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THE POLITICAL ECONOMY OF ROLL-CALL VOTING
IN THE "MULTI-PARTY" CONGRESS
OF THE UNITED STATES*

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1. *Introduction*

American politics is commonly characterized as being based upon a two-party system. Scholars, however, have long characterized the national parties as little more than loose federations of state parties. Indeed, the virtual absence of party discipline in roll-call voting in the United States Congress nicely points out that the United States has but faint traces of what would be considered a party system in Europe. Rather than having a two-party system, in many respects the United States has a multi-party system where it is each legislator for himself.

Rather than being anarchical, however, the American political system is highly structured along ideological lines. The liberal-conservative continuum can be used to classify correctly over 80 per cent of all the roll-call votes (Poole and Daniels, 1985; Poole and Rosenthal, 1985). The extent of polarization along ideological lines has increased in recent years (Poole and Rosenthal, 1984; Romer and Rosenthal, 1984). Yet, rather than being clumped about two points on the continuum, representing two "responsible" (Committee on Political Parties, 1950) political parties,

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members of Congress are spread out in a relatively smooth, if bimodal, distribution.

Economists, most notably Peltzman (1984), have taken the extreme view that this ideological diversity is largely, if not entirely, the consequence of differing economic interests represented by the legislator either in terms of his overall constituency or the voters who supported him at the polls or his campaign contributors. An opposite view is that this ideological diversity is largely the personal ideology of the legislator. Other economists, such as Kalt and Zupan (1984) and Kau, Keenan, and Rubin (1982), have in fact concluded that ideology plays an important role in determining roll-call voting even when one controls for the effect of economic interests.

Obviously, this controversy of ideology vs. economic interests cannot be resolved with current methodologies insofar as the economic interests of the constituency and the personal ideology of the legislator are likely to be highly correlated. Because of this collinearity, it is not appropriate to define ideology, as have Carson and Oppenheimer (1984), as the unexplained residual of liberal-conservative position, after controlling for economic factors.

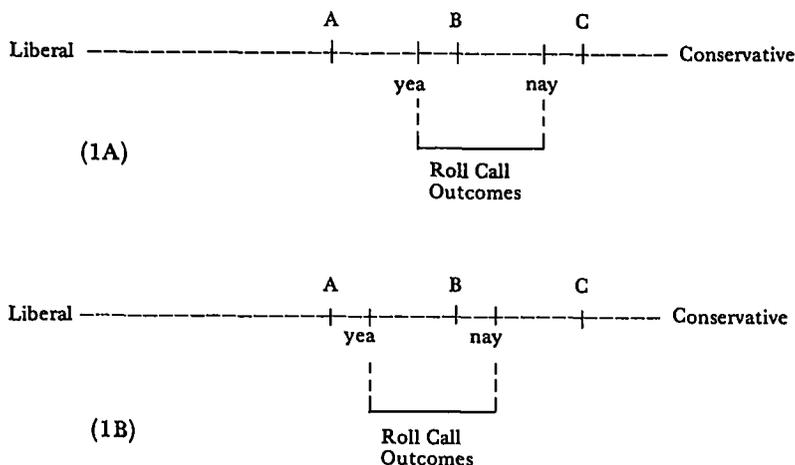
Rather than continue the meta ideological discussion of ideology vs. economic interests, we propose to proceed in a more constructive and operational manner. We note that there are basically two sets of data that have been used to explain Congressional roll-call voting behaviour. One is various measures of the basic liberal-conservative continuum, derived either from ratings issued by such interest groups as the ADA (Americans for Democratic Action) or COPE (Committee on Political Education). The second is "other" variables, chiefly aggregate constituency measures (e.g., per capita income) developed from the census and other government sources. The scientific questions we can ask are: (1) Do these other variables explain liberal-conservative position? (2) Do we get information about roll-call voting from these other variables that is not already contained in the "ideological" liberal-conservative measure?

