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Political Action and Party Formation in the United States Constitutional Convention

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SULLEN DELEGATES AND MISSING DATA

One explanation of changing patterns of states' votes across the term of the Convention involves a hypothesized alternation between one type of issue (higher-order questions) and another (lower-order questions). Alliances (or at least convergences of voting) between states are said to change as the type of question shifted. There is no reason to think, however, that such formal shifts from higher- to lower-order questions are the only, or even the dominant, explanatory factor in temporal shifts in alignments. If the type of issues being treated changed over the course of the Convention, and this changed the relations between states as a result, we should see evidence of this in a conventional factor analysis.

After first dropping the 72 unanimous votes, we can carry out such an analysis by analyzing the 497×497 matrix of correlations between nonunanimous votes. However, certain methodological problems arise. The first pertains to missing data. As discussed in the text, some data are missing because a state delegation did not appear at a certain time; indeed, there were large stretches in which certain states were not present at all. New York only cast votes on the first 131 motions; New Hampshire does not appear on the voting record until vote 203. As a result, the delegations from New York and New Hampshire were never simultaneously present at the Convention.

In this case, the pattern of missing data created as a result of these absences is problematic for factor analyses because the resulting correlation matrix is not positive definite; consequently, we must impute the unobserved values.[1] As we note in the text, new and more rigorous techniques of imputation recently

[1] To avoid artificially introducing variation into our data, we do not impute values for states whose delegations did not vote on issues that were otherwise unanimous. While a missing state *may* have changed the nature of the vote had it been present, a more likely counterfactual is that this absent state would have joined the rest in unanimity.

have been developed. Here we impute missing data using an expectation-maximization (EM) algorithm (as incorporated in SAS) that produces maximum-likelihood estimates of missing data values by using available nonmissing data from relevant predictive variables (Allison 2001). We constrain the predictions v to fall in the range $-1 \leq v \leq +1$ through truncation.[1] When researchers wish to estimate the significance of independent variables in a causal model, this stage is generally followed by the construction of a number of data sets using multiple imputation. Because we are neither interested in confidence intervals nor in a causal model, this type of approach is irrelevant to us. The issue of variability in the imputation procedure is, however, still important. The stochastic nature of the imputation process means that different imputed data sets will vary to some extent. We have therefore repeated the imputation procedure five times and compared the results (results available from the authors). While any individual number retrieved (for example, a particular factor loading) does of course change, the overall pattern is robust and hence our conclusions do not seem to be due to the particularities of the imputation.

Because the imputation procedure relies on available data, it is inherently conservative, in that it assumes a constancy of behavior. For example, in predicting values for the 202 votes that the New Hampshire delegation missed over the course of the Convention, the imputation algorithm is essentially forced to assume that the New Hampshire delegation would have voted the same way on the votes it missed as it did on the votes where it was present. We thus expect the results to be biased toward a lack of change.[2]

[1] We repeated all analyses without truncation; this increases the strength of the third factor in Table 1 to the point where it is equivalent in magnitude with the second factor. Other than this, not truncating does not affect our conclusions and we consider truncation the more conservative option.

[2] We replicated the analyses eliminating New York and New Hampshire to examine robustness. Without New York we would understate the importance of the third factor in the early part of the Convention. Further, although New York's data contributes greatly to our identification of the third factor, the same is true for almost all the states (that is, when a state is omitted this factor is hard to identify). In sum, there is no reason to think that our decision to impute adversely affected the conclusions; although our conclusions would *not* be the same if instead of imputing we had dropped New York, our conclusions would also change if we had dropped any *other* state.

The second methodological complication has to do with the nature of collective votes. The original data are in the form of a trichotomy, since every state could vote for (+1) or against (–1), and in some cases a tie within a state's delegation led it to cast what was formally referred to as a "divided" vote (0). Since there are relatively few ties, our data are in the form of a near-dichotomy. A conventional factor analysis of dichotomous data, however, is likely to incorrectly state the number of factors (see Takane and de Leeuw 1987; Reise 1999:224f). There are two possible solutions to this, depending on whether we envision the underlying data as either inherently continuous and collapsed or as intrinsically dichotomous and stochastic. In our case, the initial data (individual-level votes) are clearly continuous and collapsed to form state-level votes, and hence we re-created the underlying continuous correlations using a conventional tetrachoric correlation approach.[3] Submitting the tetrachoric correlation matrix to factor analysis led to the same conclusions as the factor analysis of the original data.

