An Autopsy of Paired Voting in the U.S. Senate*

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In 2018, Senator Lisa Murkowski cast an unexpected vote. In the highest profile roll call of the year, the confirmation of Supreme Court nominee Brett Kavanaugh, Murkowski voted "present," in spite of her stated opposition to the candidate. She cast a paired vote, a system by which a present member makes an arrangement with an absent member that would vote opposite them to withdraw their vote, so the outcome is unaffected by the absence. Senator Steve Daines was at his daughter's wedding, and the Republican leadership wanted to push through the nominee while they had a majority. Thus, Murkowski did a favor to her colleague and helped out her party at the same time. While paired voting was once commonplace, happening hundreds of times each congress, it is almost never observed today.

The Senate is a dynamic body with members that change their behavior in response to changes in political context. Such context conditions the opportunities available to senators and constraints besetting them. I argue that paired voting was a casualty of multiple contextual changes and analyze each in turn. In particular, I explore the effect of declining absences, leadership influence, and political polarization. Senate attendance rates increased because the electoral costs of absenteeism increased while changes in technology and scheduling practices made it easier to be in Washington when votes were cast. The heightened attendance

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rate removed much of the need to find pairs. Party leaders differed in the extent to which they supported members pairing. Increased polarization made it harder to find a pair within your party, as the parties became more ideologically homogeneous, and also increased the cost of helping a member of the opposite party. These changes happened concurrently and each contributed to the disappearance of pairing.

To understand paired voting and its decline, I examine the practice at two levels. First, I employ network analysis methods to investigate individual-level characteristics that determine paired voting behavior. This model allows me to make the relationship between senators, in this case the paired vote, the dependent variable while accounting for the violation of the conditional independence assumption necessary for traditional inferential methods. I find that senators with more absences and party leaders are more likely to pair, that ideologically distant copartisans are more likely to form a pair with each other. I then investigate the extent to which changing context eroded the amount of paired voting per Congress, I find that paired voting declined as the annual attendance record increased and as a party's ideological heterogeneity decreased. From these findings, I conclude that no single factor eliminated paired voting. Instead, multiple changes in Senate practice and context made paired voting untenable.

In this essay, I explore a practice whose disappearance has escaped the attention of congressional scholars. In doing so, I highlight how contextual factors influence the day to day workings of the Senate. Senators respond to changes in their environment and are particularly sensitive to the costs and opportunities available to them. When the cost of pairing was raised or the opportunity to pair becomes sparse, Senators abandoned it as a strategy.

Pairing in Historical Context

Paired voting emerged as a solution to a specific problem - members could not attend every roll call, but still wanted to have their vote counted. By finding a pair, the member nullifies the impact of their own absence on the outcome, leaving the winning margin identical to what it would have been had the senator been present. Pairing was first mentioned in congressional documents in 1838, with a reference to several members who had "paired off" to excuse themselves from a session that had run late into the evening (*Congressional Globe* vol 6. pp 378). This episode indicates that paired voting was an informal arrangement between members meant to provide cover for missed votes, with the purpose of keeping absences from affecting vote totals directly stated in Senate debates three years later. The practice was initially seen as a controversial dereliction of duty, with the House narrowly voting against excusing the absence of a member who had arranged a pair in the 27th Congress (1841-1843) (*Congressional Globe* vol. 10 pp. 406). However, by the 36th Congress (1859-1861) pairing had become regularized and the practice of announcing pairs following roll call votes was routine (Rivers 1860).

Despite its ubiquity in the *Congressional Record*, few scholars have given paired voting serious consideration or commented on its decline. Luce noted that in the late nineteenth and early twentieth century, members would form long term pairs that lasted months (Luce 1922). However, throughout the twentieth century, pairing was more democratized with many members pairing with many others. In the early years of that century arranging pairs was one of the chief responsibilities of the first party whips, though that job fell to the party secretaries over time (Oleszek 1971; Scott 1992). Beyond those historical accounts, political scientists have used paired voting in calculating ideology scores as position taking equivalent to a cast vote (Poole and Rosenthal 1997). While an expression of preference, there are reasons that members pair instead of casting votes, and examining trends in pairing can highlight features of congressional development.

Pairing was a fixture of congressional vote behavior, affecting numerous votes every session, until its disappearance in the late twentieth century. While the amount varied significantly from year to year, pairing has declined rapidly from the middle of the century to today. In Figure 4.1, I present the number of paired votes each decade from the 1960s to the present. While the decline is obvious, the Figure also indicates that pairing was a predominantly within-party phenomenon. In each decade, the number of pairs between two Democrats or between two Republicans dwarfs the number of cross party pairs. In the next section, I explore different changes in congressional context and how they influenced paired voting.

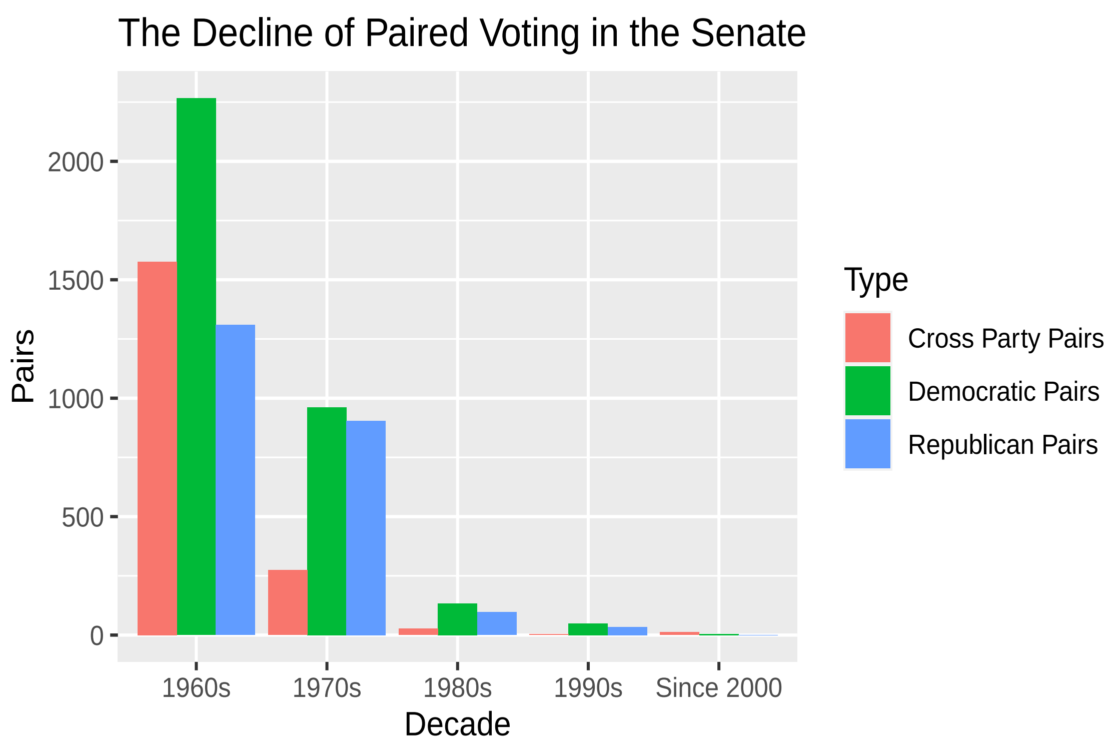

Figure 1: This plot shows the number of pairs by year, separated by whether the pair was between two Democrats, between two Republicans, or between members of the opposite party. Data collected by the author from the Congressional Record.

