How Do Senators Vote? Disentangling the Role of Voter Preferences, Party Affiliation, and Senator Ideology

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This paper develops a methodology for consistently estimating the relative weights in senator utility functions, despite the fact that senator ideologies are unobserved. The empirical results suggest that voter preferences are assigned only one quarter of the weight in senator utility functions. The national "party line" also has some influence, but the senator's own ideology is the primary determinant of roll-call voting patterns. These results cast doubt on the empirical relevance of the median voter theorem. Estimation of the model requires only roll-call voting data, making it widely applicable. (*JEL* D72, D78).

In determining whether to vote for or against a particular bill, elected officials must balance the wishes of the overall electorate, specific constituencies within the electorate, pressure from party leaders within the Congress, and their own ideology. The relative importance of those competing factors remains an open question.[1] The primary difficulty that arises in attempting to answer that question is the lack of observability of the variables in question, especially ideology.[2] Since an elected official's ideology is likely to be correlated with both party affiliation and voter preferences, failure to control for ideology will lead to biased estimates of the impact of all of the influences on roll-call voting behavior.

By focusing on the U.S. Senate, previous studies have partially succeeded in overcoming the problems caused by nonobservability of key variables. Two senators from a given state represent the same set of voters. Thus, one can test the median voter theorem without directly observing senator ideology or voter preferences; systematic differences in the voting records of senators from the same state constitute a rejection of the median voter theorem. Poole and Howard Rosenthal (1984) demonstrate that Democratic and Republican senators representing the same state exhibit very different patterns of voting behavior. The data presented in Table 1 confirms their findings. When a state has a mixed-party senate delegation those senators' votes are only slightly more similar than one would expect from a random draw of two senators.

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[1] The literature addressing this question is voluminous. Notable contributions include, but certainly are not limited to, Bruce A. Bender (1991), Charles S. Bullock and David W. Brady (1983), Michael L. Davis and Philip K. Porter (1989), Gi-Ryong Jung et al. (1991), Joseph A. Kalt and Mark A. Zupan (1984, 1990), John Kingdon (1973), John R. Lott and Davis (1991), John R. McArthur and Stephen V. Marks (1988), Douglas Nelson and Eugene Silberberg (1987), Samuel Peltzman (1984), Keith T. Poole and R. Steven Daniels (1985), Poole and Thomas Romer (1993), Catherine R. Shapiro et al. (1990), Martin Thomas (1985), James R. Van Beek (1991), Gerald C. Wright (1989), and Zupan (1990).

[2] While interest group ratings are available, these are not valid measures of ideology because they are constructed from past roll-call voting behavior, which is affected by voter preferences and party pressure.

TABLE 1—VARIATION IN SENATOR VOTING RECORDS
(Measured by raw ADA scores)

Senator classification	Group mean	Standard deviation
All Senators	44.7	31.7
Democrats	62.7	24.8
Republicans	23.3	23.3
Within state:		
Both Democrats	61.1	9.9
Both Republicans	22.0	9.3
Split delegations:		
Democrat/Republican	64.8/24.5	29.9

Notes: Based on ADA rankings for all senators, 1970–1991. Standard deviations are the weighted (by number of senators) average of yearly standard deviations by category. ADA rankings range from 0 to 100, with higher numbers signifying a more liberal voting record.

Though conclusively rejecting the median voter theorem, previous studies do not tell us very much about what factors actually *do* help to explain senator voting behavior. A number of alternatives to the median voter theorem have been proposed. The "dual constituency" hypothesis (Morris P. Fiorina, 1974) predicts that elected officials will place extra weight on the preferences of their *supporters* within the electorate. Possible explanations for such behavior are the existence of primaries and the likelihood that campaign support, both financial and in the form of volunteers, is concentrated in this group. The close correspondence in Table 1 between the Americans for Democratic Action (ADA) scores for senators from the same state and party, who are likely to share quite similar "support" constituencies, is consistent with such a hypothesis.

Another view, argued most recently by David Rohde (1991), D. Roderick Kiewiet and Matthew D. McCubbins (1991), and Gary W. Cox and McCubbins (1993), ascribes a strong role to national parties. If party allegiance is an important determinant of an official's success in the congress (as seems to be the case, for instance, in obtaining preferred committee assignments in the House, (see Steven S. Smith and Bruce A. Ray [1983]), then differences in voting behavior among senators from the same state, but different parties, might be causally attributed to senators altering their voting patterns to more closely match the party line. The fact that members of the same party exhibit substantially less variability than do senators as a whole in Table 1 is consistent with the existence of strong national parties.

A final alternative to all of the above hypotheses is that senators simply vote their own ideologies without regard for the interests of the electorate or the party line. The observation that senators from the same state and party tend to vote similarly may reflect the fact that they are drawn from a pool of candidates with relatively similar ideologies, rather than being evidence that they weigh heavily the interests of their constituents. Along the same lines, the observation that Democrats across states tend to have similar voting records may simply reflect the fact that liberal candidates tend to run as Democrats while conservatives run as Republicans.

This paper develops a methodology for estimating the relative weights senators place on the various alternatives considered above. Importantly, this methodology does not require senator ideologies to be observed in order to yield consistent estimates. The paper then proceeds to estimate the model on data from 1970–1990. Identification of the model hinges on three critical assumptions: (i) each senator's ideology remains fixed over time, (ii) senator decision functions are quadratic, and (iii) state voter preferences are assumed to be reasonably proxied by the roll-call voting patterns of a state's House delegation. Under those assumptions, it is demonstrated that the relative weights assigned to the various factors can be ascertained even though senator ideology is not observed.

The model has a number of attractive features. First, because the parameter estimates obtained are explicit weights in the utility function, interpretation of the results is straightforward.[3] Second, the model is ideal

[3] This feature contrasts with previous models of elected voting behavior (Bullock and Brady, 1983; Wright, 1989; Shapiro et al., 1990) which, in addition to failing to control for candidate ideology, do not have easily interpretable parameter estimates.

for testing a wide variety of hypotheses concerning senator voting behavior. For instance, one can test whether the weight placed on voter preferences increases as elections approach, or whether the importance of party affiliation has increased or declined over time. Third, the model generates explicit estimates of senator ideologies which may prove useful to future researchers. Finally, because the model requires only roll-call voting data as inputs, it can be applied to any time period or subset of roll calls, and therefore may prove to be a valuable tool in studying a wide range of questions.

