A Bridge Too Far?:
Examining Bridging Assumptions in Common-Space Estimations

Thomas R. Gray
School of Economic, Political and Policy Sciences
University of Texas at Dallas
thomas.gray1@utdallas.edu

Jeffery A. Jenkins
Price School of Public Policy
University of Southern California
jajenkins@usc.edu

While most common-space estimations rely upon members who served in both the House and Senate as "bridges" to scale the remaining members, this assumes that these "bridge members" do not change their preferences when they change chambers. Such an assumption conflicts with standard notions of representation, that is, that legislators' votes reflect (at least to some degree) the wishes of their constituents. We examine the constancy of this common-space voting assumption by focusing on a subset of House members who move to the Senate: those who come from statewide House districts. Using these members as the bridge actors – and thus bridging by constituency explicitly – in a one-dimensional IRT model, we find that the standard assumption of chamber-switchers in common-space estimations is technically, but immaterially, false. While there are statistically distinguishable differences in House and Senate voting records for chamber switchers, they are not sufficiently large to meaningfully undermine bridging.

The typical member of the House of Representatives has about three quarters of a million constituents. The numbers are quite different for U.S. Senators, who average over six million constituents, almost double the total number of Americans counted in the first U.S. Census (Wright 1900). A relatively common occurrence is that a member from a small, concentrated House district gets elected to serve in the Senate, and as a result represents a vastly larger and more varied constituency. For example, both of the current Senators from New York, Chuck Schumer and Kirsten Gillibrand, represented distinct (and somewhat atypical) parts of New York in the House before going on to represent the whole state later in their careers.

This particular recurring pattern – dating back centuries – has proven itself important in the modern literature on congressional roll-call voting. It is through this act of serving in both chambers that "Common Space" scores have been developed (see Poole 1998; 2005). Senators like Schumer and Gillibrand serve as "bridging observations" to place both chambers onto a single (common) scale. The key assumption in this bridging technique is to assume constancy of preferences, that is, members who serve in both chambers, like Schumer and Gillibrand, are assumed to have the same preferences in both the House and Senate.

This is obviously a strong assumption. We believe the substantive implications of the technical cross-chamber identifying assumption have been under developed, and the question of whether the assumption is true is an unanswered empirical question. We offer a partial answer by looking at a smaller set of bridging observations – those legislators who moved from the House to the Senate but who had served in statewide districts in the House. These members did not face different geographic constituencies, but did shift chambers. By bridging on only these actors, we are able to break up the remaining bridging observations into two chamber-specific versions and

estimate a unique ideal point for each. In doing so, we can assess how much their voting behavior changed after moving to the Senate.

We find little evidence of substantial shifts. The typical multi-chamber member shifts about one quarter of a standard deviation upon moving to the Senate, though there are no discernable patterns toward extremity or moderation. The direction and magnitude of these shifts also remain relatively consistent across time. While we find a few anecdotal cases of significant movement when switching chambers, these are atypical. These results suggest that existing assumptions of bridging-actor constancy are technically false but also largely immaterial. More specifically, existing methods are likely not substantially biased by relying on multi-chamber bridging observations.

Ideal Points: Theory-Driven Measurements

"Ideal-point estimation" is often associated with statistical procedures for uncovering latent variables from observed choices. Yet, as the name indicates, ideal-point estimation actually refers to the statistical estimation of an element of spatial models of voting. These spatial models underlie numerous popular statistical estimation techniques such as Poole and Rosenthal's (1997; 2007) NOMINATE scores and IRT-based measures such as those by, Jackman (2001), Martin and Quinn (2002), and Clinton, Jackman, and Rivers (2004). Within the spatial model, each voting member has a utility function for the satisfaction they derive from the locations of policy, and an "ideal point" at the location of maximum utility. Thus, ideal-point estimation techniques are specifically intended to apply a formal theoretical model of voting to a set of observed votes and estimate the ideal point of each voting member.

The underlying theoretical model of voting, in its simple form, is silent on the generation of ideal points, treating them as exogenous to the model. Any number of factors may influence

why a legislator wants certain outcomes over others and ultimately how they vote: their own personal preferences, but also the preferences of their geographic constituency, campaign donors, party leaders, and social groups. The relative weight of these is unknown and why a legislator ultimately votes for a particular outcome is "black boxed." The spatial theory of voting only explains the casting of the vote conditional on some final set of preferences existing with certain classical characteristics such as single-peakedness.

That is the underlying substantive component of these statistical techniques. From there, certain additional features of the data-generating process are assumed in order to achieve statistical estimation. One is an assumption of constancy. That is, members of Congress are often assumed to be unchanging throughout their legislative careers. Where change is allowed – such as in Martin and Quinn's (2002) "dynamic" IRT estimation or Poole and Rosenthal's (2007) DW-NOMINATE procedure – the nature and amount of that change is structured by researcher choices in the model specification. The extent to which actors change is thus a subject of assumptions on top of the typically one-shot spatial model of voting.

This assumption of constancy has been crucial in the construction of "common space" scores, or a single set of comparable ideal-points for both representatives and senators across time (see, e.g., Poole 1998). The common-space estimation relies upon those legislators who have served in both the House and Senate, and are assumed to be the "same versions of themselves" in each chamber. With the assumption that their preferences remain constant, it is then possible to bridge legislators who served in only one chamber together onto a single, identified scale. This assumption is very useful and convenient for those who would like to generate comparable preference estimates for both chambers. The resulting scores can then be employed in testing theories about a range of political phenomena more aggregated than within-

chamber voting, such as pivot-based theories of legislative productivity (Krehbiel 1998; Woon and Cook 2015; Gray and Jenkins 2017; 2019).

More broadly, the assumption of member ideological consistency, if not constancy, has been a key belief and finding in the work of Keith Poole, one of the most essential figures in the history of Congressional ideal-point estimation. Poole (2007) has claimed that members "die in their ideological boots." More importantly for our question, he (with Rosenthal) has also argued that "representatives not only die in their ideological boots, but they do not change them when they run for the Senate" (2007, p. 100).

This assumption carries a considerable amount of substantive baggage, however. It requires a very specific answer to the question of "why do members vote as they do?" It assumes a certain process for generating ideal points in the underlying spatial model. Specifically, it is a strong assumption about the nature of representation. In the real world, to retain their position in the face of regular elections, members must hew (at least to some degree) to what their constituents want. By assuming that members' underlying preferences do not change when they move from the House to the Senate, however, Poole and his coauthors treat this representational element as negligible.

All constituencies change, of course. Each day, some number of people move into or out of a district or state, while others die or are born (or age into voting eligibility). And even within individuals, opinions and preferences change and respond to new information. Yet these shifts are typically very gradual. A much more dramatic change in constituency can occur when moving from a House district to a statewide Senate seat. Rather than marginal change in the composition of the constituency or the preferences of constant members, a would-be Senator is

often adding millions of extra constituents. The typical House seat is much smaller, more homogenous, and more ideologically extreme than a state as a whole.