Paired Voting in Decline

In this section, I examine the potential factors that make paired voting a viable strategy, and how changes in those factors contributed to the disappearance in pairing overall. The most obvious reason that members pair is to nullify the impact of absences on a senator's personal attendance record. Senators have many responsibilities, both personal and political, that might detain them from casting votes. In announcing a pair, the senator is said in the Congressional Record to be "necessarily absent," lending legitimacy to their missed vote for any curious constituent.[1] Pairs allowed members to claim that their vote was recorded without ever having to set foot on the floor. Secretary for the Majority Bobby Baker said "When accused of nonaction on the bill by some future opponent, they could bluster of how they'd been "been recorded"...It would take the opponent six days to explain all the parliamentary deceptions involved, by which time he'd be speaking to empty chairs" (Baker 1978). When election day got nearer, some senators would look back at potentially dangerous missed votes and ask for a correction to the Congressional Record that showed them as paired rather than absent. A senator's vote is a precious resource and members want to signal to their voters that they are not wasting it.

Senators today are casting votes with more reliability than in previous eras. Through the 20th century, innovations in technology and Senate practice made it easier for senators to spend time in their state without missing votes. A revolution in transportation technology took place that freed members from being bound to the speed of railroad cars. The inauguration of the Jet Age in the post-World War II period meant fewer stops on cross-country trips that now made it realistic for even western members to campaign in their states during the weekend and still show up for votes during the week (Loomis 2000). At the same time, the Senate constricted their calendar to facilitate this process even further. In the early 1900s, about 60 percent of roll call votes occurred on Tuesday, Wednesday, or Thursday, which is about what would be expected if the votes were not systematically scheduled in any strategic fashion. In Figure 4.2, I show that starting in the mid-century, the proportion of roll calls held in the middle of the week began a steady increase. The Senate leadership was scheduling fewer votes on Monday and Friday, thus making it easier for members to fulfill duties

[1] The actual reason for the absence had no bearing on the phrase and often ran the gamut from illness or family obligations to betting at the racetrack (Ritchie 2009).

in their state without having to miss votes. Another factor in increased attendance is that senators are likely healthier than their predecessors and so less likely to miss long stretches of votes that historically were causes for pairing. While there is not a public, reliably consistent measure of health, senator mortality rates provide an illustration. Senate deaths have trended downward for a century, and are now a rarity. Two to three senators died per year, on average, in the first half of the twentieth century (Brant, Masthay, and Overby 2018). Since 1980, though, there has never been a year where more than one sitting senator died and 23 years when no senators died at all. Additionally, congressional deaths over the past few decades have been consistently lower than actuarial expectations (Maltzman, Siegelman, and Binder 1996). This means that, even though they are now older on average, senators are not suffering from debilitating, mortal conditions that frequently. Technology, scheduling, and health all mean that senators are missing fewer votes than ever before.

At the same time, the political cost of absenteeism has also increased. Newspapers call attention to missed votes, especially during campaign season. To provide an illuminating example, on January 1st, 2020, the Atlanta Journal Constitution, Georgia's newspaper of record, reported that senators Loeffler and Purdue missed a vote to override President Trump's veto of the N.D.A.A. Both were in the final days of a difficult campaign, but the paper was unforgiving. It reported that Loeffler had a private jet and had before rearranged her schedule to accommodate votes. Further, they quoted a Democratic party leader who charged the senator with "skipping work." In light of these factors, the average absence rate among Senators increased, as shown in Figure 4.3. Senators now miss fewer that five percent of votes, compared to an average of around fifteen percent in the middle of the century. If all senators vote, then none need pairs. Thus the number of paired votes should decline as the attendance rate increases.

Pairs are a "merely voluntary arrangement between individual Senators" according to Riddick's *Senate Procedure*(1992), but in practice they were the domain of the party. The first party whip, Hamilton Lewis, was specifically tasked with monitoring attendance and

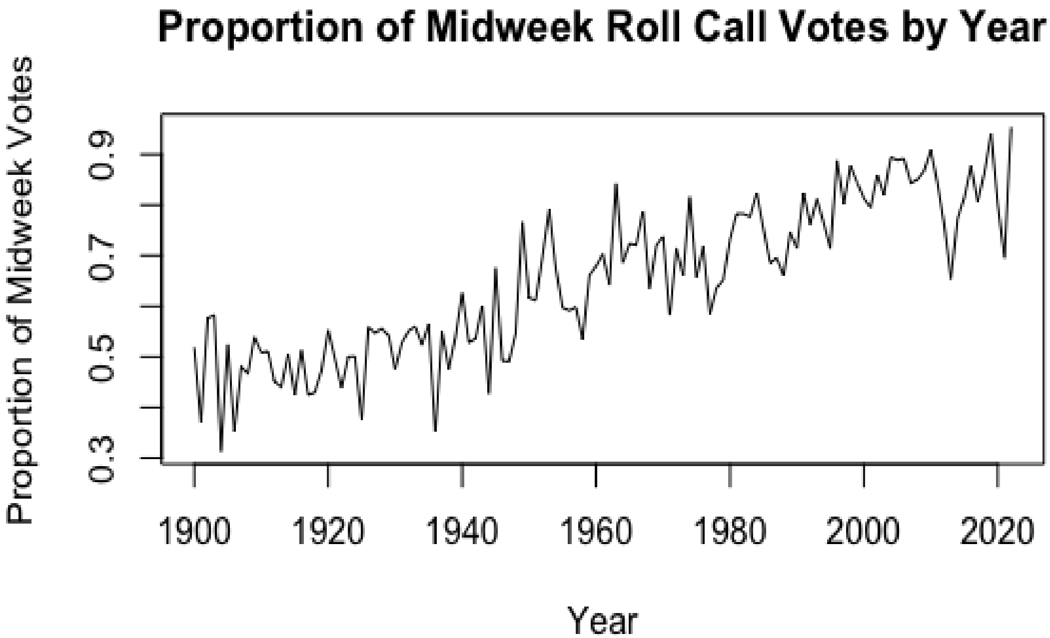

Figure 2: This plot shows the proportion of Senate roll call votes that occurred on a Tuesday, Wednesday, or Thursday aggregated by year.

arranging pairs (Oleszek 1971). Over time, that position was copied by the Republicans, and both shared the duty of setting up pairs with a party secretary. Parties too have an incentive to arrange pairs, as it helps the party to provide electoral cover for absent members and allows parties to internalize the cost of any defections by members. Because pairs were organized by the party, particularly an arm of the party leadership, some of the variation in paired voting is likely due to the varied approaches that leaders, whips, and party secretaries took toward arranging pairs. There is considerable historical evidence to support this assertion.