The results, based on the years 1970–1990, suggest that voter preferences are assigned only one quarter of the weight in senator utility functions. While the national "party line" also receives some weight, the senator's own ideology is overwhelmingly the most important determinant of roll-call voting patterns. The weight that senators do place on voters is disproportionately concentrated in the senator's "support" constituency; the estimates suggest that supporters are 3 times more influential than nonsupporters in determining roll-call voting behavior. While senators are not particularly responsive to electorate preferences, they become more so as elections approach. The weight given to voters outside a senator's support constituency is 2 times higher in election years than it is when elections are more distant. Voter preferences are also given higher weights by first-term senators. Parties appear to have strengthened substantially in the 1980's, with an offsetting decline in the importance placed on voter preferences.

The paper is organized as follows. Section I develops the model underlying the empirical specification, and demonstrates that the model can be estimated without directly observing senator ideologies. Section II describes the choice of proxy variables, the limitations of these proxies, and the sample to be analyzed. Section III presents empirical estimates of the basic specifications, while Section IV considers extensions of the model. Section V offers a brief set of conclusions.

I. The Model

It is assumed that senators potentially take into account four different sets of interests when determining where to position themselves in the policy space:

(i) Overall preferences of the state electorate.
(ii) Preferences of his/her particular constituency of "supporters" within the state electorate.
(iii) The national party line.
(iv) The senator's personal preferences or ideology.

In analyzing the influences on a senator's voting, I focus here on the overall positioning of a senator's voting record in policy space, although the model is equally applicable to any subset of roll-call votes. In what follows, it is assumed that the policy space is unidimensional. The underlying logic readily generalizes to an n-dimensional space.

The problem is formalized by assuming that the senator minimizes a weighted average of the squared distances from the bliss points of the four different sets of interests as follows:

$$(1)\quad U_{it} = -[\alpha(V_{it} - S_{it})^2 + \beta(V_{it} - C_{it})^2 + \gamma(V_{it} - P_{it})^2 + (1 - \alpha - \beta - \gamma)(V_{it} - Z_{it})^2]$$

where

V_{it} = senator i's voting profile in year t,
S_{it} = the bliss point of the voters in state i in year t,
C_{it} = the bliss point of the senator's support constituency within the state in year t,
P_{it} = the bliss point of senator i's party in year t,
Z_i = the senator's ideological bliss point, assumed to be constant over time.

Since utility functions are defined only up to an affine transformation, there is no loss of generality implied in constraining the decision weights to sum to one. In order for the estimated coefficients to be directly interpretable

as weights in the utility function, however, all of the bliss points and the voting profile V_{it} must be measured in the same units.

Maximizing the above function with respect to the senator's vote V_{it} yields a senator's optimal voting record V_{it}^* which is simply a weighted average of the four bliss points:

$$(2) \quad V_{it}^* = \alpha S_{it} + \beta C_{it} + \gamma P_{it} + (1 - \alpha - \beta - \gamma)Z_i.$$

As equation (2) makes apparent, senator ideology (Z_i) is defined as the position the senator would take if he or she placed absolutely no weight on voter preferences or the party line. The fundamental problem in applying equation (2) to actual data is that the bliss points are not directly observable to the researcher. The strategy for overcoming this difficulty has two elements. Where reasonable proxy variables are available (that is, for state voter preferences, constituency preferences, and the party line), they are employed. Concerns over possible endogeny and/or errors-in-variables can be dealt with empirically through the use of instrumental variables (IVs).

For senator ideologies, however, no reasonable proxy is available.[4] Given the availability of proxies for the other variables, this absence does not pose a problem. Rewriting equation (2) in indicator-variable notation:

$$(3) \quad V_{it}^* = \alpha S_{it} + \beta C_{it} + \gamma P_{it} + [(1 - \alpha - \beta - \gamma)Z_i]^* I_{it}$$

where I_{it} equals 1 if the observation in question is for senator i, and 0 otherwise.

Equation (3) can be estimated by including a senator-specific constant or fixed effect for each senator. The estimates of the coefficients associated with the fixed effects have two components: the senator's ideology, and the weight the senator places on his or her own ideology in the utility function. Because estimates of the weighting parameters α, β, and γ are obtained from a regression of equation (3), the weight senators place on their own ideologies $(1 - \alpha - \beta - \gamma)$ can be determined. Knowing that weight, parameter estimates of each senator's ideology can also be obtained. Therefore, all parameters in equation (3) are identified, even though senator ideology is unobserved.

The identification of the parameters hinges on having all of the variables in the model measured in the same units. If the different variables are arbitrarily scaled, then there is no reason for the decision weights to sum to 1, and none of the parameters in the model are identified. That requirement drives the data choices outlined in the following section.

II. Data Choices

In applying the model of the previous section to the data, three sets of choices are required. First, the units of measure must be defined. Second, proxy variables must be selected. Third, the appropriate sample needs to be identified. Those three choices are treated in turn.

A. *Units of Measure*

The only requirement for a unit of measure for the analysis is that it reflects roll-call voting behavior and that it is available for the House and Senate for the time period in question. Ratings compiled annually by a variety of interest groups, as well as estimates from spatial voting models (Poole and Rosenthal, 1985; James J. Heckman and James M. Snyder, 1995), satisfy this criterion. In practice, the correlations across the different measures are above 0.95. The voting scores compiled annually by the ADA are used in the analysis that follows, primarily because they have been the standard measure in the previous literature on the topic (for example, James B. Kau and Paul H. Rubin, 1979; Kalt and Zupan, 1990; Lott and Davis, 1992). The conclusions of the pa-

[4] In particular, a senator's past voting record is not a proxy for ideology since it is a function of the three other factors as well as ideology.

per are unchanged when Heckman-Snyder scores are substituted for ADA scores.[5]

The ADA calculates annual ratings of elected officials based on approximately 20 roll-call votes per year. The chosen votes are typically high-profile issues with a well-defined liberal position. Scores are scaled such that a senator who votes with the liberal position on every vote receives a score of 100, while a senator who always opposes the liberal position receives a 0. ADA scores are explicitly unidimensional, a restriction that appears consistent with the data (Poole and Rosenthal, 1985, 1991), especially in the period examined here.