2. Measuring Liberal-Conservative Ideology

Our basic spatial model of choice (e.g. Downs, 1957, MacRae, 1958) is that legislators have symmetric, single-peaked preferences on a unidimensional continuum. Preferences are strictly mono-

tonic about the peak, known as the ideal point. We refer to this continuum as the liberal-conservative dimension. Each legislator can be represented as a point on this continuum, where the point corresponds to his ideal point or point of maximum preference. Each roll call can be represented by two points, one corresponding to a “Yea” and another to a “Nay” vote¹.

Figure 1: *Voting on the Liberal-Conservative Dimension*



If voting were errorless along the dimension, each legislator would always vote for the alternative closest to his ideal point. So, in Figure 1A, legislators A and B would vote *yea* and C would vote *nay* while in Figure 1B, only A would vote *yea*. Of course, few, if any votes, will fit perfectly along the dimension, and, as explained below, provision must be made for error.

How is the continuum measured? The most widely used approach, typified by the economics literature previously cited, is to use a rating issued by an interest group as a continuum. Thus, people rated 100 by the ADA would be the most liberal, while those with 0 ratings would be the most conservative. This approach has two deficiencies. First, if the interest group itself is not more extreme than all the legislators, its ratings will be folded over. For example, a moderately liberal interest group might give identical ratings to extreme liberals and to centrists. Second, there

1 For alternative spatial representations of roll-call votes, see Weisberg (1972) and Wolters (1984).

are many interest groups (about 25 each year) issuing ratings. Each of these ratings is likely to be a relatively noisy measure of liberal-conservative position. To overcome these deficiencies, Poole (1981, 1984) developed a psychometric method which recovers liberal-conservative positions simultaneously from all the ratings.

The ratings themselves are based on how an interest group "scores" a relatively small number of roll-call votes of special significance to the group. An alternative method of finding liberal-conservative positions simply operates directly on the roll-call voting data and simultaneously recovers the positions of the legislators and the roll calls (Poole and Rosenthal, 1985). For a given year, the direct scaling procedure and the interest-group scaling procedure produce results for the legislators that correlate at 0.95 or better.

As mentioned earlier, given these liberal-conservative positions and an estimate of the midpoint (the average of the *yea* and *nay* locations) on a roll call, we can correctly classify upwards of 80 per cent of the individual votes. From the view point of our spatial models, these results should not be surprising. If ideology is determinant, every vote is in fact a measure of ideology. Finding that "ideology" predicts well is much like finding that a lagged dependent variable explains most of the variance in a regression model. The questions to investigate are: (1) Do the external constituency variables explain the liberal-conservative positions; (2) on a given roll call, can we learn anything else from the constituency variables that is not already incorporated in the continuum measure? For example, are measures of constituency costs and benefits from coal strip-mining (Kalt and Zupan, 1984) relevant to the analysis of voting on strip-mine legislation?

3. Inadequacy of the Specification Used by Economists

To answer these questions, we will have to critique the analysis of economists from the viewpoint of the spatial model. We point out that, at least implicitly, the spatial model has been widely used by economists in the analysis of local government expenditure (e.g. Bergstrom and Goodman, 1973) and tax policy (e.g. Meltzer and Richard, 1981). In those analyses, the spatial varia-

² The discussion below is obviously valid if the ideal point is a function of several exogenous variables.

ble might be expenditure or a parameter denoting the progressivity of the tax rate.

In the analysis of Congressional roll-call voting, economists have typically used a logit specification. To our knowledge, scholars who have carried out logit estimation of roll-call voting have not developed the connection of the logit model to spatial voting. In fact, the relationship is quite simple. The general relationship can be shown with a univariate example. Suppose the vote were over expenditure and that preferences for expenditure depended on a sole variable, median constituency income². Assume the relationship of a senator's ideal point in expenditure (E_{ideal}) is linear in income (I):

$$(1) \quad E_{ideal} = \gamma_0 + \gamma_1 I$$

Moreover, assume that utility for expenditures is quadratic about the ideal point but subject to a Weibull disturbance, v :

$$(2) \quad U(E) = -(E - E_{ideal})^2 + v/\beta$$

The parameter β scales the Weibull error relative to the deterministic portion of the utility function. If β is large, senators are almost always voting for the closest alternative. As β approaches zero, senators come close to voting by flipping coins. The error term represents non-spatial determinants of the legislator's evaluation, such as loyalty to the leadership or the President or a log-rolling obligation, that we are unable to observe³.