In the mid-twentieth century, the Democrats had three leaders that are illustrative of different approaches to pairing. Under Ernest McFarland, pairing was not of special interest to the party leadership (Caro 2002). Instead, pairs were arranged entirely by Felton "Skeeter" Johnston, the party secretary, or by informal, individual agreements (Scott 1992). Lyndon Johnson the Majority Leader was known to be much much less accommodating of pairs. He

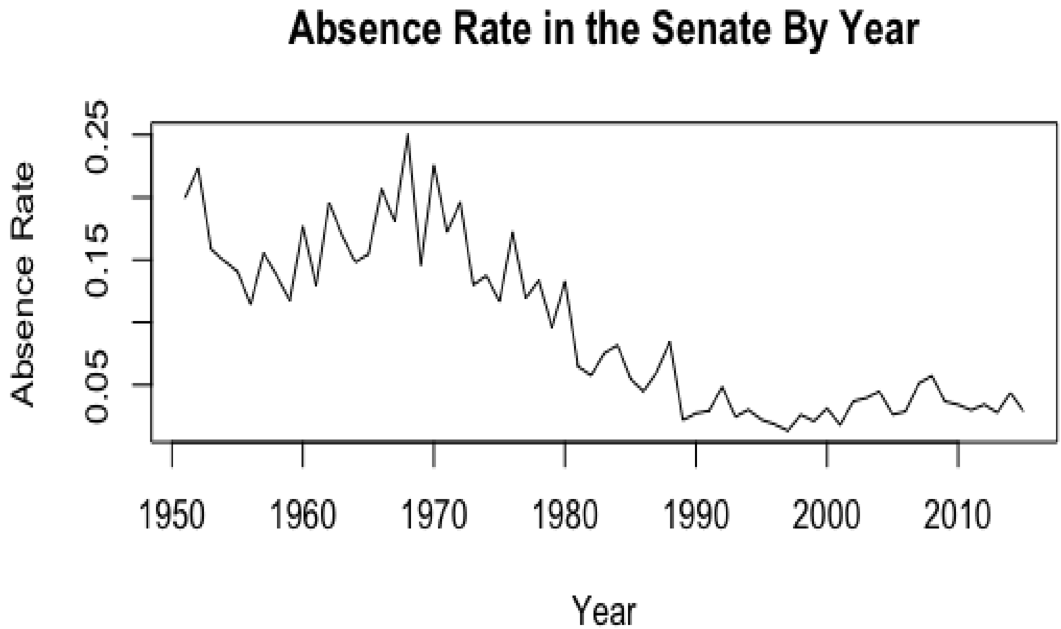

Figure 3: This plot shows the proportion of missed votes on Senate roll calls aggregated by year.

demanded that every vote be accounted for and tasked Secretary for the Majority, Bobby Baker, with always having a number for even the senators that did not want to be reached (Caro 2002). Consequently, we see fewer Democratic pairs during Johnson's tenure as leader. Pairing returned to prominence when Johnson left the Capitol for the Naval Observatory and new leader Michael Mansfield viewed pairing more favorably. According to the Democratic Party Conference minutes, in 1962 veteran senators Wayne Morse and John Sparkman decrying the disuse of pairing and suggesting its revival as a way to help protect senators that have to be out of Washington campaigning (Ritchie 1998). Accordingly, Democrats made more pairs in 1962 than any other year in my dataset.

Pairing as party strategy was not limited to the Democrats. In the 1950s, the Republican leader William Knowland repeatedly reminded his copartisans to make pairs through the party secretary rather than arranging them individually. He also urged members to not pair with Democratic colleagues and, if they must vote against the party, to pair with Republican senators who were absent (Wolf and Ritchie 1999). Similarly, Everett Dirksen warned the Democratic operative Baker to "stay on your side of the aisle" and "don't make deals with my colleagues" after Baker got Glenn Beall to pair with Eugene McCarthy (Westman and Brandi 2015). While different party leaders' views toward pairing certainly contributed to the year-by-year variation in paired voting, it is unlikely that the decline can be wholly attributed to party leader preferences.

These anecdotes suggest that members generally prefer to pair within their party than across party lines. However, senators can only pair with members who are voting against them. In votes where each party is unified, even the most desperate senator will be unable to find a copartisan with whom to pair. The most studied trend in congressional politics is partisan polarization, and it too has conditioned the opportunities and costs of paired voting. Party polarization involves two elements: increasing ideological homogeneity within each party and increasing ideological distance between the parties. The former means that copartisans are voting similarly to each other, which in turn means that there are fewer opportunities to pair within one's party. Increasing ideological distance between the parties increases the costs of pairing with an out-party member. It becomes harder for senators to justify doing a favor for an increasingly distant political opponent when that favor could mean an electoral victory. This is a more salient consideration in an era of insecure majorities, where a change in a single seat could determine control of the Senate. There has not been a rise in cross-party pairing to compensate the reduced opportunity to pair within one's own party, even though there are ample opportunities to find potential pairs on the opposing side. In the 111th Congress, Majority Leader Harry Reid took to the floor to beseech Republicans to pair with the long-serving Democrats Ted Kennedy and Robert Byrd who had become too ill to attend votes. Polarization was too much to overcome. There were no Democrats voting against Kennedy and Byrd's positions, and there were no Republicans willing to assist their colleague.

The disappearance of paired voting is caused by a number of contextual changes that condition the opportunities and costs of senators. Practical considerations, like how easy it is to cast votes, reduce the need for pairing, but do not tell the full story on their own. Partisan factors, like the electoral price of absenteeism and the ideological distance between the parties, make it more costly to pair with members of the opposite party. At the same time, ideological consistency within parties reduces the number of opportunities a senator has to pair within their own party. In the next section, I statistically test the degree to which these factors apply.

Research Design and Methods

I analyze paired voting in two ways. First, I look at pairing behavior on the individual level to determine what factors make members more likely to pair. By understanding why members pair, we can then infer that broad changes in those variables likely diminished pairing overall. To follow, I examine pairing at the Congress-level to see what overarching factors correlate with the decline in the total volume of pairing activity. I used the *Congressional Record* to collect the universe of paired votes in the Senate. While some previous data on paired voting does exist, it contains many errors.[2] Pairs were announced in a standardized way, with either the member or a floor leader (if the both members were absent) declaring that they had a pair, who was in it, and how each would have voted. My analysis depends on the relationship between members, rather than the individual member, and so the unit of analysis is the relationship, characterized as a network of possible and realized paired votes. I collected these data from 1951 to 2015. The final several years have under 10 pairs each, and include several zeroes after the turn of the century. Because of the small number of pairs, the networks were too sparse to be informative and so my model for testing the determinants

[2] The main roll call vote data, Voteview, has several problems. It does not always list both sides of a pair as having paired, it confuses announced votes and paired votes, and does not provide a way to tell who paired with whom on votes where there were multiple pairs. My method detects more pairs in most Congresses than this dataset.

of pairs uses data only from 1951 to 1985.[3] The models to test the system level variables, though, use the number of pairs in a given year and can incorporate the entire series.