There are two primary shortcomings of ADA scores. First, ADA scores are not necessarily comparable across years or chambers of congress.[6] A score of 50 in one year may not mean the same thing as a score of 50 in another year. Timothy Groseclose et al. (1995), however, demonstrate that under a fairly general set of assumptions it is straightforward to translate ADA scores from different years and chambers into comparable units. Their analysis allows for both shifting and stretching in the year-to-year scores, akin to translating temperatures from Fahrenheit to Celsius. The ADA scores used throughout this paper are adjusted using these conversion factors.[7]

A second potential problem with ADA scores is that they exhibit censoring (that is, scores are restricted to fall between 0 and 100), which may lead to inconsistent parameter estimates. In practice, however, only about 10 percent of the senators receive scores of 0 or 100 in a given year. As a check for bias induced by censoring, the basic specifications of the following section were replicated using symmetrically trimmed least squares (James L. Powell, 1986), an estimation technique that is robust to censoring. In all cases, the estimates of the weighting parameters in the utility function were virtually unchanged, suggesting that censoring is not a critical issue.[8] While there are further criticisms of ADA scores and their construction (Snyder, 1992; Lott, 1990), the fact that spatial voting models yield similar results in this framework alleviates concerns that the results obtained are an artifact of using ADA scores.

B. *Choice of Proxy Variables*

Proxy variables are needed for state voter preferences, preferences within the support constituency, and the national party line. The framework developed in Section I imposes an important restriction: in order for the model to be identified, all of the proxies must be scaled by the same units as the dependent variable, namely ADA scores. See Table 2 for the summary statistics of the proxy variables.

A logical proxy for state voter preferences in a given year is the mean ADA score across the state's House delegation in that year. The mean House ADA score is strongly correlated with other possible measures of a state's liberal-conservative position such as the percent of the state's presidential vote cast for the Democratic party. Moreover, there is a high degree of overlap between the issues covered by the roll-call votes that are used to calculate the two House and Senate ADA scores in a given year. Therefore, to the extent that a

[5] Because year-to-year variation is critical to identifying the model, I have not attempted to replicate the results of the paper using the NOMINATE scores of Poole and Rosenthal (1985), the available version of which are computed at 2-year intervals corresponding to congresses. A further problem with NOMINATE scores in this context is that the House and Senate scores are not necessarily scaled in the same units, invalidating the inter-chamber comparisons upon which this paper is based.

[6] The same problems of noncomparability arise in spatial voting models because voting scores for any given year are defined only up to an affine transformation.

[7] An earlier version of the paper used unadjusted ADA scores. The results, while generally similar, were less precisely estimated and far more sensitive to model specifications.

[8] In contrast to the weighting parameters, the estimates of the senator ideologies were somewhat affected by censoring. When censoring was taken into account, estimates of the ideologies were more extreme than in the results reported in the following section. The relative ordering of senators was virtually unaffected, however. The correlation between the estimated ideologies using 2-stage least squares and symmetrically trimmed least squares is greater than 0.95.

TABLE 2—SUMMARY STATISTICS FOR THE PROXY VARIABLES

Variable	Mean	Standard error	Minimum	Maximum
Senate ADA scores	42.2	30.6	−13.6	119.5
Democrats	55.6	26.6	−8.1	119.5
Republicans	23.4	25.6	−13.6	98.2
House delegation ADA (state means)	43.0	18.6	2.6	90.4
House Democrats	58.6	24.1	2.0	98.4
House Republicans	18.0	15.9	−4.8	83.5
Party leaders				
Democrat	59.7	12.2	36.4	77.9
Republican	11.6	7.1	0.1	25.2

Notes: Data are for the period 1970–1990. Summary statistics based only on data for senators meeting the following criteria: (i) senator served at least six years in sample, (ii) at least four members in the state's House delegation, (iii) at least one member of the House delegation is from the same party as the senator, leaving 1,259 observations. ADA scores from different years are made comparable following the procedures in Groseclose et al. (1995). These adjusted ADA scores, unlike the raw ADA scores, are not constrained to fall between 0 and 100. Statistics for the House refer to state delegations rather than individual members of the House.

single ADA score reflects not only overall liberal tendencies, but also stands on issues of particular interest to a state, the mean House ADA score may better capture state voter preferences than would measures based on the presidential vote.[9]

The preferences of a senator's support constituency are proxied using the mean House ADA score among members of that senator's state *and* party. That variable is somewhat crude, overlooking the possibility that two senators from the same state and party may have different sets of supporters, or that support constituencies may cross party lines. While more direct measures of constituency would clearly be preferred, the restriction that the explanatory variables be scaled in ADA scores precludes that possibility. The fact that senators from the same state and party typically exhibit quite similar voting patterns (see Table 1) provides some justification for this choice of proxy.

Two proxies are considered for the national party line: the mean ADA score of the party leadership[10] in a given year, and the mean ADA score of all party members in that year. While the voting scores of the party leadership correspond more closely to the theoretical notion of a party line, concerns over possible noise in that measure due to the small number of senators upon which it is based makes use of a broader measure of party preferences attractive. The two proxies are highly correlated ($\rho > 0.90$), and the results are not sensitive to the choice.

The use of House ADA scores as proxies potentially induces two countervailing sources of bias. The first source of bias is measurement error. It is clear that the voting record of any particular House member only loosely reflects district interests as evidenced by the variability in voting patterns when there is replacement in the House (Poole and Romer, 1993).[11] Con-

[9] Survey data provides a more direct measure of constituency preferences. The problem with survey data in this context is that there is no simple way to scale survey responses in units that are comparable to senator roll-call votes. While survey responses could in theory be used as instruments for the state voter preference proxies, survey data is not available on a consistent enough basis to make such an approach feasible.

[10] The party leadership was defined as the floor leader, the party whip, the chairman and secretary of the conference committee, the President Pro Tempore, and the chairman of the Republican policy committee.

[11] While the roll-call voting behavior of any given representative is a noisy reflection of underlying voter preferences, it is nonetheless plausible that *on average* congressmen represent their districts. Put another way, Congress should be roughly as liberal as the nation as a whole unless there are systematic institutional biases in action.

sequently, the mean House ADA score is a noisy measure of overall voter preferences, and attenuation bias is likely to result. As long as deviations from voter preferences are not perfectly and positively correlated across congressman from a state, however, the measurement error will be a declining function of the number of districts in the state.