Consider the two senators from New York in the 116th Congress: Chuck Schumer and Kristin Gillibrand.[1] At the end of his time in the House of Representatives in 1999, Schumer represented New York's 9th district, which straddled the border of the southern portions of the Brooklyn and Queens boroughs of New York City. In the preceding presidential election (1996), his district had given 66% of its vote to Bill Clinton. This was a moderate amount more than New York as a state had – about 59.5%. Schumer went from representing a compact urban district of several hundred thousand people in just a few dozen square miles to a state of 20 million people with a vast array of interests, industries, and preferences that he had not represented in his time in Brooklyn and Queens.

In her time in the House, Gillibrand represented New York's 20th district, on the state's eastern border encircling Albany, including chunks of the rural Catskill mountain region and some extended Albany suburbs. In the preceding presidential election (2008), her district had voted for eventual president Barack Obama 51-46, but had voted twice for both George W. Bush and Bill Clinton in the four preceding elections. Even President Obama's 51% represented considerably less than the 63% he earned in New York as a whole in 2008. Gillibrand moved from a moderate swing rural/suburban district to the same state of 20 million, whose median voter was reliably liberal.

[1] The details in the summaries of Schumer and Gillibrand are taken from a combination of sources: their congressional webpages, historical maps of Congressional districts provided by the UCLA Congressional Districts Shapefiles repository of Lewis et al. (2013), and Wikipedia and Ballotpedia summaries of historical Congressional districts.

Schumer and Gillibrand each exemplify that moving from the House to the Senate involves a substantial change in constituency. Gillibrand suddenly became the representative of many millions of New York City residents with a set of political preferences considerably different from those of her prior constituency. Schumer suddenly added millions of more rural "upstate" citizens to the list of those he represented, with a variety of interests he may not have previously been attached to. If some part of the voting calculation is based on picking the policies desired by, or in the best interests of, those who elected you, then we should expect that both Gillibrand and Schumer had reason to alter their voting behavior as they shifted from the House to the Senate.

Gillibrand especially had substantial movement from the median voter in the 20th district to the median voter in New York as a whole. And there is anecdotal and rhetorical evidence that she has suitably changed, moving from a "moderate" representative of a "purple" district to being one of the fiercest opponents of President Trump in the first two years of his presidency. In the clearest example, Gillibrand went from an "A" rating with the National Rifle Association (NRA) as a rural moderate Democrat to an "F" rating after moving to the Senate.[2] While this is often seen as a sign of her presidential ambitions, it also fits the idea of better matching her new statewide constituency.[3]

Yet, our technical identification assumptions in the typical common-space estimation require that Gillibrand has the same vote preferences in the 116th Congress that she had in the 110th when she served in the House. Similarly, we must assume that Schumer's preferences

[2] Her positional shifts were noted in a 2013 article in the *Atlantic*, which includes the NRA anecdote, among others (Terris 2013).
[3] As of August 2019, Gillibrand had declared herself for president on a strongly progressive platform. *See* https://2020.kirstengillibrand.com/

representing Queens and Brooklyn are identical to the preferences he has now when representing all New Yorkers. In short, we must assume that the impact of adding 19 million extra constituents was sufficiently negligible that we can assume it to be zero.

It is certainly plausible that the voters of New York picked Schumer and Gillibrand based on who they were and expected them to stay that way, regardless of the voters' own preferences. Perhaps the sole driver of voting in the Senate is a senator's own individual preference on a given policy question, and voters simply delegate to them the ability to make choices. This delegation does not require fidelity to district preferences. But this is a claim that should be interrogated and tested.

We attempt to do this by altering the key common-space assumption. Instead of assuming that legislators remain the same when they switch chambers, we instead rely on a special category of House members who moved to the Senate: those coming from statewide districts. This includes those members from states such as Wyoming, whose single House district includes the whole state. It also includes states that used "General Ticket" or "At-Large" voting, picking representatives based on statewide elections.[4] These election types occurred with some frequency up until the middle of the 20th century, when "One Person, One Vote" judicial victories led to greater standardization in House elections.[5]

Members in this special category do not face the sudden shifts in constituencies that other members who switch from the House to the Senate do. We use this smaller group as our set of

[4] "General Ticket" represents those systems in which an entire state's delegation was selected in a single statewide election. "At-Large" represents sub-systems within a state that selected one or more members by statewide election, while all other members in the state were selected via single-district elections. See Martis (1989, 6-7).

[5] The last At-Large district in the House was in the 89th Congress (1965-67), while the last General-Ticket district was in the 91st Congress (1969-71).

bridging actors, allowing members who served in non-statewide House districts as well as the Senate to be estimated as two distinct actors: their House version and their Senate version. We can then estimate the differences in revealed preferences across the chambers.

Estimation

We estimate a one-dimensional Item Response Theory (IRT) model similar to that of Clinton, Jackman, and Rivers (2004). This conventional "two-parameter" model features a "difficulty" and a "discrimination" parameter for each roll call, names owing to the educational-testing origins of the models. "Difficulty" pertains to the item curve's intercept and can be thought of as reflecting the inherent liberalness or conservativeness of the proposition put to vote. The "discrimination" parameter pertains to the item curve's slope and indicates how sharply the question divides respondents with higher and lower values of the latent dimension.

We measure a single latent dimension, which – in keeping with the conventions of the literature – we call "ideology," with poles at liberalism (negative) and conservatism (positive). The model is locally and globally identified with two assumptions: (1) the combined set of ideal points is normally distributed with a mean of zero and a variance of one, and (2) the average Democrat's score is negative, and the average Republican's score is positive, fixing the dimension to be increasing in conservatism.

We estimate the model using Imai, Lo, and Olmsted's (2016) `emIRT` R package, which approximates the results of the estimation methods used by Clinton, Jackman, and Rivers (2004) and others, but does so in a much shorter time period with large amounts of data. Instead of the Markov Chain Monte Carlo (MCMC) algorithm conventionally used to estimate Bayesian IRT models, Imai, Lo, and Olmsted use an Expectation-Maximization (EM) algorithm, which recovers very similar results in a fraction of the time.

We estimate this model on all non-lopsided roll call votes from both chambers of the 72nd through 116th Congresses (1931-2019).[6] We define "non-lopsided" as votes won with 97.5% or less of the recorded votes. In a modern, full-voting Senate, this would be roll calls with winning sides up to 97 votes, however in older senates and in cases of imperfect attendance, this number may vary.

We estimate a single, unchanging ideal point for all members with two exceptions. First, we drop all members (and their votes) who cast fewer than 200 total recorded votes in their congressional career starting from the 72nd Congress. Second, for all members who served in both the House and the Senate, and whose House district was not statewide, At-Large, or General Ticket, we estimate two separate versions of those members. For members who did come from statewide House districts, we leave them as a single person throughout their careers and they serve as the bridging observations between the chambers. In total, we estimate 4,100 ideal points for 3,894 members: 3,665 members who served only in the House or the Senate; 23 who served in both chambers with a constant statewide constituency, and finally 206 members who served in geographically subdivided House seats and statewide Senate service.[7] These final 206 are each estimated twice, once for their House career and once for their Senate career.

Twenty-three bridging observations is a significant reduction from the 229 we would have in the conventional model. But there is reason to believe this may not be a significant problem. Shor, Berry, and McCarty (2008; 2010) have done considerable work on the

[6] We begin with the 72nd Congress because it represents the best ratio of number of statewide-district bridging observations to the total number of Congresses evaluated. In terms of the 116th Congress, all votes through August 11, 2019 are included.