Now let the proposed "yea" vote for an expenditure be z_y , and the "nay" alternative be z_n . We obtain:

$$(3a) \quad U(z_y) = -(z_y - \gamma_0 - \gamma_1 I)^2 + v_y/\beta$$

$$(3b) \quad U(z_n) = -(z_n - \gamma_0 - \gamma_1 I)^2 + v_n/\beta$$

Expanding the square and subtracting gives:

$$(4) \quad U(z_y) - U(z_n) = -[z_y^2 - z_n^2 - 2\gamma_0(z_y - z_n) - 2\gamma_1(z_y - z_n)I] + v_y/\beta - v_n/\beta$$

Because the quadratic income term vanishes, one is left with a logit estimation that is linear in income. However, ignoring β for the time being, there are four parameters to estimate in this

3 Ladha (1984) shows that this form of error would not be appropriate to model either perceptual error or omitted spatial dimensions.

structural model, z_y , z_n , γ_0 and γ_1 , but the logit estimation provides only two coefficients. As the structural model is not identified, the coefficient on income has no ready interpretation. It is the product of the effect of income on preference and the "spread" between the roll-call alternatives. Finding a substantial coefficient on income does not differentiate between a prodigious effect for income and large separation among roll-call alternatives.

One way to identify the coefficients γ_0 and γ_1 would be to assume that they are constant across roll calls (or a substantial subset of roll calls)⁴. But even here there is a fundamental problem of identifying β . If we rewrite (4) in the estimation equivalent form:

$$(4') \quad U^*(z_y) - U^*(z_n) = -\beta(z_y - z_n)[(z_y + z_n) - 2\gamma_0 - 2\gamma_1] + v_y - v_n,$$

it can be seen immediately that, with quadratic utility, we can never identify the noise level separately from the spread, $|z_y - z_n|$. It is important to do so. In comparing two roll calls, we would like to know if alternatives were more distinct on one than on the other. We would like to know if voting were more systematic (less noise) on one than on the other.

We ourselves have abandoned a quadratic utility model only partly for these identification reasons. We also have strong priors that the assumption of increasing marginal loss inherent in a quadratic model is not realistic for political actors. Legislators should be nearly indifferent over alternatives that are remote from the ideal point. In this case, marginal loss should approach zero as alternatives become remote from the ideal point. We implement this viewpoint by using a quasi-concave utility function.

4. *Our Specification and Tests of "Ideology" vs. Constituency Variables*

As an alternative to the standard linear logit model, we (Poole and Rosenthal, 1985) adopted the quasi-concave function:

⁴ The estimation could proceed as follows. Define the scale of the space by arbitrarily fixing z_y and z_n for one roll call. Results from this roll call then provide values for γ_0 and γ_1 . In turn, these values can be used to find z_y and z_n for the other roll calls when β is fixed.

$$(5) \quad U(z_{yj}) = \exp\left[-\frac{w^2}{2} (z_{yj} - x_i)^2\right] + v_{yj}/\beta$$

$$U(z_{nj}) = \exp\left[-\frac{w^2}{2} (z_{nj} - x_i)^2\right] + v_{nj}/\beta$$

where j indexes the roll calls and i indexes the legislators and where x_i , the ideal point of a legislator, receives the following specifications:

- A. $x_i = \gamma_i$; an estimated parameter that is constant across all roll calls. In other words, each roll call is viewed as a contest on the liberal-conservative dimension. "Ideology" determines voting. We refer to this as the IDEOLOGICAL model. We have preset w to 1/2.
- B. $x_i = r_i' \gamma$ where r_i is a vector of independent variables. Note that the coefficient vector γ is subscripted neither by legislator nor by roll call. In other words, the liberal-conservative position is constrained to be a common linear function of constituency characteristics. We refer to this as the CONSTITUENCY model.