The second source of bias resulting from the use of proxies is more subtle. If House members maximize a utility function similar to that of senators, their roll-call voting patterns will reflect not only voter preferences, but also the party line and their own ideologies. A 1-point change in preferences for all voters in a state will translate into a less than 1-point change in the ADA scores of the state's congressmen. Assume, for instance, that House members maximize the same form of utility function as senators. Let there be a uniform 1-point shift in the bliss point of all voters in the state, but no corresponding change in national party preferences or congressmen ideologies. Then using equation (2), the change in the mean House ADA score is $\alpha_H + \beta_H < 1$, where α_H is the weight placed by House members on overall state voters and β_H is the corresponding weight given to the support constituency.[12] Using House ADA scores as a proxy for voter preferences will make it appear as if voter preferences shifted by $\alpha_H + \beta_H$ points. Senators, however, cast their votes based on the true 1-point shift, not the muted shift reflected in House ADA scores. Because the proxy for voter preferences is more stable than voter preferences themselves, the responsiveness of senators to voter preferences will tend to be exaggerated, that is biased *upward*.

[12] The exact responsiveness of the mean House ADA score to a change in voter preferences depends on the precise composition of shifting preferences in the state. The important point is that $dV_{itH}/dS_{it} < 1$. It is also worth noting that it is dV_{itH}/dS_{it} not $\partial V_{itH}/\partial S_{it}$ that determines the degree to which the House voting proxy understates the true change in voter preferences. Because all of the determinants of roll-call votes tend to be positively correlated, the total derivative is generally greater than the partial derivative. For example, in the uniform-shift example above, $dV_{itH}/dS_{it} = 1 - \gamma_H$ which is greater than or equal to $\partial V_{itH}/\partial S_{it} = \alpha_H$ for all feasible values of the decision weights.

Because the two sources of bias arising from the use of House ADA scores point in opposite directions, it is impossible to sign the overall bias a priori. Attenuation bias should be greatest in states with small House delegations. Consistent with that prediction, the coefficient on overall state voter preferences steadily increases as states with small House delegations are excluded. When senators from all states are included, the coefficient on overall voter preferences is 0.056, the standard error (SE) is 0.036. Excluding senators from states with only one House seat increases that coefficient to 0.064 (SE = 0.038); excluding senators from states with two or fewer House seats yields an estimate of 0.113 (SE = 0.045). Beyond this point, the estimated coefficients stabilize in the vicinity of 0.13. The approach adopted in this paper is to drop senators from states with small House delegations, thus reducing attenuation bias, possibly at the price of exaggerating the impact of voter preferences due to the second source of bias. Empirically, however, the weights given to voter preferences are relatively low, placing an upper bound on the degree to which the latter source of bias can predominate.

The possible endogeny of both party proxies is also an important concern. A party-line variable is intended to capture the extent to which senators alter their behavior based upon pressure from other members of the party (relative to how they would have behaved in the absence of party pressure). If, however, there are common "shocks" to ADA scores across senators of a given party (for example, due to the particular set of votes included in the calculation of ADA scores that year), these shocks will mistakenly be attributed to the influence of the party line in the regression. Thus, in the presence of common party shocks, the coefficient on the party proxy is likely to be biased upwards using ordinary least squares (OLS). The use of instrumental variables provides a means of eliminating this source of bias. The party proxies are therefore instrumented using their once-lagged and twice-lagged values in what follows. The lagged values are likely to be good instruments since they are highly correlated with the current value of the proxies, but are not contaminated by the particular set

of votes used to compute ADA scores in the current year. The use of multiple lags makes testing of the overidentifying restrictions feasible which provides a useful check on the model specification.

C. *The Choice of Sample*

Senator voting records over the period 1970–1990 are the basis of the sample. Four types of exclusions are made in the data. First, senators who serve less than 6 years in the sample are dropped. The model requires estimating a fixed effect for each senator. For those senators who serve for only a few years in the sample (either because their term(s) only partially overlap with the sample, or because of death, resignation, or appointment to a partial term), those estimates are quite imprecise. Moreover, the imprecision of those estimates has an adverse impact on the standard errors of the weights in the utility function. Including only senators that serve a minimum of 6 years in the sample reduces the number of parameters to be estimated by 71, while lowering the available observations from 2,100 to 1,898.

Second, as noted earlier, for senators from states with small House delegations, the state voter proxy is likely to be noisy and very sensitive to the party composition of the state House delegation. Therefore, senators from states with House delegations of three or fewer members are excluded from the sample.[13] This eliminates an additional 55 senators and 617 observations from the sample, leaving 113 senators and 1,281 observations.

The third type of exclusion is for senator observations in which no members of the House delegation are of the same party as the senator. In these cases, the proxy for support constituency cannot be constructed. For states with four or more House members, this situation arises infrequently: only 16 observations in the sample fall into this category.[14] In all cases where observations are discarded because no House members share party affiliation with a senator in a particular year, ample observations on the senators in question remain for estimating a senator-fixed effect.

Finally, the observations on James Buckley (Conservative-NY) are eliminated from the sample because he was not affiliated with a major party, leaving 112 senators and 1,259 observations.[15]

III. Empirical Estimates

Regression estimates of equation (3), using the variables and sample defined in the previous section, are presented in Table 3. The coefficients reported in Table 3 are decision weights in senator utility functions. As a test of the robustness of the results, a range of specifications are estimated using different party proxies, sometimes instrumenting for party, and sometimes including year dummies to capture any systematic variation over time. Columns (1), (2), (5), and (6) of Table 3 use the ADA scores of party members as the proxy for the party line; the remaining columns use ADA scores of party leaders as a proxy. The odd-numbered columns are OLS estimates; the even-numbered columns instrument for the party proxies with once-lagged and twice-lagged values. Columns (5)–(8) add year dummies to the specification. In all cases, the sum of the weights in the utility function were

[13] Choosing a more stringent cutoff for state size does not affect the point estimates substantially, but increases the standard errors. An alternative approach to dropping small states is instrumental variables. If there are variables that are correlated with a state's true voter preferences, but not correlated with the measurement error in the proxy, then instrumental variable techniques can be used to circumvent the errors-in-variables problem. In particular, I instrumented for state voter preferences using the Democratic share of the state's vote in presidential elections, and the ADA score for the other senator from the state. The point estimates were generally robust to instrumenting. In all cases, however, the overidentifying restriction on the exogeny of the instruments was rejected. Therefore, interpretation of the results from the instrumented regressions is questionable.