[7] In Appendix A, we list the 23 members who bridge on constant constituencies. This list is not exhaustive of all such members who also served in the Senate, as some were dropped due to too few votes – generally when their Senate service was as an appointed replacement at the end of a term.

requirements of bridging across institutions, exploring "pooling" versus "mapping" methods. Our approach is "pooling," estimating a single matrix of both chambers at once. This is appropriate given the substantial similarities between the two chambers. Shor, Berry, and McCarty find that effective bridging requires surprisingly few bridging observations.

We must also acknowledge that these bridging observations are neither chosen at random, nor willfully chosen to optimize their representativeness. To serve our purposes in investigating House and Senate differences, we selected those whose states and districts were the same. Yet, this does raise the possibility that the group of bridging observations is unusual in some way that might threaten the quality of the estimate. By definition, most are from rural, small-population states. However, reviewing these members, we find meaningful diversity in preferences, with handfuls of solidly liberal and solidly conservative members, as well as more moderate members. And while most are from rural states, the addition of At Large and General Ticket members from states such as Ohio and Illinois does provide members from different types of districts.

Our efforts to prune lopsided votes and members who took too few votes produces a 4100 X 48992 roll-call matrix where each value is either 1, 0, or -1. A "1" corresponds to all those who voted in favor of a proposition, including "paired" and "announced" votes, while a "-1" is for all those who voted against a proposition, again including paired and announced votes. Finally, a "0" designates that no vote was cast, either because the person was not a member of Congress at the time, abstained from voting, or through some other event missed the vote. In total, there are a total of 12,837,826 positive or negative votes in the dataset, with the remainder made up of "0"s corresponding to missing data.

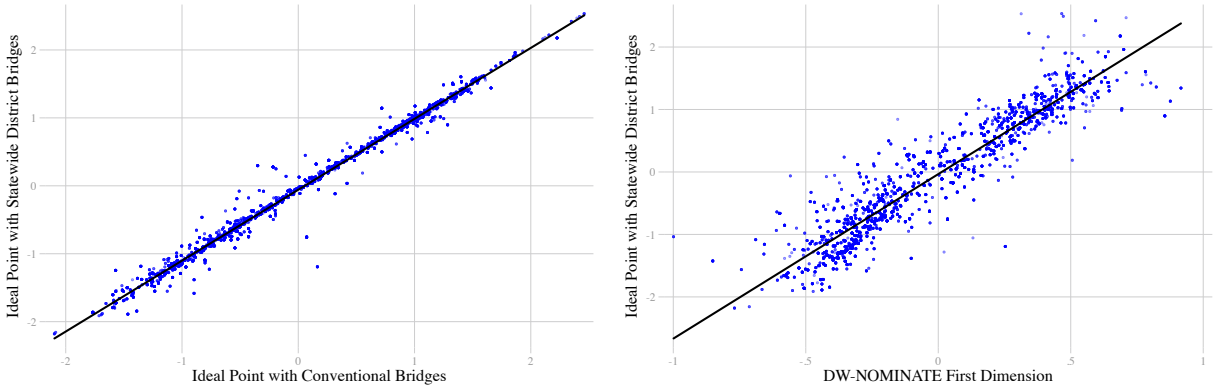
To improve the quality of our estimation, we took a number of pre-estimation steps to provide helpful starting values. First, we estimate each Congress-chamber individually using a one-dimensional IRT model and the EM algorithm. Then, we create Groseclose, Levitt, and Snyder (1999) [GLS] scores based on these 90 Congress-chamber scores. We use these as starting points for the algorithm in the overall estimation. GLS scores also allow us to estimate good starting values for the item parameters using a Bayesian probit model on all votes. In our ultimate IRT estimate for the full time period, we use standard-normal priors for members' ideal points and minimally informative (mean zero, high variance) priors for item parameters.

Results

Comparison of Conventional and Our Limited Bridging

An initial threshold of consideration is the impact of moving from 229 bridging observations to just 23. We compare the estimates in a model with the same votes, but holding all members who served in both chambers constant – what we call the "conventional" method – with our own method of "limited" bridging. Unsurprisingly, the two scores are highly correlated ($r = 0.992$) for those actors who served in only one of the two chambers. In Figure 1 (Left), we plot these paired ideal-point estimates for all non-bridging observations, with a fit line to show their substantial similarity. This match is not perfect: there appears to be a set of members slightly shifted in a more liberal direction in the bottom left quadrant, likely the result of less consistent bridging coverage in our limited model compared to the conventional approach. These differences are trivial for most possible uses of the estimates. In Figure 1 (Right), we also plot our scores against the First Dimension of DW-NOMINATE "Common Space" Scores, to show that the dimension we uncover is substantially the same as the canonical "First Dimension" used in most research in the Congress literature.

Figure 1. Comparison between Conventional- and Limited-Bridging Methods



As indicated in the section on estimation, we additionally bootstrap standard errors for all of the ideal-point estimates. Moving from the conventional to the limited bridging assumption, we find only a one-percent increase in the average standard error obtained through bootstrapping. Thus, we do not see any evidence that our estimates became substantially less certain by this shift. While there is a slight increase in uncertainty, it is not sufficient to deter us from using this approach, nor does it raise doubt about the quality of measurements we use in the rest of this article.

Do Members Who Shift Between House and Senate Change in their New Constituency?

Next, we consider our core research question: do members change when they move from the House to the Senate? Recall that the conventional bridging method assumes that members do not change. They maintain their ideal point and underlying ideological commitments exactly the same in the Senate as they had been in the House. In our analysis, we put that to the test by allowing most "bridgers" – those who shifted from a smaller district to a larger statewide electorate – to split into House and Senate versions of themselves.

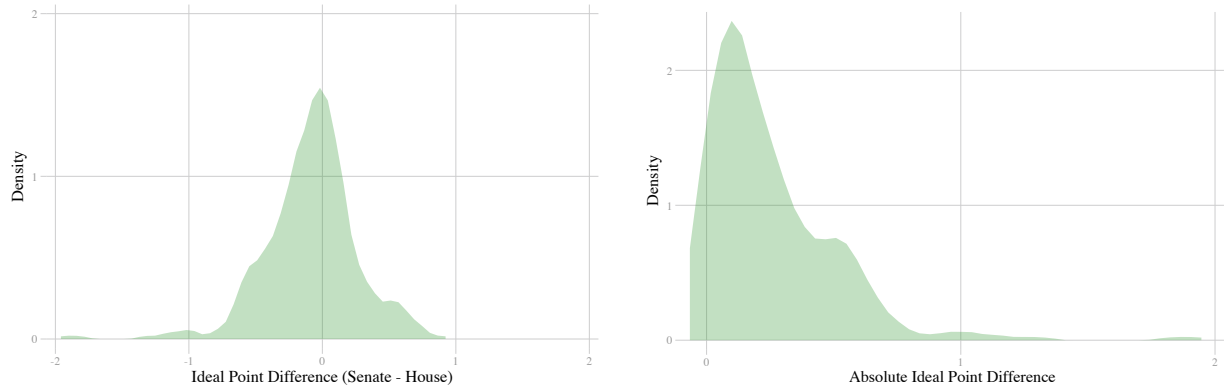
In short, we find that as a technical matter, the bridging assumption that undergirds Common Space scores – that members are constant across chambers – is false. This is

unsurprising, given the exacting nature of the assumption. More interestingly, we do not find considerable movement. The average member moves modestly – about one quarter of a standard deviation of the overall distribution of preferences. While in about 82% of cases, we are able to distinguish this from zero, this is largely because of the precision provided by members taking thousands of votes. In only a small number of cases do we find evidence of substantial ideological shifts between chambers.