If the coefficient vector were subscripted by legislator, there would be no way to identify the coefficients separately from the single ideological parameter in the IDEOLOGICAL model. However, we can combine ideology and constituency characteristics by finding an external measure of ideology. We first regress this external measure on the independent variables and then use its residual as a variable in r_i . This allows the constituency variables to pick up as much of the likelihood as they can. We refer to this model with the residual as CONRES.

The coefficients of these models are all identified (up to linear transformation of the entire space), including the z_y , z_n , and β (β is assumed constant across all roll calls).

To compare these models with the standard fare produced in the literature, we conducted a linear logit estimation of roll calls using the vector r_i , with separate coefficients estimated for each roll call. We refer to this as the LINEAR model. Finally, LINRES combines the linear model with the residual. The models are summarized in Table I as they pertain to the data described below.

Table I: *Description of Models*

	Estimated Parameters	Specification of x_1
CONSTITUENCY	$\beta, \gamma, z_{yj}, z_{nj}, j = 1, \dots, 568$	$x_i = r_i \gamma$
CONRES	Identical to Constituency except that r_i vector augmented by residual from regression of exogenous liberal-conservative measure on r_i .	
LINEAR	$\gamma_j, j = 1, \dots, 568$ [Note: β, z_{yj}, z_{nj} not identified]	$x_{ij} = r_i \gamma_j$
LINRES	Identical to LINEAR except r_i augmented by residual.	
IDEOLOGICAL	$\beta, \gamma_i, i = 1, \dots, 100$ $z_{yj}, z_{nj}, j = 1, \dots, 568$	$x_i = \gamma_i$

5. *The Data*

We decided to focus on the Senate in 1977 as this is the central year in the study of Kalt and Zupan (1984). We considered all roll calls with more than 2.5 per cent of those voting or paired or announced votes being on the minority side (at least three minority votes out of 100 senators in most cases). There were 568 such roll calls. Our 2.5 per cent filter can be contrasted with the work of Peltzman (1984) who analyzed only votes with 25 minority votes or more. We need to include the minority votes to gain information about the x_i values of extreme liberals and extreme conservatives. On roll calls that have large minorities, most liberals will be on the same side and most conservatives will be on the other side. Using roll calls with minorities over 25 votes will thus only provide information about the relative positions of moderates.

As for constituency characteristics, in CONSTITUENCY and LINEAR, we used a subset of the general constituency characteristics used by Kalt and Zupan. These were party, income, growth, education, urbanization, union membership, age, and manufacturing. Party is, of course, a dubious choice as an "economic" variable. It may proxy interests of support groups. In any event, we included it to deliberately load the dice in favor of the

constituency-interests hypothesis. We dropped the Kalt and Zupan environmental variable because we believed it to be poorly measured and mainly related to their specialized concern with strip-mining. We also dropped the percentage of vote for McGovern in 1972, which we viewed as a purely political variable. We added percentage non-white. In summary, r_i has 9 variables plus a constant. Our choices closely parallel those of Peltzman (1984) who embarks on a similar "fishing expedition" (his apt term) and uses seven average characteristics.

Rather than being concerned with all roll calls, Kalt and Zupan studied strip-mining legislation in detail. They developed seven independent variables designed to measure constituency interest on this specific issue. These variables included changes in marginal cost, surface reserves, underground reserves, the fraction of electricity generated by coal, support for environmental groups, agriculture/timber yield of strip-mine acreage, and the value of already-stripped but unrestored acres. We use these variables in applying LINEAR and LINRES to a separate analysis of the 10 1977 strip-mine roll calls selected by Kalt and Zupan.

Our external measure of ideology comes from scaling interest group ratings. For senators who had served in 1976, we used their 1976 liberal-conservative positions. For those who entered the Senate in 1977, we used their 1978 position⁵. Thus, the external measure does not reflect 1977 roll-call data.