[14] Most notably, between the years 1975–1980 Oregon had two Republican senators, Robert Packwood and Mark Hatfield, but all four House members were Democrats.

[15] Including Buckley as a Republican had no impact on the parameter estimates or standard errors. Harry Byrd is classified as a Democrat.

TABLE 3—ESTIMATED WEIGHTS IN SENATOR DECISION FUNCTIONS

Weight on:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overall state voter preferences	0.13	0.13	0.12	0.11	0.13	0.12	0.12	0.10
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Support constituency	0.13	0.14	0.15	0.17	0.10	0.12	0.13	0.14
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Party line	0.14	0.12	0.11	0.02	0.25	0.17	0.13	0.07
	(0.05)	(0.11)	(0.03)	(0.06)	(0.09)	(0.12)	(0.04)	(0.06)
Senator ideology	0.60	0.61	0.62	0.69	0.52	0.59	0.62	0.69
	(0.06)	(0.10)	(0.05)	(0.06)	(0.09)	(0.09)	(0.06)	(0.07)
Proxy for Party Line	Members	Members	Leaders	Leaders	Members	Members	Leaders	Leaders
Includes instrument for Party	No	Yes	No	Yes	No	Yes	No	Yes
Includes year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.96	—	0.97	—	0.97	—	0.97	—
P value: F test of year dummies	—	—	—	—	0.65	0.74	0.25	0.49
P value: χ^2 test of overidentifying restrictions	—	0.43	—	0.34	—	0.72	—	0.26

Notes: Dependent variable is senator ADA score. The specifications in table are variations on equation (3) in the text. Values reported in the table are the estimated decision weights assigned to the competing factors in senator utility functions. Decision weights constrained to sum to one in each column. ADA scores from different years adjusted for comparability using the procedure outlined in Groseclose et al. (1995). Overall state voter preferences proxied by mean House delegation ADA score in the state; support constituency preferences proxied by mean ADA score for House members from the same state and party as the senator. To be included, senator had to serve at least 6 years between 1970–1991, had to represent a state with a House delegation with at least 4 members, one of whom is from the same party as the senator. The estimation procedure allows for heteroskedastic errors across senators. Standard errors in parentheses. Number of observations is 1,259 in all columns. Standard errors are in parentheses. Overall state voter preferences proxied by the mean adjusted House ADA score in the senator's state in that year. Support constituency preferences proxied by the mean adjusted House ADA score for representatives in senator's state and party. Lagged values of the party proxies are used as instruments in some of the columns.

restricted to equal 1, and senator ideologies were assumed to be constant over time.

The results are quite similar across the different specifications. It is reassuring to note that all of the weights are positive, although that restriction was not imposed. The high adjusted R^2 values in the OLS cases imply that the regressions are able to explain almost all of the variation in senator ADA scores.[16] This is largely attributable to the senator fixed effects, since variation across senators is much more pronounced than variation in a given senator's voting pattern over time. The weights are estimated fairly precisely, particularly for voter preferences.

Overall state voter preferences receive only 10 to 13 percent of the weight in senator decision functions, suggesting that the median voter has relatively little influence on the voting patterns of senators. The coefficient on the senator's support constituency is approximately the same magnitude as that on overall state voters: 0.10 to 0.17. The similarity of those parameters, however, is somewhat deceptive since the support constituency is also included in overall state voter preferences. For example, assume that a senator's support constituency comprises 50 percent of the overall state electorate. Using the estimates in column (3), for instance, if the preferences of everyone in the senator's support constituency

[16] R^2 is not a meaningful statistic when an instrumental variable is employed. For instance, it is not bounded between 0 and 1.

increase by 1 ADA point, the senator will alter his voting position by 0.21 points (0.15 directly through the parameter on support constituency, and $0.5 \cdot 0.12$ since the support constituency is half of the overall state electorate). If everyone in the state *outside* the senator's constituency changed their preferences by 1 ADA point, the senator's position would shift by only 0.06 points ($0.5 \cdot 0.12$ since those outside the constituency are one half of the overall state electorate). Thus, senators place 3 to 4 times as much weight on the preferences of those within their support constituency as they do on those outside their constituency. These results provide little evidence for the median voter theorem, but strong support for the dual constituency hypothesis.

The coefficient on party line is least stable across specifications, ranging from 0.02 to 0.25. When party leaders are used as the proxy for the party line, the estimated weight given to party is somewhat lower than when all party members are used as the proxy. The estimates are, however, somewhat more precise when party leaders are used. To the extent that there are common party shocks associated with the particular set of votes adopted by the ADA in a given year, instrumenting for party should reduce the coefficient on party line. Instrumenting (the even columns) does in fact reduce the coefficients somewhat in all cases, although the instrumented parameters are not statistically different from the uninstrumented parameters.[17] In either case, however, the party appears to have an independent effect on senator voting. This result is consistent with Snyder (1994) and lends some empirical support to the recent theoretical work that stresses the importance of parties.

Senator ideology appears to be the most important determinant of senator voting by a wide margin, garnering between 50 and 70 percent of the overall weight. The senator's own ideology is a more important predictor of voting patterns than the three other factors combined, implying that senators exercise a tremendous amount of personal discretion in deciding how to cast their votes.