Individual-Level Analysis

The structure of the data at the individual level requires a network analytic approach which allows for the incorporation of both individual and dyadic dependent and independent variables. Simply looking at whether an individual member makes a pair loses important information about the member with whom they are pairing. Members do not select their pair partners at random, they choose with systematic regard to various factors, and those factors must be appreciated as a product of the tie rather than the individual. Using a more traditional generalized linear model with dyad-level data would also be problematic because the conditional independence assumption is not met. Pairs are exhaustible and once a senator is paired on a vote, they cannot typically be simultaneously paired with another senator.[4]. Members who pair, additionally, might be more likely to pair again with different members. My modeling strategy must be able to incorporate information about network structure to handle spatial dependence. Additionally, I expect some temporal dependency between each year's network. Institutional memory is largely preserved in each Senate, which has less potential year to year turnover than the House of Representatives, and so how each pairing network is organized is in part a function of the previous year's pairing network. These concerns require a model that can incorporate each of these dependencies.

To estimate the equation I use the additive and multiplicative effects latent factor model

[3]It is computationally difficult to run the model with very few pairs, as there are past 1985, and the significantly diminished variation in later years might raise concern about bias. There is no problem with selecting on the dependent variable because the model compares senators that pair with senators that do not in every year, rather than years where there is pairing to years where there is not. Further, I examine the pairs in later years with the congress-level models.

[4]Riddick's Rules for Senate Procedure state that for votes that require a two-thirds majority, one member voting nay can pair with two members voting yea. For my purposes, I have coded each of these as two separate pairs

(AME).[5] The AME is structured to incorporate several different dependencies that plague networks to allow for better estimates on the coefficients of exogenous variables. This model takes into account first and second order dependencies in network structure.[6] Because this model is an extension of a typical regression framework, it can be interpreted similarly to an ordinal variable model, where the dependent variable is the number of pairs forming between two members in a given year.[7] Finally, I model the network as undirected, so it makes no difference to the model who the present and absent members are. Though this may seem like an odd choice, as the present member could be thought of as "giving" a pair to the absent member, many cases exist where both pairing members are absent and so no directionality could be determined.

The AME model can take dyadic and individual level covariates, and can also be estimated for a series of networks across time. The dependent variable is the the number of a pairs formed between a dyad in a given year. The main variables of interest are both dyadic and individual. Key individual-level variables are how often a member is absent in a given year, as defined by the proportion of roll calls on which a senator did not cast a yea or nay vote, and whether a member is part of the party leadership. While the latter variable does not reveal the extent to which the party controlled pairing, a positive result would suggest that the leadership helped support pairing by being willing to serve as a pair at a higher rate than other members. The dyadic variables of interest are whether two members share the same party, the ideological distance between those two members (measured by the difference

[5] Alternative specifications using the more common exponential random graph model (ERGM) and some of its extensions are given in Table C.1 and Figures C.1 and C.2 of the appendix. In Minhas et al. (2018), the authors find that the AME outperforms the ERGM on both the true positive and false positive rate for predicting pairs, while not performing worse on measures of network structure. In general, the ERGM is better for understanding the generative process of an entire network, while the AME is useful for predicting dyadic ties based on individual or dyadic covariates, which is what I am interested in accomplishing.

[6] For example, values of the dependent variable might be more similar if they are all from the same nodes, or some nodes may be more likely to form ties than others. The model incorporates these dependencies using additive effects from the social relations model (Minhas et al., 2018). It is able to do this by decomposing the variance of observations in an adjacency matrix in terms of heterogeneity across row means, heterogeneity along column means, correlation between row and column means, and correlations within dyads. Full specification of the model can be found in equations one through ten in the appendix.

[7] This framework can also incorporate alternative modeling strategies. For example, considering edges as dichotomous rather than ordinal. This specification is provided in Table C.2 of the appendix.

between their first dimensional NOMINATE scores) and the interaction between the two. These variables enter the model as sets of matrices showing the relation between members i and j for all i and j.

Congress-Level Analysis

Analyzing the decline in pairing requires a different modeling strategy, as I now aggregate up to the Congress-level. The outcome variable is the number of pairs in a given year. Because the data generating process for pairing differs by party, I estimate three different equations with the dependent variable being the number of pairs between members who are both Democrats, between members who are both Republicans, and between members of different parties. My independent variables are the factors that contribute to the overall decline in paired voting. In the copartisan models, I analyze the absence rate of the Senate, defined as the proportion of votes cast that were neither a yea or nay, which represents the amount of pairs that could potentially occur. I use the size of the party as an indication of how many copartisans exist with whom one might pair and the standard deviation of the party's ideology, which indicates the frequency with which copartisans are opposing each other. I add fixed effects for each party leader, which controls for the varying extent that a particular party leader supports paired voting as a practice. I also control for the total number of roll call votes in a given year and whether or not it was an election year.

In the model for cross-party pairs, I again use absence rate as a main independent variable. I also use a series of independent variables meant to establish the political cost of cooperating across party lines. The size of the majority party is an indicator of how tenuous majority control in the Senate is, and members should be less willing to form cross-party pairs when majorities are smaller. I have an indicator for whether or not it was an election year, when doing favors for members of the opposite party might be particularly costly. Finally, I assess political polarization, defined as the distance between the two parties' median DW-NOMINATE scores. I expect increasing political polarization will make members less willing to form cross party pairs. Again, I control for the total number of roll call votes.

Findings

Individual-Level Analysis

In Table 4.1, I present the results of the AME model, which speak to the factors that determine which individual members are pairing with what other members. The largest coefficient is for attendance. Senators with the lowest levels of attendance are about half as likely to pair as those with high attendance rates. Members of the leadership are slightly more likely to pair than their colleagues. The effect of polarization is found in the interaction between ideological distance and shared partisanship. The interaction in the model can be interpreted in the same way as it would in a typical ordinal probit GLM model. Figure 4.4 shows the marginal effect of shared partisanship at different values of the ideology variable, with 95% credible intervals. The effect of shared partisanship is indistinguishable from zero at low levels of ideological distance, which is expected because these members rarely find themselves opposing one another, and are thus unable to pair. However, the effect of shared partisanship grows as ideological distance increases. At 0.2 units of ideological distance, which is near the smallest for which the marginal effect is significant, shared partisanship is associated with being 1.5 times likely to form a pair. At 0.9 units, shared partisanship correlates with a 2.7 times greater likelihood of pairing. This is a large effect, and the different levels show how ability conditions willingness to form pairs.

Table 1: The Conditional Effects of Shared Partisanship and Ideological Distance on Pair Formation

	Dependent variable:
	Pair Formation
Attendance (nodal)	-0.737***
	(0.132)
Leadership (nodal)	0.038 *
	(0.021)
Same Party (dyadic)	0.255
	(0.260)
Ideological Distance (dyadic)	−0.239
	(0.483)
Party x Ideological Distance (dyadic)	0.896**
	(0.264)
Seniority (nodal)	0.002
	(0.036)
Intercept	0.175 ***
	(0.036)
Variance Parameters	
va	0.062
	(0.01)
ve	1.000
	(0.00)
n	3500
Note:	*p<0.1; **p<0.05; ***p<0.01

Table entries are AME coefficients with standard errors in parentheses.