In Figure 2, we plot the distribution of shifts (left) and the distribution of absolute shifts (right) between the two chambers. The average shift is slightly less than zero (-0.09), indicating that, on average, members shifted liberally more than conservatively upon entering the Senate. The average absolute shift is 0.25. Given that the entire range of values is normalized with a standard deviation of one, these shifts can be viewed in units of a standard deviation of the overall distribution of ideal points. Thus, the average member moved about one quarter of a standard deviation upon switching to the Senate.[8]

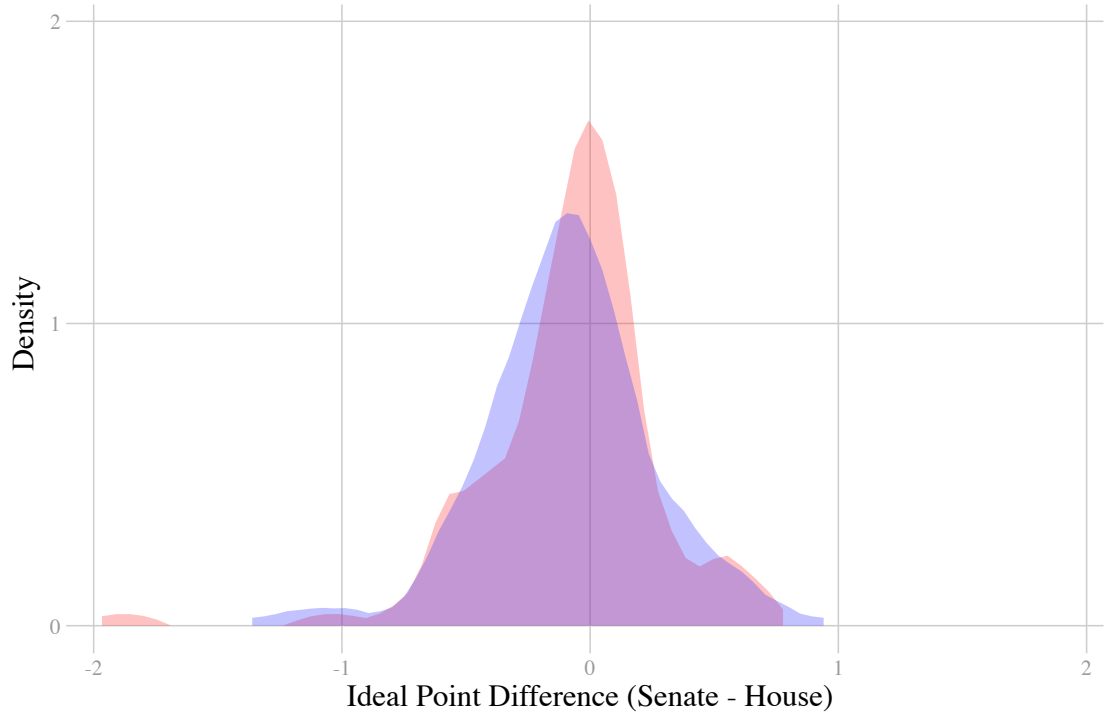
[8] For a comparison point, we separately analyzed the shifts of a small (18) set of House members with constant constituencies – single-district states – who never went on to serve in the Senate. These members shifted, on average, 0.43 standard deviations in absolute terms between the first and second halves of their House service. Thus, the size of the shift we uncover in bridging observations is entirely consistent with the amount of change we might expect from any member without moving chambers or constituencies.

Figure 2. Distribution of Shifts between Chambers



In Figure 3, we present the distribution of movement by party. Here, we see virtually no difference. Both Republicans and Democrats increase and decrease in conservatism moving from the House and Senate.

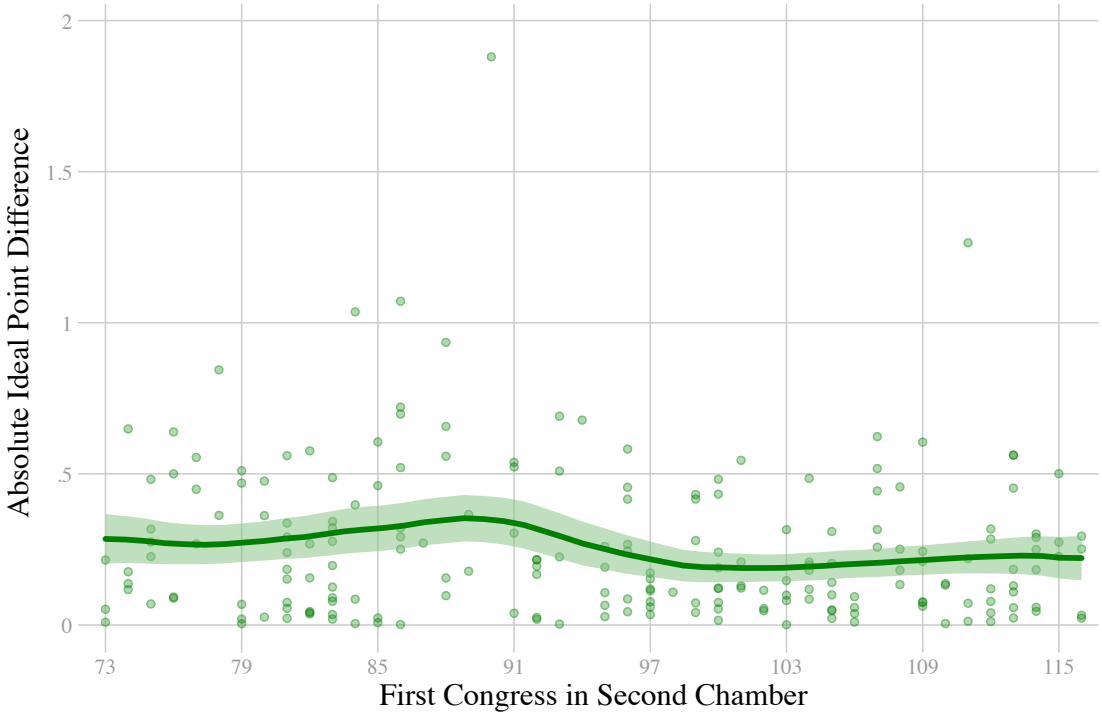
Figure 3. Distribution of Shifts between Chambers, by Party



Note: The red distribution represents Republicans, and the blue Democrats.

We consider also whether there have been over-time changes in the amount of shifting as members move from the House to the Senate. In Figure 4, we plot the absolute difference between the House and Senate scores against the member's first Congress in the second chamber – usually the Senate. While many of these careers stretched long before and after the Congress they switched in, this provides some estimate of the differences for each "switching cohort." On top of these individual data points, we have overlaid a local regression line. The results indicate a fairly stable level of movement across time, with a slightly higher level in the earlier years and a stable, slightly lower amount of movement in the later years. This slight difference appears to be owed to the lack of substantial shifts in the last several decades. Gillibrand is the only member to move by more than three quarters of a standard deviation since 1968. Between 1932 and 1968, it had occurred five times. Thus, modern shifts appear more consistently small.