Table 3 provides two specification tests for the model. First, if equation (3) is properly specified and ADA scores are comparable across years and chambers, then the inclusion of year dummies should not have any explanatory value. For columns (5)–(8), p values of the joint significance of the year dummies are presented in Table 3. In all cases the year dummies are jointly insignificant, supporting the specification of the model.[18] A second available specification test is a test of overidentifying restrictions in the instrumented regressions. Rejection of the overidentifying restriction implies either that the instruments are invalid or that the model is generally misspecified. The test statistic is computed as $N \cdot R^2$, where N is the number of observations and R^2 is the percent of the variance explained in the regression of the residuals from the second-stage equation on all of the exogenous variables as well as the instruments. The test statistic is distributed χ^2 with degrees of freedom equal to the number of overidentifying restrictions (in this case, 1). As reported in the bottom row of Table 3, the statistic is well within acceptable bounds in all cases, and the specification cannot be rejected.[19]

The regressions in Table 3, in addition to providing estimates of the weights in the utility function, also generate estimated senator ideologies. While the precise values of the estimated ideologies do not warrant too literal of

[17] The regressions in Table 3 were also run instrumenting for the two voter proxies as well as the party proxy, in all cases using the once- and twice-lagged values as instruments. The coefficient on state voter preferences ranges from 0.01–0.14 in these specifications (standard errors range from 0.11–0.14). The coefficient on the support constituency vary between 0.20 and 0.26 (standard errors range from 0.07 to 0.26). The party line coefficient falls between 0.00 and 0.15 with standard errors of 0.07 to 0.20. In all instances, tests of overidentifying restrictions are well within acceptable bounds.

[18] If, however, raw ADA scores are used instead of the Groseclose et al. (1995) rescaled ADA scores, the year dummies are significant in all specifications. This fact highlights the dangers of attempting to make comparisons across years and chambers using raw ADA scores.

[19] When states with smaller House delegations are added to the sample the overidentifying restriction *is* rejected. That result furthers strengthens the argument against including the small states.

an interpretation since any bias in estimating the other parameters will also affect the ideologies,[20] the rank order of senators is very stable across specifications. A full listing of estimated ideologies for senators in the sample is provided in the Appendix. The reported estimates are based on column (3) of Table 3; similar results are obtained from other specifications. John East (R–NC) is the most conservative senator in the sample with an estimated ideology of −15. Close behind are conservative stalwarts Jesse Helms (R–NC) and Phil Gramm (R–TX). Richard Clark (D–IA) is the most liberal senator with a score of 106. Of the senators 19 percent have negative estimated ideologies; 4 percent have estimated ideologies greater than 100, implying that they are more liberal than the ADA. There are few surprises with respect to the rank ordering of senators. Except for a handful of Southern Democrats, almost all of the most conservative senators are Republicans, and only a few Republicans are ranked among the most liberal senators. One interesting point is that most of the serious Democratic presidential candidates that have emerged from the Senate (Humphrey, Kennedy, Tsongas, Hart) have very similar ideologies (between 81 and 85), and are liberal compared to Senate Democrats as a whole (see also Alberto Alesina and Rosenthal, 1995). The only exception is Walter Mondale who is even more liberal.

The estimates obtained here have important implications for a wide range of political science research. An ongoing debate concerns the extent to which voting records are satisfactory proxies for ideology (as, for instance, Peltzman [1985] assumes). The estimates of Table 3 clearly show that roll-call votes reflect voter preferences and party affiliation in addition to ideology. Because of the strong correlations between ideology and the other determinants of senator voting, however, the raw correlation between estimated senator ideologies and voting records is even higher than the regression coefficients might suggest: over 0.90 in my sample. Thus, voting scores may provide a reasonable proxy for senator ideology.

The flip side of the coin, however, is that studies that use voting patterns as a dependent variable, but do not directly control for ideology due to the lack of available proxies may be seriously flawed due to that omission. The fact that the estimated ideologies are strongly correlated with party affiliation ($\rho \approx 0.40$), state voter preferences ($\rho \approx 0.60$), and preferences of a senator's support constituency ($\rho \approx 0.70$), intensifies concern over the likelihood and magnitude of bias resulting from the omission of ideology as an explanatory variable.

IV. Extensions to the Basic Specification

The model developed here is extremely flexible in its ability to test hypotheses about senator voting patterns. In this section, a wide range of factors that potentially influence decision weights are examined. In all cases, the specification employed uses party leaders as a proxy for the party line, and does not instrument for that variable using lagged values. Therefore, the results reported below are variations on the results reported in column (3) of Table 3. In all regressions, each senator's ideology is constrained to be constant over time.

Table 4 demonstrates the effect of election proximity and tenure in the Senate on decision weights. Columns (1)–(3) compare estimated decision weights when the next election is 4 or more years in the future, 2 to 3 years off, and in election years.[21] As elections near, the weight given to overall state voter preferences doubles, with that increase being offset

[20] For instance, because there is censoring in the dependent variable, the estimated ideologies will tend to be artificially compressed. When procedures that account for censoring, such as Tobit, were used, the estimates of the ideologies were more extreme. The rank order of the ideologies was virtually unchanged, however, and the correlation between the sets of estimates was approximately 0.97.

[21] Senators who retire are not included in the election year estimates since their behavior would be expected to differ from senators seeking reelection. Because the number of retiring senators in the sample is small, however, it is not possible to precisely estimate decision weights in the year of retirement for evidence of shirking.

TABLE 4—THE EFFECT OF ELECTION PROXIMITY AND TENURE ON SENATOR DECISION WEIGHTS

Weight on:	4+ years to election (1)	2–3 years to election (2)	Election year, not retiring (3)	*P* value: (1) = (3) (4)	First term (5)	Later terms (6)	*P* value: (5) = (6) (7)
Overall state voter preferences	0.09 (0.04)	0.12 (0.04)	0.18 (0.05)	0.01	0.21 (0.05)	0.10 (0.04)	0.01
Support constituency preferences	0.14 (0.04)	0.14 (0.04)	0.14 (0.05)	0.93	0.09 (0.05)	0.12 (0.04)	0.49
Party line	0.15 (0.03)	0.11 (0.03)	0.05 (0.04)	0.01	0.09 (0.04)	0.14 (0.03)	0.12
Senator ideology	0.62 (0.05)	0.63 (0.05)	0.63 (0.05)	0.31	0.61 (0.05)	0.64 (0.05)	0.27

Notes: The dependent variable is senator ADA score, adjusted for comparability across years using the techniques of Groseclose et al. (1995). Columns (1)–(3) estimated jointly, restricting senator ideologies to be constant over time. Columns (5) and (6) are also estimated jointly restricting senator ideology to be constant over time. ADA scores of party leaders are used as the proxy for the party line. The estimation procedure allows for heteroskedastic errors across senators. Standard errors are in parentheses. Year dummies are not included in the specifications. To be included in the regression, a senator had to serve at least 6 years between 1970–1990, and had to represent a state with a House delegation of at least 4 members. Standard errors are in parentheses. Only senators who are seeking reelection are included in column (3). Decision weights constrained to sum to 1 in each column.

by a decline in the weight placed on the party line. For both state voter preferences and the party line, the weights significantly differ between columns (1) and (3) at the 0.01 level, as reported in column (4) of Table 4. These results suggest that senators alter their voting patterns as elections approach to better reflect the preferences of the median voter. Senators apparently consider voters to be myopic since most of the change in voting patterns is concentrated in the election year itself. It is interesting, but puzzling, that allegiance to the party line is sacrificed as elections near, but not the weight placed on one's own ideology.