6. Results

The results⁶ for the entire set of 568 roll calls are shown in Table II. It can be seen that CONSTITUENCY without party is a very poor model. The ideological position of the senators and its relation to roll-call voting are poorly captured by "average" characteristics. Adding party to the linear combination helps matters considerably. Even with party included, there is another dramatic improvement from adding the residual of the ideology variable. By adding only two parameters (for the party and residual variables) over 568 roll calls, we are able to classify correctly nearly 8 more votes per roll call and to raise the geometric mean probability from .585 to .668. (This quantity is obtained by

5 These positions were computed by Poole and Daniels (1985).

6 The quantitative results in Tables II–IV are due to Krishna Ladha.

taking the log-likelihood, dividing by the total of 51,283 votes and exponentiating.)

Table II: *Estimation Results*

Model	Number of Estimated Parameters	Percentage Correctly Classified	Log-Likelihood	Geometric Mean Probability
CONSTITUENCY without Party	1146	73.2	-27469.1	0.585
CONSTITUENCY with Party	1147	78.2	-23454.3	0.633
CONRES with Party	1148	81.0	-20726.3	0.668
IDEOLOGICAL	1237	82.3	-19741.7	0.680
LINEAR	5680	82.8	-18981.7	0.690
LINRES	6248	86.2	-15472.0	0.740

The ideological residual accomplishes much of what is to be gained by fine-tuning the x_i directly from the 1977 data in the IDEOLOGICAL estimation. Still, the improvement in classification, and likelihood of IDEOLOGICAL over CONRES seem to justify the larger set of parameters.

In contrast, it is difficult to endorse the LINEAR model. With 4400 more parameters than IDEOLOGICAL, LINEAR barely does better than a pure model of spatial voting. LINEAR is improved substantially by the addition of the ideological residual.

The importance of the ideological residual is shown in Table III which compares CONSTITUENCY and CONRES and LINEAR and LINRES. The Chi-square probabilities are based on the likelihood contributions from each roll call. In both cases, there is a very disproportionate number of roll calls in the tail of the distribution of likelihood-ratio test results.

Table III: *Significance of Ideological Residual*

Chi-Square Probability	Residual Added to . . .		Expected Under Null Hypothesis
	CONSTITUENCY	LINEAR	
.001-.000	239	286	0.6
.01-.001	94	72	5.1
.025-.01	30	34	8.5
.05-.025	22	16	14.2
.10-.05	16	27	28.4
1.00-.10	167	133	511.2
Total Roll Calls	568	568	568

Note: CONSTITUENCY calculations assume one parameter added per roll call.

The various models we have estimated are not all nested. However, CONSTITUENCY is nested within CONRES and LINEAR is nested within LINRES. As shown in Table IV, the standard likelihood-ratio test is highly significant for these comparisons. Adding the ideological residual variable is important to both models.

Table IV: *Chi-square Probabilities*

	(1)	(2)	(3)	(4)	(5)
(1) CONSTITUENCY w/o Party					
(2) CONSTITUENCY with Party	.001				
(3) CONRES with Party	.001	.001			
(4) IDEOLOGICAL	.001	.001	.001		
(5) LINEAR	.001	.001	.999	.999	
(6) LINRES	.001	.001	.001	.001	.001

Note that only models (1), (2), (3) and models (5), (6) are nested. When degrees of freedom exceed 30, we approximate the significance probability by using $\sqrt{2\chi^2} - \sqrt{2df-1}$ as a normal deviate with unit variance.

To compare the non-nested models, we sin by running the standard test when it is inappropriate. Because of the large effective sample size, the test probability either tilts to highly significant or highly non-significant. The IDEOLOGICAL model is an improvement over all the models where constituency variables are constrained to have a single coefficient across all roll calls. Liberal-Conservative positions clearly cannot be explained as simple linear combinations of aggregate characteristics.

Only two comparisons were non-significant. The LINEAR model does not improve on the IDEOLOGICAL model nor does it improve on CONRES. This latter result, if it can be upheld by an appropriate test for non-nested models, is important. It says that we cannot do better allowing free coefficients for constituency variables on every roll call than by constraining the coefficients to be equal across roll calls and adding the ideological residual.