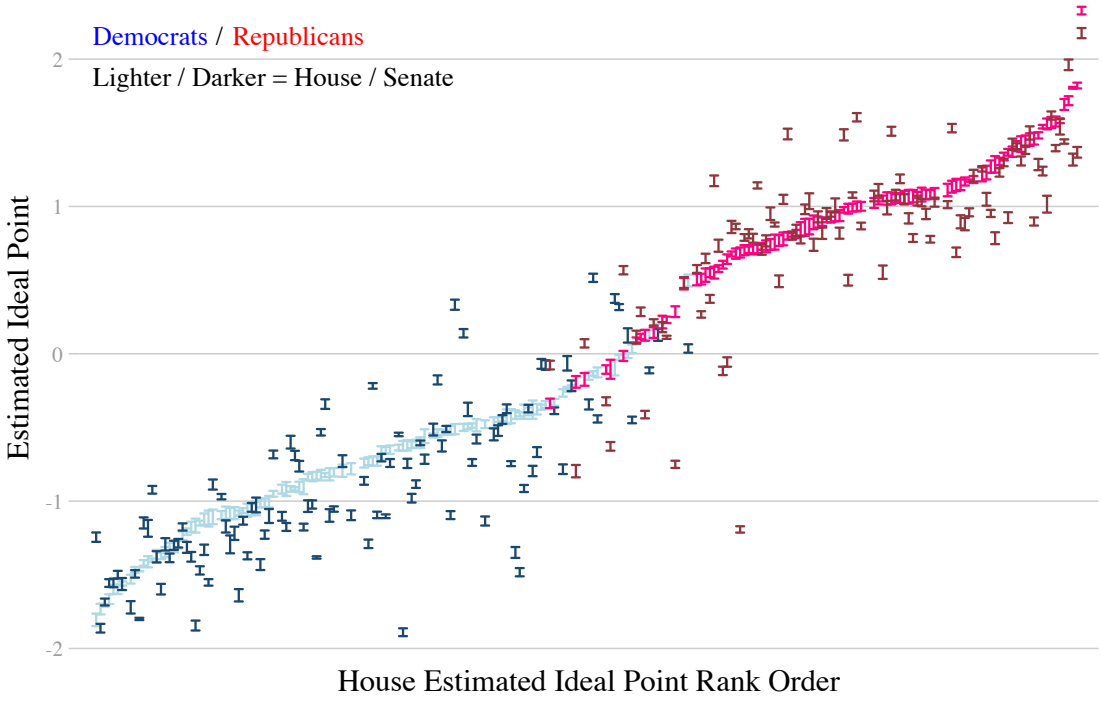
Figure 4. Average Shifts by Congress Cohort across Time



Note: The green line represents a localized polynomial regression with 95% confidence intervals surrounding.

Next, we analyze the results individually. In Figure 5, we plot, for each bridging member that we have split in two in our estimation, their House score and their Senate score in the same vertical space. Members are in a rank order of their House ideal point, while their Senate ideal points fluctuate above and below the monotonic line of House scores as members themselves changed in their shifts. Democrats are in blue hues and Republicans in red hues, while the darker hues represent Senate ideal points and lighter hues represent House ideal points. Because the confidence intervals are sufficiently small, we plot only the intervals rather than the dots themselves.

Figure 5. House and Senate Scores for Each "Split" Bridging Member



As indicated in our preceding discussion, most members' Senate records are distinguishable from their House records, but in most cases the shifts are not dramatic. There are several anecdotal cases where substantial shifts do occur. Kirsten Gillibrand, mentioned

previously, has the second largest shift, over a point in the liberal direction. She went from a center-left member of the House when representing her purple rural New York district to one of the most liberal members of the Senate.

The largest shift in our records was a somewhat similar story – and in the same state. Charles Goodell, father of the controversial current commissioner of the National Football League, Roger Goodell, served in the House from New York as a moderate Republican between 1959-1968.[9] After the assassination of Robert Kennedy (D-NY), Goodell was appointed by Republican Governor Nelson Rockefeller to finish Kennedy's remaining Senate term. Though it was not yet the Democratic bastion that it has become, New York had been more Democratic than the nation in the preceding two presidential elections (and would be for every one that has followed). Perhaps chasing very uncertain prospects of being elected to fill the seat permanently, Goodell's Senate behavior strongly reflects a leftward shift, well more than a point in our ideal-point scale, becoming a solidly left-of-center figure in his Senate years. As it was, this leftward movement was insufficient, as he was not ultimately elected to continue in the seat.[10]

The examples of Gillibrand and Goodell, two New York moderates while in the House chasing a state that was left of center by national standards, are notable because they are actually extreme and unusual based on our data. Most members do not show any such evidence of substantial shifts in voting behavior. There are slight differences. The bridging assumption does not technically hold, but its violation is, in most cases, immaterial.

[9] Poole (2007) also notes Goodell as a major ideological mover upon his switch to the Senate.
[10] Bump (2014) suggests that Goodell was derailed in his bid for a full Senate term by, among other things, running afoul of President Richard Nixon after becoming a vocal anti-war advocate. Conservative James Buckley won the Senate election in 1970 in a three-candidate race.

One possibility is that what we observe is simply some combination of noise and changing agendas, not underlying changes in preferences that have anything to do with constituencies. Our standard errors may underrate the uncertainty we should have in these IRT estimates and our "technically distinguishable but immaterially different" may simply be noise. To consider this further, and to better establish that there is some relationship between constituencies and the change, we test whether we can explain the amount and direction of movement. Ideally, we would have fine-grained measures of state and district-level ideological preferences. For House districts, going back to the 72nd Congress, this is quite difficult. We use partisanship as a stand-in for ideological preferences, taking on the problems inherent in that choice.

We estimate a linear model with the absolute difference between Senate and House ideal points serving as the dependent variable. The model includes four covariates. First, we include the party of each member, which takes the form of **Republican**, with Democrats becoming the base category. Second, we include **Democratic Presidential Advantage**, which is the Democratic candidate's two-party vote share in the member's state relative to the national Democratic vote share. Thus, if the Democratic candidate won by 10 points in a state, but only won by five points nationally, the state is marked as five points more democratic. We average these over the three presidential elections preceding a member's shift from the House to the Senate. We then include an interaction of the two variables. Finally, we also add a time trend to account for changes over time in the magnitude of shifts.

The logic of the test is that, while we are unable to measure specifics about each member's district, we assume that Republicans in Democratic states are likely to come from districts more conservative than the state as a whole and we should observe them shifting

leftward in the Senate in order to hold on to that seat. Predictions for Democrats are much harder given the north-south split in the party for much of the 20th century. We primarily look to Republican cases given the bluntness of these data. We exclude six members who, due to unusual career paths, served in the Senate before the House, or went back and forth between the chambers more than once.