We observe similar results by looking at the marginal effect of ideology at different values of the moderating variable of shared partisanship. When partisanship is set at zero, the effect of increasing ideological distance is -0.230 [-1.390, 0.990]. The marginal effect is negative and insignificant. When members do not have the same partisanship, ideological distance plays no role. The cost of cooperating with a member of the opposite party are too high, regardless of the ideological predilictions of the member. However, when senators share partisanship, they are more likely to form more pairs as ideological distance increases. This marginal effect is 0.666 [0.588, 0.753], large and statistically distinguishable from zero. Substantively, this effect indicates a member is almost twice as likely to form pairs (1.95 times as likely) with one unit of ideological distance.

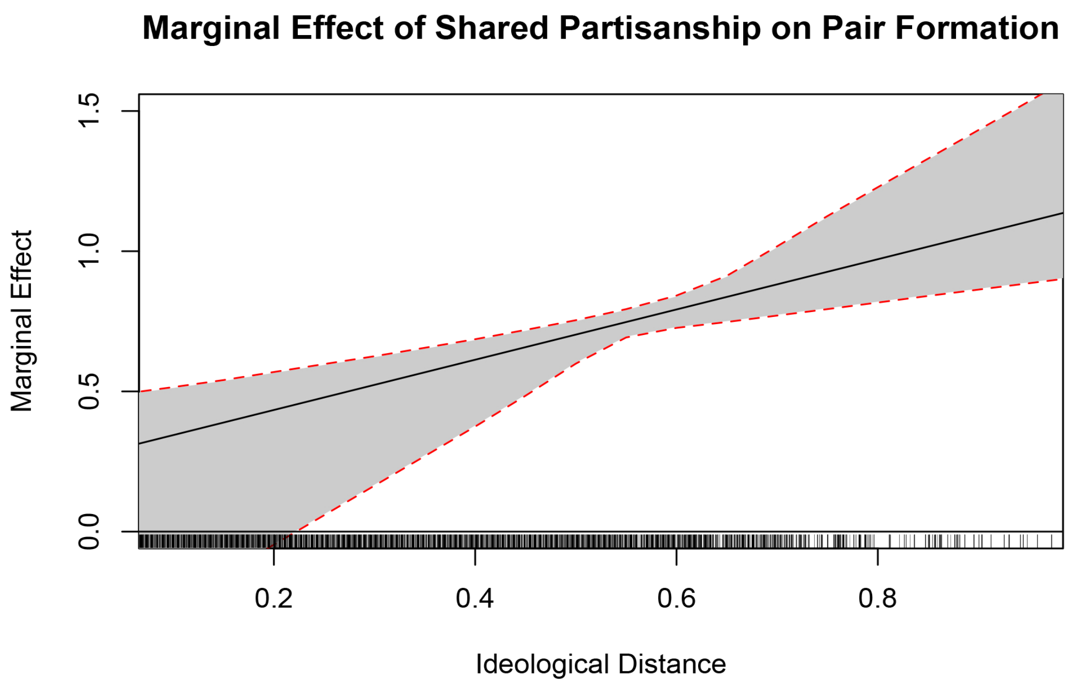

Figure 4: This plot shows the marginal effect of party at different levels of ideological distance. The rug at the bottom indicates the level of ideological distance between copartisans throughout the dataset.

Congress-Level Analysis

I now turn to Congress-level models to understand what factors affect the amount of pairing activity in the institution as a whole. Because the data generating process differs for the formation of pairs by party and for cross partisan pairs, I model each of them separately. Table 4.2 shows the model that estimates the number of pairs between two Democrats, Table 4.3 between two Republicans, and Table 4.4 between two members of the opposite party. In all three models, an increase in the amount of absences in a session is associated with a greater number of pairs. Accordingly, a decrease in the amount of absences, as was seen over time period under analysis, would be associated with a decrease in pairs between partisans. While election years and party size did not have a discernible effect, in both cases the number of pairs increased when parties were more ideologically heterogeneous. The opportunity for pairs, in the form of the amount of copartisans voting against each other, increases the number of pairs. Additionally, in both parties, the identity of the party leader often has a statistically distinguishable effect on the number of pairs, which supports the idea that pairing is influenced in part by leader strategy.

The model analyzing cross-party pairs also shows a mix of the practical and the political. Similar to the partisan counterparts, there are more pairs when more members are absent. While senators may prefer to pair within their party, they still might turn to the other party when they must be absent. However, the model also shows that fewer cross-party pairs occur when it is politically costly. When the two parties are further apart ideologically, there are fewer cross party pairs. Similarly, during election years and when there are smaller majority parties, there are fewer cross party pairs. Senators do not want to excuse the absence of a member of a different party and thus help him in an election that might determine the majority party, especially when the parties diverge ideologically.

Table 2: A negative binomial model predicting the number of pairs in a given year between two Democratic senators.

	Dependent variable:
	Democratic Pairs
Absence Rate	5.592**
	(2.697)
Number of Democrats	0.001
	(0.022)
Standard Deviation of Democratic NOMINATE Scores	21.721***
	(6.536)
Election Year	0.143
	(0.203)
McFarland	2.357***
	(0.843)
Johnson	3.132***
	(0.813)
Mansfield	3.770***
	(0.774)
Byrd	3.321***
	(0.604)
Mitchell	3.298***
	(0.694)
Daschle	1.007
	(0.781)
Total Roll Calls	0.002**
	(0.001)
Constant	−4.570***
	(0.983)
Observations	64
Log Likelihood	−223.849
θ	3.718*** (0.927)
Akaike Inf. Crit.	471.699
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 3: A negative binomial model predicting the number of pairs in a given year between two Republican senators.

	Dependent variable:
	Republican Pairs
Absence Rate	21.474***
	(7.810)
Number of Republican Senators	0.048
	(0.030)
Standard Deviation of Republican NOMINATE Scores	32.512***
	(12.496)
Election Year	−0.204
	(0.305)
Bridges	0.839
	(2.059)
Knowland	2.119
	(1.632)
Dirksen	2.274
	(1.658)
Scott	2.066
	(1.535)
Baker	1.711
	(1.184)
Dole	2.015***
	(0.780)
Lott	0.809
	(0.959)
Frist	−0.354
	(1.188)
Total Roll Calls	−0.002
	(0.002)
Constant	−8.263***
	(2.930)
Observations	64
Log Likelihood	−218.336
θ	2.339*** (0.549)
Akaike Inf. Crit.	464.673
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4: A negative binomial model predicting the number of pairs in a given year between two senators of different parties.

	Dependent variable:
	Cross-Party Pairs
Absence Rate	18.658***
	(2.325)
Majority Size	0.067**
	(0.030)
Polarization	−14.333***
	(3.381)
Election Year	−0.659**
	(0.273)
Total Roll Calls	−0.002**
	(0.001)
Constant	6.347***
	(2.031)
Observations	64
Log Likelihood	−208.782
θ	1.461*** (0.352)
Akaike Inf. Crit.	429.563
Note:	*p<0.1; **p<0.05; ***p<0.01

Norms and Partisanship

One factor unexplored in the preceding analysis is the changing role of norms in the Senate. While the Senate was once considered an inward-focused, clubby body with practices supported by norms, the rise of partisanship has meant that many old norms are no longer observed (Rohde, Ornstein, and Peabody 1985). Paired voting could be considered to be a manifestation of the reciprocity norm that senators ought to do favors for each other when they can, and keep their word once a bargain has been struck.[8] In this understanding, the decline in paired voting is caused by the shift towards individualism in the Senate that limited the benefit that norms could provide (Sinclair 1989). I have chosen to emphasize the changing context of the institution, and argue that this focus offers a more direct account of the disappearance of paired voting. If paired voting was reinforced norm, then this analysis highlights how norms can dissolve when the circumstances under which they could prosper change. Any norm of pairing was upheld by the context of widespread absences in the Senate and had a partisan dimension that was only possible through heterogeneous pairing. Changes in those factors led to the decline of the norm and the disappearance of the practice.

