 is the effect of ideological distance on cosponsorships, and β_2 is the effect of being in the same party on cosponsorships. The ERGM specification estimates these coefficients against a null hypothesis of completely random cosponsoring; i.e. a Senator randomly selects partners to cosponsor. The following figures show the values of these coefficients over time.

Figure 2: ERGM Coefficients on cosponsorships in the US Senate, 1975 – 2022.



Notes: Figures show coefficients on ERGM regressions for each two-year Congress from 1975 through 2022. **The scale of coefficients is not meaningful, only their changes over time.** Shading shows when the Presidency and Senate are controlled by the same party, color indicating which party. Bands show 95% confidence intervals.

The figures make the described pattern clear. While it has always been true that Senators were more likely to cosponsor bills within their own party, the effect has increased dramatically since the 2010s. Meanwhile, the effect of ideological gap used to be negative; that is, Senators were **more likely** to cosponsor with others who are ideologically **similar**. This effect has reduced, perhaps

even reversing. Senators have become much **increasingly** likely to cosponsor with others who are ideologically **different**.

Taken together, these two patterns suggest that legislators seek to cosponsor across the spectrum *within their own party* to win support. For example, a moderate Republican might cosponsor with a very conservative Republican to signal broad support within their own party.

References

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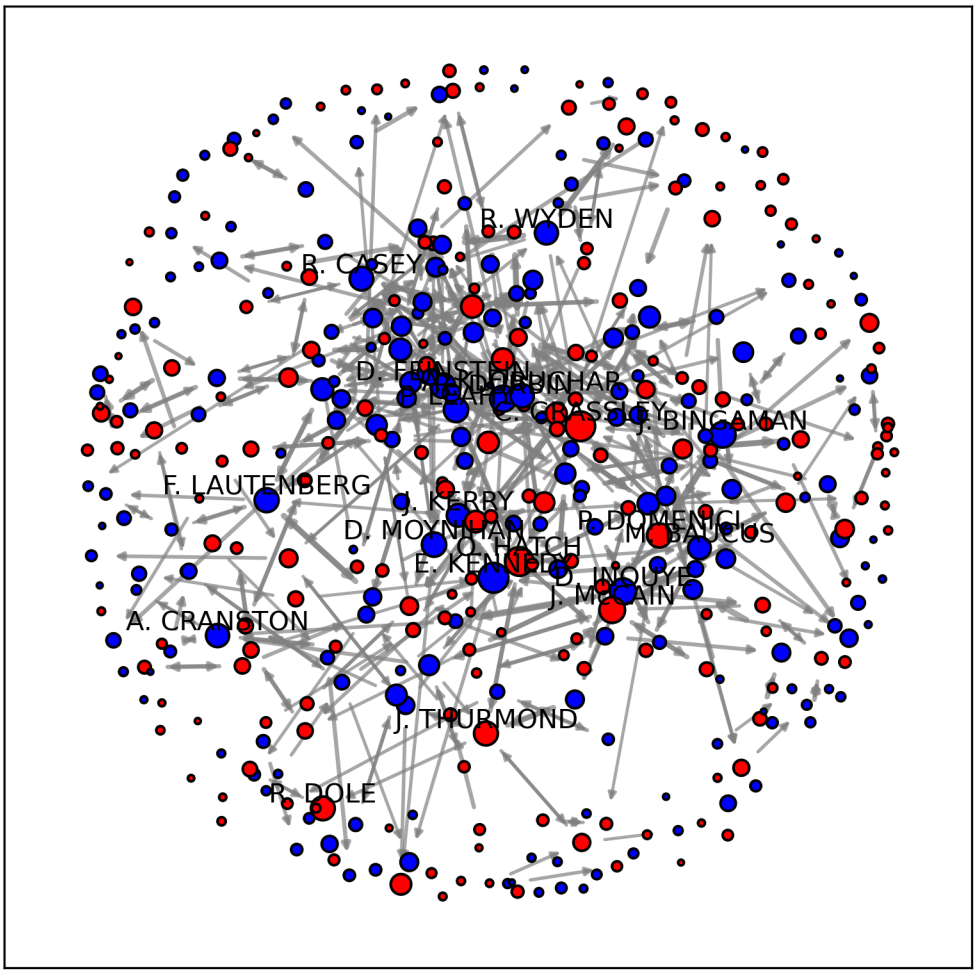
Fowler, J.H. 2006. "Legislative cosponsorship networks in the US House and Senate". Social Networks, 28.

Lewis, J.B., K. Poole, H. Rosenthal, A. Boche, A. Rudkin, and L. Sonnet (2025). Voteview: Congressional Roll-Call Votes Database. https://voteview.com/

Figure 1: Cosponsorships in the US Senate, 1975 – 2022.



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