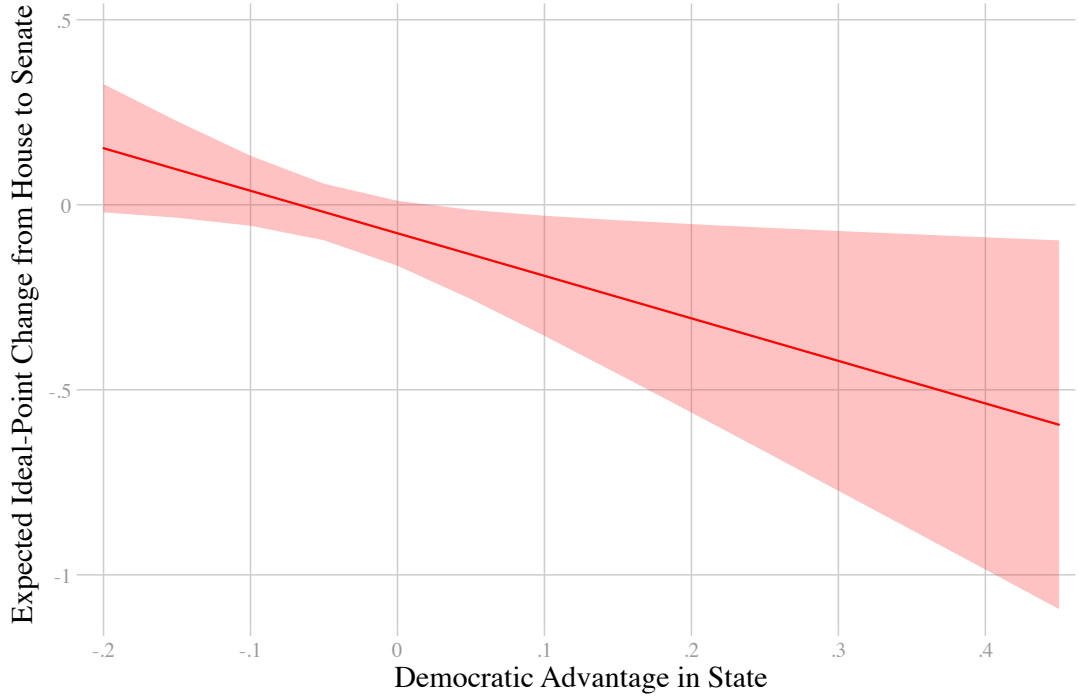
Table 1. Explaining Shifts from House to Senate

Variable	Coefficient (S.E.)
Republican	0.02 (0.05)
Democratic Presidential Advantage	0.07 (0.38)
Rep. X Dem Pres. Advantage	-1.22 (0.55) *
Year of Switch	-0.00 (0.00) ^
N	192
Clusters	46 States
R^2	0.04

Note: Numbers in cells are Ordinary Least Squares coefficients with clustered standard errors in parentheses. A constant is included, but not presented. * = $p < 0.05$; ^ = $p < 0.10$

The results of the model, as presented in Table 1, indicate that Republican House members who move to the Senate in a more Democratic-leaning state were likely to shift to the left once in the Senate, as we would expect. This result is modest and does not hold true for Democrats, as we might expect given the somewhat broken relationship between party and ideology for Democrats in the mid-century. At the highest observed levels of Republicans in the Senate in a "Blue" state, we would expect a shift of about 0.35 in the liberal direction. In Figure 6, we plot the predicted shifts over the range of observed values for Republicans in the data. In total, the model explains a modest five percent of the variation.

Figure 6. Predicted Shifts for Republicans



Do Constant-Constituency Members Shift? A Second Approach

One limitation of our approach is that we must still assume that some members remain constant. Without this assumption, the models are unidentified and the chambers incomparable. This means we are unable to tell whether members from a state such as Wyoming or Alaska – whose constituency does not dramatically change – also move. If we think movement is primarily owed to constituency changes rather than anything else, these are the members who should feature minimal movement.

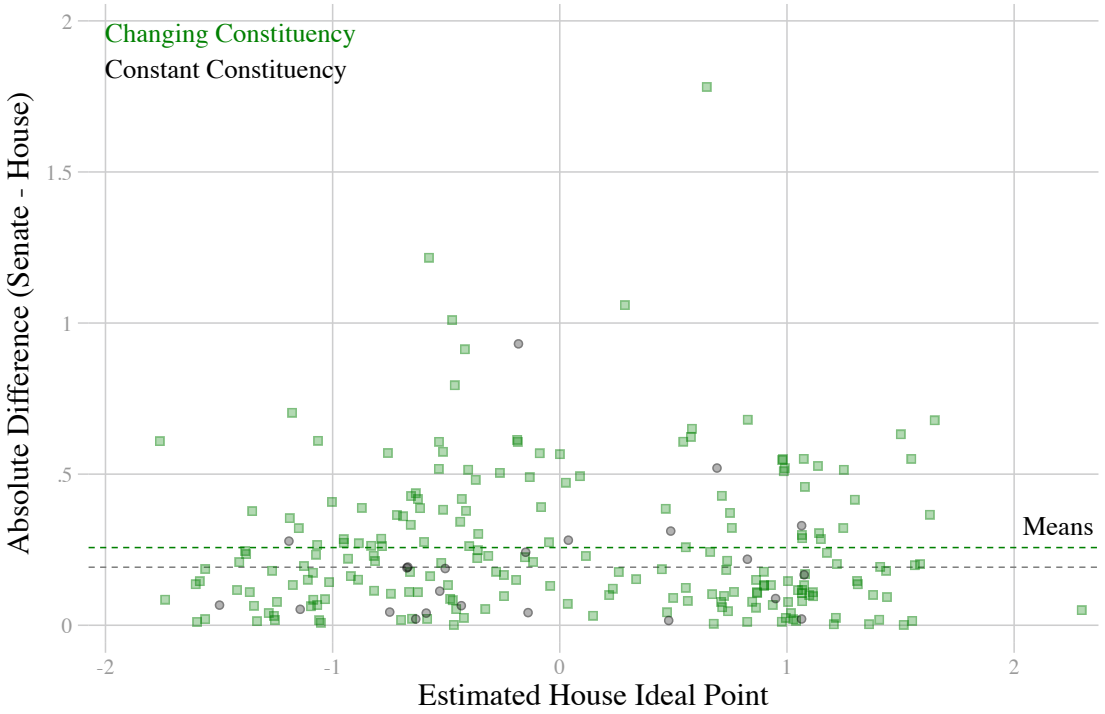
It is possible, however, that what modest change we observe is due to other things – personal change, statistical noise, or even the differences in the rules and norms of the House vs. the Senate (or "chamber effects"). It would be useful to understand the change that occurs in the absence of sudden and dramatic additions to a member's constituents list.

To measure this, we take a second approach. After estimating our model with the full set of conventional bridging actors held constant (all legislators who served in both the House and the Senate), we then take the resulting item parameters and ideal points and apply a method analogous to Nokken and Poole's (2004). Given the slope and intercepts of roll calls from the conventional (static) model, and actual vote outcomes, we can recreate vote equations with a single unknown (member ideal points), which can then be re-estimated (using a Bayesian probit) at a chamber-specific level for all members who served in both chambers. This produces a second approach to estimating the differences across chambers, and does provide us with an estimate of the shifts made by members who we held constant in our first approach: senators coming from statewide House districts.