Discussion and Conclusion

In this paper, I explored contextual explanations expectations both about why pairs occur and why they would decline. Pairing is both a functional and political process. An individual members' congressional attendance rate is associated with their pairing behavior. While I do not disaggregate between various explanations for increased attendance, be it technological advancement in travel or various electoral pressures. Any explanation reveals the same trend: Senators are showing up for votes and do not need to accommodate their absence. However, pairing is not solely a relic of a time when members had less incentive or ability to

[8]Indeed, There are several cases throughout Senate history where members keep to their pairing agreement even when reneging on the pair would allow a senator's side to win the vote. Senator Joe Biden, in 1986, tried to break his pair to sink the nomination of a Reagan-appointee Daniel Manion until Robert Byrd, himself an opponent of the nominee, counseled him against going back on his word.

attend. My results suggest that pairing had a strategic political dimension as well. Members formed pairs with their copartisans when opportunities were available, but were less likely to form pairs with opposite party members when it became politically costly.

These results provide scholars with some lessons for any understanding of congressional politics. Broad advances in scientific technology, while seemingly benign, alter the bounds of what members are capable of doing. The ease of physical presence can change what members do. The use of virtual meetings during the Covid-19 pandemic emphasizes this idea, as our understanding of what is meant by presence changes. Though it is beyond the scope of this paper, the House of Representatives experienced a similarly steep decline in paired voting. Because the contextual factors discussed above also weighed on the House, it is likely that the same changes explain paired voting behavior in that chamber. Further, though the substance of cast votes rightly undergird scholarly understandings of polarization, the type of vote that a member cast can also shed light on how political context can facilitate or constrain their behavior.

This paper does not, nor does it aim to, fully characterize pairing throughout congressional history. Several important questions remain for future research. The historical record suggests that the early days of pairing were a more bipartisan process. It thus becomes necessary to ask how political context weighed on those members and what was responsible for the shift of pairing to an overwhelmingly partisan process. Additionally, how did the emergence of party whips, and then party secretaries, as those responsible for organizing pairing influence Senate procedure? Tackling any one of these questions would require significant work, but scholars have not reached the end of what lessons can be learned from paired voting.

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Appendix

Pairing Data Collection

I contend that my method of data collection improves upon the list of pairs in the VoteView dataset. My process uncovers as many or more pairs than VoteView in 25 of the 33 congresses under study. There are additional reasons, though, to favor my data. First, I identified several instances where announced votes were errantly recorded as pairs and pairs were recorded as announced votes. Further, in no congress does VoteView report that the number of paired yeas match the number of paired nays, including one congress that reports nearly twice as many yeas as nays. This implies that the VoteView record inconsistently includes both sides of a pair and/or recorded votes that were not pairs as pairs. Assessments of my method by comparing it to hand-coding the Congressional Record in a few select congresses increases confidence that my method is exhaustive.

AME Specification and Description

In this section, I provide the full specification of the AME latent factor model, all of which comes from Minhas et al.,2018. The AME incorporates the following covariance structure into the systematic component of the GLM framework $\beta^T \boldsymbol{X}_{ij} + a_i + b_j + \epsilon + ij$, where $\beta^T \boldsymbol{X}_{ij}$

incorporates dyadic, sender, and receiver covariates. The covariance structure is given by

$$y_{ij} = \mu + e_{ij} \tag{1}$$

$$e_{ij} = a_i + b_j + \epsilon_{ij} \tag{2}$$

$$\{(a_1, b_1), ..., (a_n, b_n)\} \overset{iid}{\sim} \mathcal{N}(0, \Sigma_{ab}) \tag{3}$$

$$\{(\epsilon_{ij}, \epsilon_{ji}) : i \neq j\} \overset{iid}{\sim} \mathcal{N}(0, \Sigma_{\epsilon}), \text{ where} \tag{4}$$

$$\Sigma_{ab} = \begin{pmatrix} \sigma_a^2 & \sigma_{ab} \\ \sigma_{ab} & \sigma_b^2 \end{pmatrix} \tag{5}$$

$$\Sigma_{\epsilon} = \sigma_{\epsilon}^2 \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \tag{6}$$

Where μ is a baseline measure for the mean density of the network and e_{ij} is the residual variation. That variation then decomposes into a row effect (a_i), a column effect (b_j), and a within-dyad effect (ϵ_{ij}). The row and column effects are modeled jointly to account for correlation in sending and receiving ties. Row and column mean heterogeneity is captured by σ_a^2 and σ_b^2 respectively, while σ_{ab} is the linear relationship between the two. Second order dependencies are described by σ_{ϵ}^2 and the within dyad correlation ρ.

The model also handles third order dependencies that often plague networks. An example of a third order dependency is triadic closure. If member A forms a tie with member B, and member C forms a tie with member B, that may impact the probability of a tie forming between A and C. This is done with a multiplicative effects latent variable extension that incorporates higher order dependencies after accounting for the covariates in the model.

$$y_{ij} = g(\theta_{ij}) \tag{7}$$

$$\theta_{ij} = \beta^T \boldsymbol{X}_{ij} + e_{ij} \tag{8}$$

$$e_{ij} = a_i + b_j + \epsilon_{ij} + \alpha(\boldsymbol{u}_i, \boldsymbol{v}_j), \text{ where} \tag{9}$$

$$\alpha(\boldsymbol{u}_i, \boldsymbol{v}_j) = \boldsymbol{u}_i^T \boldsymbol{D} \boldsymbol{v}_j = \sum_{k \in K} d_k u_{ik} v_{jk} \tag{10}$$

With this structure, the observations are independent conditional given θ, where θ depends on unobserved random effects $a_+ b_j + \epsilon_{ij}$, which are modeled to capture the effect of the first and second order dependencies discussed above. The multiplicative effects, $\boldsymbol{u}_i^T \boldsymbol{D} \boldsymbol{v}_j$ capture higher order dependence patterns in θ after accounting for known covariate information (Minhas et al., 2018).