On the other hand, LINRES is a significant improvement over all other models. It says that economic variables and ideology together do better than either alone. Yet we must be cautious in evaluating LINRES. Whereas IDEOLOGICAL is a parsimonious model with a clear theoretical backing, there is nothing in

LINRES other than the "fishing expedition" philosophy that aggregate constituency characteristics will, in some way, influence roll-call behavior. There is no theory to tell us how all those free coefficients will float across the roll calls.

The primacy of the ideological model is reinforced by analysis of Kalt and Zupan's 10 strip-mining roll calls. Applying LINEAR with the seven issue-specific constituency variables selected by Kalt and Zupan shows a log-likelihood of -352.84 , which is actually worse than that obtained by the conceptually simpler IDEOLOGICAL model. The total contribution of these 10 roll calls to the log-likelihood for that model is -335.67 . LINEAR is rescued only by the addition of the ideological residual, which significantly raises the log-likelihood to -319.8 . The residual has a significant t-statistic at the .10 level or less in 5 of the 10 individual roll-call estimations. The test statistic for all 10 roll calls jointly shows that the improvement from adding the residual is significant at less than .001.

7. Discussion

We find ourselves in agreement with those authors who emphasize that ideology is important even when economic variables have been considered. More strongly, our results argue that constituency variables add little in the way of systematic, non-spurious knowledge to what was learned from the IDEOLOGICAL model.

In contrast, we think Peltzman (1984) has overinterpreted his findings in favor of the constituency story. For one, he presents a set of tables indicating there is little explanatory power to ideology once constituency characteristics are controlled for, but the reverse tables are not present. We do not know how much constituency characteristics explain once ideology is controlled for. Even within his context, Peltzman minimizes the importance of ideology. He fails to point out, for example, that in his ADA final regression, the t-statistic on party is higher than that of 4 of 7 of his average characteristics and 2 of 6 of his support group characteristics while in his COPE regression, by this criterion, party does better than 6 of the 7 average characteristics and all of the support group characteristics. Similarly, ideology is important in his roll-call estimates.

There is, however, a highly innovative aspect to Peltzman's specification. Peltzman makes the insightful observation that

legislators may be more atune to the economic interests of key support groups than to those of “median” or “average” voters. Peltzman included variables for these support groups. Unfortunately, the measurement of these variables is problematic. Peltzman regressed county-wide voting percentages against demographic and economic variables within each state. Variables with regression t-statistics for that state above 1.5 were then given non-zero entries in a dummy variable for support group. In addition to this procedure being rather arbitrary, it is likely to create dummy variables that correlate quite highly with another dummy variable of interest, the senator’s party. We are neither impressed nor surprised that this somewhat tortuous procedure picks up much of the variation that is explained by party.

Kalt and Zupan (1984) point out that, for strip-mine roll-calls, they also developed a number of measures likely to capture support-group interests. These did not better our IDEOLOGICAL model. However, Kalt and Zupan failed to address a theme implicit in Peltzman’s specification — senators from different parties will have different support groups. Peltzman’s efforts along these lines are worth pursuing.

In conclusion, to Peltzman’s assertion that economists can operate as if ideology were unimportant, we would reply that political scientists can be even safer in assuming that economics is unimportant once ideology has been accurately measured. Of course, both of these extreme views are somewhat ludicrous. We suspect that economic interests are much more likely to be manifest when a bill goes through the committee process than when it reaches the roll-call voting stage. Nonetheless, we suspect that the spatial model theme we have developed here will be quite resistant to any constituency characteristic modifications.

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Abstract

The Congress of the United States can be characterized as a "multi-party" system where each legislator has a unique position on a liberal-conservative dimension. This dimension correctly classifies over 80 percent of individual roll-call votes. Previous attempts to explain roll-call voting by economic characteristics of constituencies have not been developed within a spatial model of choice. Within the context of a spatial model, constituency characteristics representing state "averages" do not succeed as explanatory variables and add little, if anything, to the explanatory power of liberal-conservative position. This point is documented by the analysis of 568 Senate roll calls for 1977 and a specific set of coal strip-mine roll calls previously analyzed by Kalt and Zupan.