In Figure 7, we plot the absolute differences between House and Senate ideal points for all members who served in both chambers, with those who featured changing constituencies in green (squares) and those in constant constituencies (statewide House members) in black (circles). Contrary to our expectations, the two groups are not distinguishable. Those with constant constituencies moved by about as much (no significant difference) as members who added millions of constituents by moving to statewide election. This implies that constituency differences do not play a systematic role in the changing behavior observed between the chambers.[11]

[11] Additional analyses and robustness checks appear in Appendix B.

Figure 7. Absolute Difference between House and Senate Scores for All Bridge Members



Conclusion

Collectively our tests yield several insights. First, the constancy bridging assumption of chamber-switchers in Common Space ideal-point scores (at least in terms of one-dimensional IRT models) is technically, but immaterially, false. That is, while House and Senate voting records for these members are statistically distinguishable, the differences are not sufficiently large to meaningfully undermine bridging. We see our results as largely supporting the work and assumptions of Poole, Rosenthal, and others who have used these bridging assumptions to create Common Space scores.

Second, there *are* individual cases of substantial shifts. This indicates that when using Common Space scores for inferences about individual senators who have also served in the House, researchers should be cautious – as these estimates are perhaps the least accurate of all scaled members. These scores are substantially informed by performance in a different chamber

and the more chamber-specific vote choices of the member may vary – modestly, or, in cases like Gillibrand or Goodell, significantly.

Third, to the extent that we observe shifts when changing chambers, these are likely only modestly owed to the different constituents the senators now represent. We find some modest evidence that Republicans in blue states move left in a systematic way, but find no further evidence of an electorally driven shift. And we find contrary evidence in that those with no substantial constituency shifts show just about as much movement.

Fourth, this may indicate some level of "chamber effect" – spread across members irrespective of their underlying electoral conditions. Yet, we also find little evidence to support this. Members shift liberally and conservatively. There is no systematic trend toward either extremism or moderation. While there is slightly more movement to the left than to the right, these are not large, systematic differences that we can easily call "chamber effects." And notably, there is over-time stability in both the direction and magnitude of shifts, showing no signs of changing even as Senate rules and partisan control changed.

Finally, these results have implications for the study of representation in American democracy. We find little evidence that members change in response to substantial changes in their constituencies. This confirms the basic claim made by Poole (2007), that once elected to Congress, members adopt an ideological position and maintain it both over time and across chamber. More generally, our results might imply that members place relatively little importance on voting in accordance to citizen preferences. Or, perhaps, members' assessments of constituent interests might be flawed (Broockman and Skovron 2018). More research will be needed to determine which of these suppositions is likely (more) true.

References

Broockman, David E., and Christopher Skovron. 2018. "Bias in Perceptions of Public Opinion among Political Elites." *American Political Science Review* 112(3): 542-63.

Bump, Philip. 2014. "Roger Goodell's Father Was a Senator – and He Lost His Seat because He Opposed the Vietnam War." *Washington Post*, September 11.

Clinton, Joshua, Simon Jackman, and Doug Rivers. 2004. "The Statistical Analysis of Roll-Call Data." *American Political Science Review* 98(2): 355-70.

Gray, Thomas R., and Jeffery Jenkins. 2017. "Unpacking Pivotal Politics: Exploring the Differential Effects of the Filibuster and Veto Pivots." *Public Choice* 172(3-4): 359-76.

Gray, Thomas R., and Jeffery Jenkins. 2019. "Pivotal Politics and the Ideological Content of Significant Laws." *Journal of Public Policy* 39(1): 115-42.

Grosclose, Tim, Steven D. Levitt, and James M. Snyder. 1999. "Comparing Interest Group Scores across Time and Chambers: Adjusted ADA Scores for the U.S. Congress." *American Political Science Review* 93(1): 33-50.

Imai, Kosuke, James Lo, and Jonathan Olmstead. 2016. "Fast Estimation of Ideal Points with Massive Data." *American Political Science Review* 110(4): 631-56.

Jackman, Simon. 2001. "Multidimensional Analysis of Roll Call Data via Bayesian Simulation: Identification, Estimation, Inference, and Model Checking." *Political Analysis* 9(3): 227-41.

Krehbiel, Keith. 1998. *Pivotal Politics: A Theory of U.S. Lawmaking*. Chicago: University of Chicago Press.

Lewis, Jeffrey B., Brandon DeVine, Lincoln Pitcher, and Kenneth C. Martis. 2013. *Digital Boundary Definitions of United States Congressional Districts, 1789-2012*. Retrieved from http://cdmaps.polisci.ucla.edu.

Martin, Andrew, and Kevin Quinn. 2002. "Dynamic Ideal Point Estimation via Markov Chain Monte Carlo for the U.S. Supreme Court, 1953-1999." *Political Analysis* 10(2): 134-53.

Martis, Kenneth C. 1989. *The Historical Atlas of Political Parties in the United States Congress, 1789-1989*. New York: Macmillan.

Nokken, Timothy P, and Keith T. Poole. 2004. "Congressional Party Defection in American History." *Legislative Studies Quarterly* 29(4): 545-68.

Poole, Keith T. 1998. "Recovering a Basic Space from a Set of Issues Scales." *American Journal of Political Science* 42(3): 954-93.

Poole, Keith T. 2005. *Spatial Models of Parliamentary Voting*. New York: Cambridge University Press.

Poole, Keith T. 2007. "Changing Minds? Not in Congress!" *Public Choice* 131(3-4): 435-51.

Poole, Keith T., and Howard Rosenthal. 1997. *Congress: A Political-Economic History of Roll Call Voting*. New York: Oxford University Press.

Poole, Keith T., and Howard Rosenthal. 2007. *Ideology and Congress*. New Brunswick, NJ: Transaction Publishers.

Shor, Boris, Christopher Berry, and Nolan McCarty. 2008. "Methodological Issues in Bridging Ideal Points in Disparate Institutions in a Data Sparse Environment." Unpublished manuscript. Available at: https://bshor.files.wordpress.com/2015/08/stateideal_methodology.pdf.

Shor, Boris, Christopher Berry, and Nolan McCarty. 2010. "A Bridge to Somewhere: Mapping State and Congressional Ideology on a Cross-Institutional Common Space." *Legislative Studies Quarterly* 35(3): 417-48.

Terris, Ben. 2013. "Kirsten Gillibrand's Improbable Path to Liberal Stardom" *The Atlantic*. October 26.

Woon, Jonathan, and Ian P. Cook. 2015. "Competing Gridlock Models and Status Quo Policies." *Political Analysis* 23(3): 385-99.

Wright, Carroll D. 1900. "The History and Growth of the United States Census." Prepared for the Senate Committee on the Census. February 24, 1900.