ERGM and TERGM Specification and Modeling

In the following section of the appendix, I discuss some potential issues with the data and their solutions, as well as exploring some alternative modeling strategies. I begin by detailing an alternative model to deal with network data as a robustness check for the model presented in the paper, the exponential random graph model. The ERGM is the canonical model for the inferential analysis of network data (Cranmer and Desmarias 2017). It treats the network, as the adjacency matrix, as a single draw from a multivariate distribution. It is a probability model that estimates the probability of determining a dyadic tie Y according to the formula

$$P(Y) = \frac{\exp(\sum_{j=1}^{k} \theta_j h_j(Y))}{\sum_{Y^* \in \mathcal{Y}} \exp(\sum_{j=1}^{k} \theta_j h_j(Y^*))}$$

Where $\mathcal{Y}$ is the set of all networks with the same number of nodes as Y and contains every permutation of edges within the network, h_j are statistics theorized to influence the likelihood of observing the specific configuration of the adjacency matrix, and θ are parameters that give the effect of the network statistic on observing a particular instance of the matrix (Desmarias and Cranmer 2012; Cranmer and Desmarias 2017). Thus the θ act similar to regression coefficients that model the effect of a network statistic on observing a network. h_j can also take exogenous covariates as well as network statistics. All statistics, then, are sums over subgraphs and give you the influence of covariates and network level statistics in observing the particular realization of the network that is the data. The Temporal Exponential Random Graph Model (TERGM) is an extension of the ERGM that models a series of networks over time by including lagged networks as statistics in h_j, and so can include temporal dependencies as well as those across space (Leifield, Cranmer, and Desmarias 2018). TERGMs do not weight strength of the edges by number of pairs, and so one assumption underlying this modeling strategy is that one pair is sufficient to establish a paired voting relationship and that additional explanatory purchase would not be gained by incorporating the frequency of pairs between members.

ERGMs and TERGMs handle covariates in a different way than the typical regression framework. The coefficients on the covariates represent the change in the log-odds of observing a link between nodes with some covariate value, similar to logistic regression. However, because this model is concerned with the relation as the unit of analysis rather than the individual, there are several different ways to think about how covariates might relate to each other that must be taken into account when specifying the model. The first is 'match', which takes on a value of one if the covariates are the same between two observations, and zero otherwise. I use match to model party, and expect the coefficient to be positive, indicating that pairs are more likely to form among copartisans. The second way is to use the absolute value of the difference between the value of covariates, and so a negative coefficient would show that more similar members on that dimension are more likely to form a tie and a positive would mean the opposite. I use absolute difference to model ideology and expect this to be positive, indicating that ideologically dissimilar members are pairing with each other. Additionally, a researcher can just model individual level nodal covariates if they believe that the singular characteristic, and not the relationship between actors, is driving the effect of the covariate. I model leadership status, southern status, and attendance as nodal covariates. Leadership and south are both indicator variables coded 1 if the member is in party leadership in that year or from Missouri, Oklahoma, and any state formerly in the Confederacy, respectively. Attendance is a variable gathered from Congressional Quarterly's annual voting scores of the proportion of votes the member took a position on. TERGMs allow researchers to model endogenous network characteristics to get a sense of how probable the observed network, given the set of all possible networks with those characteristics. I add a covariate for the geographically weighted edgewise shared partners, which controls for triadic closure by at least one shared partner. TERGMs also incorporate temporal characteristics of network strucutre and so I include an autoregressive memory term, as I expect institutional memory to create similarly structured networks on a year to year basis.

In Table A1, I first present the results of a bootstrapped temporal exponential random graph model (TERGM) that allows me to pool the networks across time.

Table A1: TERGM for Paired Voting Network, 1951-1985

	Estimate	2.5%	97.5%
Edges	-4.981	-5.422	-4.633
Party (Match)	1.471	1.299	1.724
Ideology (Difference)	1.091	0.863	1.275
Attendance	-0.009	-0.016	-0.001
South	-0.046	-0.130	0.044
Leadership	0.223	0.147	0.290
Seniority	0.008	0.004	0.012
GWESP	0.429	0.369	0.494
Memory	0.957	0.818	1.131

TERGM coefficients are difficult to interpret because, much like logistic regressions, the magnitude of a one-unit shift in one covariate is dependent on the values of the other variables. I will thus interpret changes under specified assumptions about the other variables. The `Edges` term is akin to an intercept, it controls for the density of a network. If we knew nothing about a network at all, the probability of any two nodes forming a tie would be equal to the network density. From this coefficient, we can find the probability of any two members pairing is .007. I will now shift to interpreting each coefficient in terms of predicted probabilities.

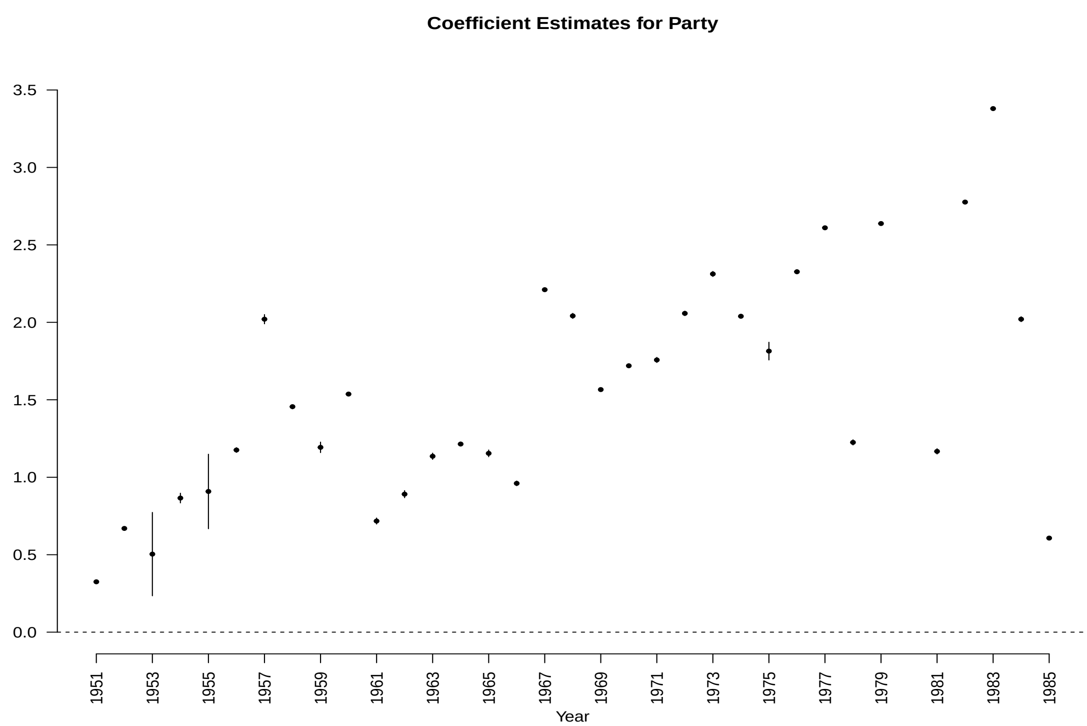
The probability of a member who is not a leader, not from the south, with five years in the Senate and with an attendance rate of 90% forming a tie with someone who is .5 units away ideologically, but not a member of their party is 0.012, whereas with an identical pair who are copartisans, the probability is .051, a fourfold increase. Similarly, if we take our non-south, rank and file, moderately senior copartisan with 90% attendance, the probability that they pair with someone .1 ideological units away versus .8 is .033 and .069 respectively, a probability that is twice as large with some ideological distance. From this, we see clear evidence that paired voting relationships are more likely to occur between members of the same party and members who are ideologically dissimiliar, implying that this is a function of heterogeneous parties.