Columns (5) and (6) of Table 4 compare decision weights of first-term senators to those with greater tenure.[22] First-term senators place significantly more weight on overall state voter preferences (0.21 versus 0.10). Senators in their first term also place more weight on members of their support constituency: if the support constituency comprises half of the electorate, then a 1-point change in supporter preferences leads to a 0.195 change by first-termers ($0.09 + 0.5 \cdot 0.21$) compared to a 0.17 change among those with more tenure ($0.12 + 0.5 \cdot 0.10$). The additional weight given to voters is offset by less adherence to the party line and less weight given to ideology.

The results of Table 4 carry implications for the term-limits debate. Term limits will have two direct effects: (i) increasing the number of first-term senators, and (ii) decreasing the number of standing senators seeking reelection. According to the estimates, those two factors will largely counterbalance since first-term senators and those seeking reelection exhibit similar voting patterns. There may, however, be general equilibrium effects that result from the imposition of term limits that are not captured by this analysis.

Columns (1)–(3) of Table 5 compare estimated weights by party affiliation, differentiating between Northern and Southern Democrats. The point estimates suggest that Southern Democrats are most responsive to both overall state voters and their support constituency, while Republicans are least responsive. Although the individual point estimates do not significantly differ across columns (1)–(3), the null hypothesis of no difference

[22] No statistically significant differences in decision weights were detected between second-term, third-term, and higher-term senators.

TABLE 5—THE EFFECT OF PARTY AFFILIATION AND TIME PERIOD ON SENATOR DECISION WEIGHTS

Weight on:	Northern Democrats (1)	Southern Democrats (2)	Republicans (3)	*P* value: (1) = (2)/(1) = (3) (4)	1970's (5)	1980's (6)	*P*-value: (5) = (6) (7)
Overall state voter preferences	0.11 (0.08)	0.31 (0.14)	0.06 (0.05)	0.19/0.67	0.17 (0.05)	0.10 (0.04)	0.07
Support constituency preferences	0.12 (0.07)	0.16 (0.10)	0.10 (0.05)	0.76/0.77	0.12 (0.05)	0.07 (0.04)	0.20
Party line	0.16 (0.05)	0.07 (0.05)	0.05 (0.05)	0.20/0.13	0.04 (0.03)	0.16 (0.03)	0.01
Senator ideology	0.61 (0.09)	0.46 (0.08)	0.79 (0.08)	0.20/0.15	0.67 (0.05)	0.67 (0.05)	0.96

Notes: The dependent variable is senator ADA score, adjusted for comparability across years using the techniques of Groseclose et al. (1995). Columns (5) and (6) are estimated jointly restricting senator ideology to be constant over time. ADA scores of party leaders are used as the proxy for the party line. The estimation procedure allows for heteroskedastic errors across senators. The standard errors are given in parentheses. Year dummies are not included in the specifications. To be included in the regression, a senator had to serve at least 6 years between 1970–1990, and had to represent a state with a House delegation with at least 4 members. The standard errors are given in parentheses. Southern states are those classified as Southern by Congressional Quarterly. Decision weights constrained to sum to 1 in each column.

across columns in the *total weight given to state voters* (overall state voters plus support constituency) can be rejected at the 0.05 level across all three columns. Southern Democrats appear to put relatively low weight on their own ideology. Republicans, in contrast, are guided almost exclusively by ideology. Northern Democrats demonstrate the most allegiance to the party line.

Columns (5) and (6) compare estimated decision weights in the 1970's to the 1980's. Senators in the 1970's are more responsive to state voters both within and outside their support constituency. Although the individual parameters on voter preferences do not differ significantly across the columns, equality of the sum of weights given to voters can be rejected at the 0.01 level. The decline in responsiveness to voters has been matched by a sharp increase in the importance of party (0.04 versus 0.16). These results concerning the strengthening of parties are consistent with the empirical work of Rohde (1991) and Snyder (1994), both of which find a significant increase in party voting in the 1980's.

One might predict that senators who expect to be involved in close elections would be more responsive to voters than those holding safe seats.[23] Two separate tests of this hypothesis were undertaken, although space considerations preclude tabular presentation of the results. First, senators were divided according to whether their share of the two-party vote in the previous election was greater than or less than 60 percent.[24] Senators who won with less than 60 percent of the vote in their last election assign a total of 29 percent of their decision weight to state voters (both within and outside

[23] Of course, senators who disregard the interests of the electorate will likely be punished by voters, leading them to be involved in close elections, even though their seat would have been safe had they voted with state interests. In fact, I find some evidence for that story. If senators are divided between those who received a smaller fraction of the two-party vote than did the presidential candidate from their party in the last presidential election, those senators who are less popular than the president place significantly more weight on their own ideology at the 0.02 significance level. Consequently, the comparisons presented below, which do not differentiate between the two reasons senators might be vulnerable (that is, holding marginal seats versus ignoring voter concerns) will tend to be biased *against* finding that close elections induce more attention to voter preferences.

[24] Other cutoffs were also examined with similar results.

their support constituency), compared to 23 percent for senators who won by a wider margin. Those estimates differ from one another only at the 0.12 level, however.