Appendix A – List of Bridging Observations (Statewide House and Senate Membership)

Name	State	Senate Debut (Congress)
William H Dietrich	IL	73
Dennis Chavez	NM	74
Berkeley L. Bunker	NV	76
James G. Scrugham	NV	77
Clinton P. Anderson	NM	81
Frank A. Barrett	WY	83
Quentin N. Burdick	ND	86
Winston L. Prouty	VT	86
Stephen M. Young	OH	86
James C. Boggs	DE	87
Daniel K. Inouye	HI	88
Joseph M. Montoya	NM	89
Robert T. Stafford	VT	92
William V. Roth, Jr.	DE	92
James M. Jeffords	VT	101
Byron L. Dorgan	ND	103
Craig L. Thomas	WY	104
Tim P. Johnson	SD	105
Thomas R. Carper	DE	107
John Thune	SD	109
Bernie Sanders	VT	110
Steve Daines	MT	114
Kevin Cramer	ND	116

Appendix B – Additional Tests

B.1 – Additional Tests Using Measures of District Preferences

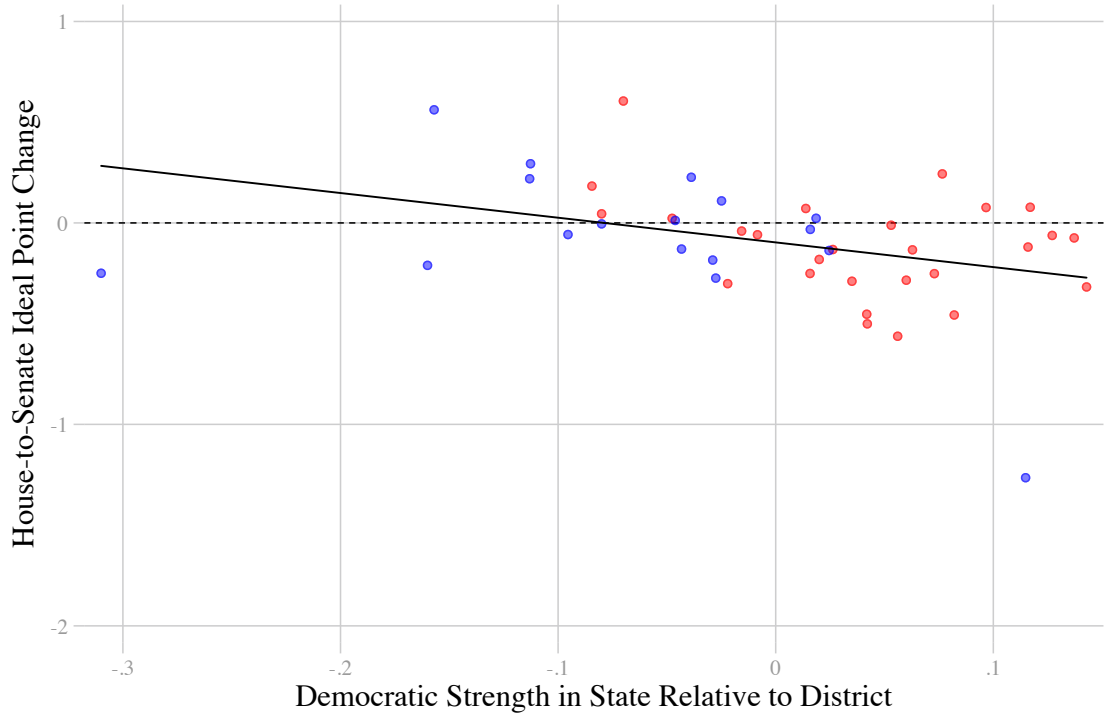
In Table 1, we report a simple model of change by conventional bridging members as they move (usually) from the House to the Senate. In that section, using our full time period of data, we only have state-level voter preferences (via presidential voting data). However, a valid question may be whether the districts that senators come from actually closely match their states, and thus the small changes we uncover are in fact consistent with many expectations about legislators as representatives. We are unable to test this proposition on our full dataset, but can use district-level presidential vote returns from the 21st century to assess this.

For each multi-district-state bridging members from the 108th Congress (2003-04) onward, we take data on the Democratic party's 2-Party Vote Share (2PVS) in their district and in the state as a whole in the election that immediately preceded their switch between chambers (always House to Senate in this shorter time frame). From this we produce a measure of the difference between the two geographies: state 2PVS minus district 2PVS. Members with positive scores come from districts less favorable to Democrats than their state as a whole. We might expect these members to become more conservative, while those with negative scores should become more liberal – as their state was more liberal than their previous district. Based on our results in the main text, we would expect these effects to be small.

We plot these against the House-to-Senate change in estimated ideal point from our main model. This plot is presented in Figure B-1. What we see comports with Table 1 as well as our broader findings. There are some shifts, and they move in a logical direction, but the shifts are generally small. Only Kirsten Gillibrand makes the drastic shift we might expect. The results also show us that bridging members are not just those whose districts closely matched their state.

To the contrary, many members whose districts was seven or more points out of line with their state won Senate seats. Thus, as with Table 1, we find a small, statistically significant relationship in the direction of shifts and the changes between district and state preferences, but in a way that comports with our overall findings – that member shifts when moving between chambers are non-zero but modest.

Figure B-1. Change Between Chambers is Weakly Correlated with Differences Between Districts and States



Additionally, we estimate a pair of linear regressions. In the first, the dependent variable is the estimated House score for the conventional bridging observations. In the second, the dependent variable is their Senate score. As covariates, we use the district and state Democratic 2PVS variables for Figure 1. We present the results in Table B-1. Interestingly, we find that the House score is primarily explained by district preferences, but the Senate score is best explained by a combination. This would imply that another worry – that members who make it to the Senate had

been strategically representing their desired statewide constituency in the House – is less of a concern than it might appear. There is no strong relationship between statewide preferences and House voting. There is a relationship between statewide preferences and Senate voting, as we would expect. Yet, we also find a robust correlation with the preferences of the senator's former House district. This fits within our overall finding that members do not change drastically – the voting pattern that forms in the House is largely continued in the Senate, with modest changes.

Table B-1. Relationship Between District and State Preferences and House and Senate Estimated Ideal Points

DV: House Score	House Ideal Point	Senate Ideal Point
House District Democratic 2PVS	-5.63**	-4.30**
	(1.13)	(1.12)
State Democratic 2PVS	-2.61	-4.58*
	(1.73)	(1.72)
N	44	44
R^2	0.69	0.68

B.2 – An Alternative One-Congress-at-a-Time Approach

Splitting a member's career in two, as we do in the manuscript introduces the opportunity for change within a career, but still often bunches many thousands of votes together. This has the effect of smoothing over changes in preferences. We thus pursue another approach – instead of breaking members into two observations, we break them into *K* observations, where *K* is the number of Congresses of which they were a member. All other members remain static single-observations, providing the bridging across time and across chamber that are conventionally used. However, for the 206 members we focus on in this paper, they now are free to vary from Congress to Congress. Given that this is not a fully dynamic model and their years are treated as independent from one another, this allows for maximal movement and variation and only smooths within Congresses, not across them as our main model does.

We plot these series of Congress-specific ideal-point estimates in Figure B-2, with the X axis as the number of Congresses since switching chambers. Thus, "0" represents the first Congress in the new chamber, while "-3" indicates that the chamber shift is still three Congresses away. The results show two things: first, we see plenty of movement within individual lines, but, second, a lack of large, systematic patterns. The identity of the member explains 92.6% of the variation in these scores, while accounting for the Senate switch only explains an additional 0.1% of the variation. While somewhat noisily bouncing around, the scores remain substantially the same across time and chambers.

Figure B-2. Noise and Stability Within Switching Members Over Time