There are smaller, but still statistically distinguishable effects for seniority, attendance and leadership. Taking the member described in the first scenario, with a copartisan pair, with a one year tenure, the probability of them forming a pair is .049, while with ten years, the probability goes up to 0.053. The effect of attendance is minescule, if we vary that member's attendance record from 90% to 50%, the probability that they form a pair increases from 0.0506 to 0.0507. Finally, if we make the member a leader, their probability of forming a paired voting relationship goes from 0.051 to 0.062, a modest increase.

The two final terms in the model correspond to network structure and temporal dependency in the model. While unrelated to the main argument made in this paper, I will briefly describe the effects. The geometrically weighted edgewise shared partners term (GWESP) indicates that the network structure is more likely to have triadic closure, which is to say that when member A pairs with member B, and member B pairs with member C, we often observe member C pairing with member A. The memory term accounts for autoregression in the temporal domain, indicating that the network structure is similar from one year to the next.

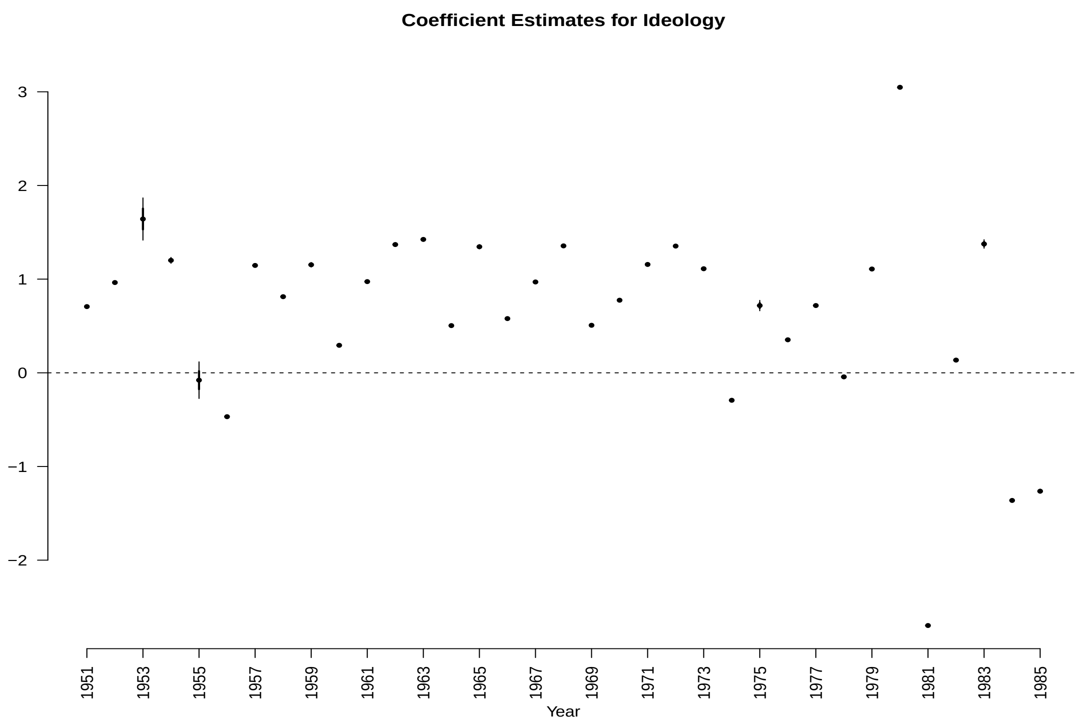
These grouped coefficients mask some important variation in the effect of the variables across time that are important for understanding the evolution of the role of party and ideology in constructing these relationships. In Figures A1 and A2, I present coefficient plots from individual year ERGMs for party and ideology.[9]

Figure A1: Single Year ERGM Coefficient Plots for Party



[9]The coefficient for 1982 is not shown on the figure because it was so high (19.42), as there were no cross-party pairs in this year.

Figure A2: Single Year ERGM Coefficient Plots for Ideological Difference



In these figures, we can see that the effect of sharing partisanship was generally larger throughout the 1970s and 1980s, indicating an increased preference for same party pairs. The effect of ideology is relatively stagnant over this period, until the final years in the dataset, where there is a decline, with some coefficients even being negative. I argue that this is due to ideologically sorting parties, making it unsustainable for members to have pairs that are both within party and with ideologically distant members. These results broadly support the conclusions in the paper that pairs were more likely between copartisans and those who are ideologically different.

AME Alternative Specification

In Table A2, I present the results of the AME model that takes instead as the dependent variable a dichotomous edge value for any pairs between two members. The interaction in the model can be interpreted in the same way as a typical probit interaction. As such, the coefficients on the constituent parts of the interaction cannot be interpreted as unconditional marginal effects (Brambor et al. 2006). The interaction is large, positive, and significant, and so I can interpret the variables of interest with regard to the interaction.

Table A2: Additive and Multiplicative Effects Latent Factor Model on Pair Formation

	Dependent variable:
	Pair Formation
Same Party (dyadic)	−0.018
	(0.133)
Ideological Distance (dyadic)	−0.422
	(0.306)
Party *x* Ideological Distance (dyadic)	1.264***
	(0.264)
Seniority (nodal)	0.002 **
	(0.001)
Attendance (nodal)	-0.828***
	(0.088)
South (nodal)	−0.135***
	(0.042)
Leadership (nodal)	0.033
	(0.023)
Intercept	− 0.641 ***
	(0.057)
Variance Parameters	
va	0.215
	(0.024)
ve	1.000
	(0.00)
Note:	*p<0.1; **p<0.05; ***p<0.01

Main Variable	Moderater	Moderater Value	Marginal Effect	Odds Ratio
Same Party	Ideological Difference	0.1	0.108 [0.060, 0.142]	1.11
Same Party	Ideological Difference	0.3	0.360 [0.331, 0.390]	1.43
Ideological Difference	Same Party	0	-0.422 [-0.591, -0.334]	0.656
Ideological Difference	Same Party	1	0.842 [0.758, 0.928]	2.321

The marginal effect of a variable is the partial derivative with respect the variable of interest. Thus, the marginal effect of being in the same party on tie formation between two members is equal to the coefficient of party plus the coefficient of the interaction multiplied by the value of the moderating variable, ideological distance. In Table A3, I present the marginal effects of the party and ideological distance variables at different values of the moderating variable. As ideological distance increases, the impact of being in the same party on the probability of forming a tie increases. More interesting are the divergent results of the marginal effect of ideology. For members who are not copartisans, an increase in ideological distance reduces the odds that they will form a tie, whereas for members who are copartisans. These results all support the view that pairing largely occurred among heterogeneous copartisans. In substantive terms, at 0.1 units of ideological distance, being a member of the same party is associated with being about 1.11 times as likely to form a pair. At 0.3 units of ideological distance, being a member of the same party makes one 1.43 times as likely to pair. On the other side, one unit of ideological distance, which is a very wide gulf and somewhat unrealistic within party, relates to a member being over twice as likely to form a pair with a copartisan and only about 66% as likely to form a pair with an out party member. These results replicate the ones presented in the main text of the paper and show that the results are robust to different modeling choices.