A second test of whether elections bind involves comparing the decision weights of senators who eventually lose to those who either retire or still hold office.[25] Defeated senators are likely to have held marginal seats throughout their tenure, and therefore should be most responsive to voters. In fact, that hypothesis is strongly supported in the data. Eventual losers assign 45 percent of the weight in their decision functions to state voters (both within and outside their support constituency), compared to 22 percent for all other senators. Those weights are significantly different at the 0.01 level. It is also interesting to note that eventual losers are especially responsive to voters outside their support constituency. The ratio of weight given to voters inside versus outside the support constituency (assuming the support constituency comprises half of the electorate) is 1.5:1 for eventual losers, compared to 6:1 for all other senators. Thus, it appears that vulnerable senators attempt to move towards the median voter.[26]

V. Conclusions

This paper attempts to disentangle the relative weights that senators assign to various factors in establishing a voting record. The primary methodological contribution of this work is the attainment of consistent estimates even though senator ideologies are not observed. Voter preferences and the national party line are both shown to play a role in predicting senator voting patterns, but ideology is the primary determinant. Less than one quarter of the weight in the decision function is devoted to voter preferences, suggesting a substantial amount of discretion on the part of senators. Even among the weight that is devoted to voter preferences, the median voter theorem fares poorly: 2 to 3 times as much weight is given to the preferences of supporters relative to nonsupporters.

Elections act as constraints on senator behavior, particularly when reelection is in jeopardy. As elections approach, the weight placed on voters outside the support constituency doubles. The weight given to supporters also rises. Senators who received less than 60 percent of the two-party vote in their last election also appear to put more weight on voter preferences. The most precarious senators—those who are eventually defeated—place twice as much weight on voter preferences and are especially responsive to voters outside their support constituency.

The apparent importance of ideology in explaining senator voting has implications for voting study research. Ideologies are strongly correlated with party affiliation as well as voter preferences both inside and outside of the support constituency. Therefore, any analysis that purports to attribute a causal role to any of those factors without explicitly controlling for ideology is unlikely to obtain reliable results due to omitted variable bias. The estimated ideologies obtained in this analysis could be used to control for senator ideology in future research.

Because the estimation technique applied in this paper requires only roll-call voting data, it can be applied to any time period and any subset of roll-call votes. For instance, one could examine earlier periods of U.S. history, tracing the importance of parties and the degree of voter representation over time. It might also be of interest to apply this methodology to other legislatures. Alternatively, one could determine how voting patterns vary across policy areas, comparing, for instance, economic issues to social or foreign policy questions.

[25] Of the senators in the sample, 31 are eventual losers.

[26] Another possible scenario involves causality running the other direction, that is, senators who are too moderate alienate their support constituency and consequently have trouble getting reelected. The story seems unlikely to be true, however, since eventual losers not only place more weight on those outside the constituency, but also place more weight on those inside the support constituency.

APPENDIX—ESTIMATED IDEOLOGIES FOR SENATORS IN SAMPLE

Estimated ideology	Senator name	State	Party	Estimated ideology	Senator name	State	Party
−15	East	NC	R	44	Dixon	IL	D
−14	Jepsen	IA	R	45	Huddleston	KY	D
−13	Helms	NC	R	45	Randolph	WV	D
−13	Gramm	TX	R	50	Durenburger	MN	R
−12	Nickles	OK	R	51	Hartke	IN	D
−12	Armstrong	CO	R	51	Pearson	KS	R
−9	Thurmond	SC	R	52	Packwood	OR	R
−8	McConnell	KY	R	52	Jackson	WA	D
−7	Kasten	WI	R	53	Ford	KY	D
−7	McClellan	AR	D	53	Heinz	PA	R
−6	Eastland	MS	D	59	Gore, Jr.	TN	D
−6	Allen	AL	D	59	Percy	IL	R
−6	Denton	AL	R	61	Magnuson	WA	D
−6	Goldwater	AZ	R	61	Schweicker	PA	R
−5	Mattingly	GA	R	62	Proxmire	WI	D
−5	Quayle	IN	R	64	Glenn	OH	D
−5	Lugar	IN	R	64	Pryor	AR	D
−5	Fannin	AZ	R	66	Sasser	TN	D
−4	Tower	TX	R	67	Rockefeller	WV	D
−3	Trible	VA	R	68	Specter	PA	R
−3	Hayakawa	CA	R	69	Symington	MO	D
−2	Byrd, H.	VA	D	69	Dodd, C.	CT	D
−1	Bartlett	OK	R	71	Weicker	CT	R
−1	Grassley	IA	R	75	Simon	IL	D
0	Dole	KS	R	75	Moynihan	NY	D
1	Griffin	MI	R	76	Ribicoff	CT	D
2	Warner	VA	R	79	Bayh	IN	D
2	Stennis	MS	D	79	Bumpers	AR	D
3	Cochran	MS	R	80	Kerry	MA	D
5	Scott, W.	VA	R	80	Bradley	NJ	D
6	Baker	TN	R	81	Humphrey, H.	MN	D
8	Long	LA	D	82	Kennedy	MA	D
8	Brock	TN	R	82	Hart, G.	CO	D
8	Talmadge	GA	D	82	Tunney	CA	D
9	D'Amato	NY	R	82	Hatfield	OR	R
9	Hawkins	FL	R	83	Stevenson	IL	D
12	Boschwitz	MN	R	83	Eagleton	MO	D
14	Gorton	WA	R	84	Mathias	MD	R
14	Morgan	NC	D	85	Tsongas	MA	D
15	Bellman	OK	R	85	Haskell	CO	D
16	Sparkman	AL	D	86	Brooke	MA	R
16	Heflin	AL	D	86	Lautenberg	NJ	D
18	Stone	FL	D	87	Levin	MI	D
19	Boren	OK	D	89	Williams, H.	NJ	D
21	Beall	MD	R	90	Riegle	MI	D
22	Nunn	GA	D	91	Cranston	CA	D
25	Taft	OH	R	91	Javits	NY	R
25	Johnston	LA	D	94	Hart, P.	MI	D
26	Danforth	MO	R	97	Nelson	WI	D
29	Bentsen	TX	D	98	Sarbanes	MD	D
30	Scott, H.	PA	R	99	Harkin	IA	D
36	Hollings	SC	D	100	Culver	IA	D
38	DeConcini	AZ	D	101	Mondale	MN	D
42	Chiles	FL	D	103	Metzenbaum	OH	D
42	Kassebaum	KS	R	104	Case	NJ	R
42	Byrd, R.	WV	D	106	Clark	IA	D

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