In sum, our results do not seem to be greatly affected by the way in which we handle the aforementioned data problems. Here we present the results from a conventional factor analysis that averages imputed values from five different constructed data sets. We do a principal factors extraction with varimax rotation, the most commonly used and easily interpreted approach (Rummel 1970; Kim and Mueller 1978a, 1978b). (We chose the conventional factor analysis as opposed to the tetrachoric because an additional adjustment must be made to the matrix of tetrachoric correlations to ensure that it is positive definite; this necessarily affects the resulting estimates somewhat.)

FIRST AND SECOND ORDER QUESTIONS

As noted above, one recent explanation for the temporal evolution of political action in the

[3] One might expect that given the trichotomous data one could attempt a more general polychoric approach, but the distribution for each variable is so completely nonnormal (bimodal) that such a polychoric correlation is ruled out from the start. To dichotomize the data before producing the tetrachoric correlations, there are three possibilities. One is to recode ties as "0," a second to recode ties as "1," and a third to treat ties as missing and to impute the results as we imputed the unobserved missing data. We did all three, and we constructed multiple data sets for each. In no case were our conclusions changed by the choice of dichotomization procedure.

Convention was that there was a change in the *type* of question being voted on. First, we might ask whether there is clear evidence of a very few types of questions. Table 1 (see below) presents the eigenvalues and explained variance for each of the 11 possible factors[4]—clearly, there is no evidence that there are two primary factors that might correspond to higher-order and lower-order questions. The second and third factors are comparable in strength.

This does not in itself have strong implications for the theory of higher- and lower-order questions, for there might be two or more different lower-order factors such that at least one of these increases in importance when the higher-order factor declines in importance. Given that we cannot exclude the third factor, we recompute a constrained three-factor solution. Because of the size and shape of the data set, conventional rules of thumb regarding choice of number of factors (e.g., retain factors with eigenvalues greater than 1) are inappropriate. We choose three factors because while little distinction can be made between the second and third factors in terms of the proportion of variance explained, from the fourth factor onward there is progressively less "work" being done by each successive factor, and only incremental differences between factors.

Still, in this three-factor solution there is little evidence to make us believe that the overall organization is primarily due to the difference between higher- and lower-order questions. When we examine the substance of the votes, paying attention to those that load most strongly on one particular factor, we do not see strong evidence that any factor can be interpreted as reflecting higher- or lower-order issues. To the extent that these factors are interpretable, the first seems to pertain to broadly construed notions of states' representation. For example, vote 40, which has a loading of .965 on Factor 1, is on the motion "That in the second branch of the national Legislature each State have One vote" (Farrand 1966 [1911]: I, 195).

The third factor (we deal with the second below) seems to tap into a complex of issues regarding the relationship between states and the federal government, and the different sorts of people imagined to be in charge of each. As a result, it combines issues of federalism, the nature of the executive, and "aristocracy." These were understood as connected because, for one, a strong executive would tend to disempower the states, and, it was feared by some, elevate the fortunes of a national political elite (perhaps tied to a standing army) over local elites. Ignoring procedural matters (e.g., adjournment), the 20 votes loading highest on this factor pertain to the relation between the Senate and the executive when making treaties, relations between state and federal governments, restrictions to keep federal office holders from enriching themselves or being enriched, as well as two miscellaneous votes. The combination of these considerations is illustrated by vote 451, which has a loading on this factor of .749 and had to do with how the president was to be elected. The crucial issue was how likely it would be that the choice would end up in the hands of the Senate, an institution many delegates associated with aristocratic rule (as discussed in the text).

The second factor, which seems most labile in response to imputation, seems closely related to the third: similar substantive concerns are present, though the votes that load more heavily on the second factor are more likely to be concerned with qualifications of various office holders, and what to do about potential malefactors; others seem to also tap into suspicions of the misuse of power. Of the 20 votes loading most highly on this factor, eight have to do with such concerns; others are scattered across different issues that overlap in substance with those picked up by the third factor.

Interpreting factors is a chancy business at best. While we cannot put any great analytic reliance on our interpretations, we certainly do not find any evidence that there was a distinction between higher- and lower-order questions, nor do trends in which factors are important suggest that there was a predictable oscillation between question types. Figure 1 (see below) presents changes in the average importance of each factor. Here we smooth the absolute value of the rotated factor loading to give a sense of to what extent these different factors mattered across the course of the Convention. (We use running-means smoothing with a bandwidth of .175, meaning that at any point, 17.5 percent of the data is used to calculate a local average.) The vertical lines indicate period breaks that we use in the text.

While there is no pattern of waxing and waning that seems compatible with the division of the factors into higher- and lower-order questions, we see some interesting patterns that do agree with the argument made in the article. First, we see that the issue of representation decreases in importance in the third period (the reader should bear in mind that because

[4] Note that because we have only 11 cases, we know that 11 factors are always sufficient to fully account for the observed correlations.

factor loadings were smoothed, there is necessarily a lag between the time when a factor becomes unimportant and when the curve in Figure 1 reaches its nadir). Second, and perhaps more importantly, the factor that seems to tap the cluster of issues involving the executive, power of the national government, and aristocracy, rises in the fifth period.

Finally, there is no evidence of increasing simplification of debate, whereby these factors would explain more and more of the variance as time goes on. Dividing the Convention into five equal periods, Figure 2 (see below) displays the cumulative variance explained by each of three factors across time.[5] Rather than observing a unidirectional change of more to less complexity (or the reverse), we see a U-shaped pattern whereby the second and third factors first decrease in the proportion of variance they explain and then increase again. This suggests that debate may have grown somewhat *more* complex, not less so, as decisions were made, but perhaps then became somewhat less complex as certain issues were resolved. The absence of change in the percent of variance explained by the first factor makes it difficult to conclude that the reduction of complexity is somehow indicative of a process of polarization. It does, however, fit both our account and many others whereby the middle period of the convention involved more confusion and complexity than did the beginning or end.

SOURCES OF PARTY DIVISION

Finally, we note in the article that these factors shed some light on the logic of the dispersion of states in the final period. We can recompute three different Euclidian distances for each pair of states, the first using only the 10 fifth-period votes that loaded most heavily on the first factor, the second using only the 10 fifth-period votes that loaded most heavily on the second factor, and the third using only the 10 fifth-period votes that loaded most heavily on the third factor. We can then examine the correlation between these distances and the distances along the horizontal and vertical dimensions of the period 5 space considered separately, as determined by the MDS coordinates used to produce Figure 5 in the article (see Table 2 below). We see that distance between states on the vertical dimension (which, to reiterate, corresponds to later Federalist as opposed to Republican orientation) is only highly correlated with distances computed using those votes that loaded heavily on the "executive/aristocracy" factor.[6] But position on the size dimension has little to do with this issue of executive power—instead, it is most closely related to issues of representation. Thus the observed two-dimensionality of the space in the final period seems to be a natural result of the continued importance of different themes that maintained some degree of independence.

[5] Here we conduct our imputations separately within each period, so that we do not introduce a bias by constraining the results of one period to be similar to those of another period. As before, we first constructed a variety of data sets to determine whether the results were unduly affected by the imputation procedure. Finding that our results did not change, we averaged the imputed values.

[6] We labeled the factors on the basis of a reading of the content of items before beginning the spatial analysis of states.

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Table 1. Results from Exploratory Factor Analysis of Convention Votes

Factor	Eigenvalue	Difference Between This and Next Eigenvalue	Proportion Variance Explained	Cumulative Variance Explained
1	96.352	26.388	.194	.194
2	69.964	6.245	.141	.335
3	63.719	10.157	.128	.463
4	53.562	12.181	.108	.571
5	41.381	.742	.083	.654
6	40.640	3.768	.082	.736
7	36.872	3.254	.074	.810
8	33.618	3.277	.068	.878
9	30.341	4.676	.061	.939
10	25.665	20.779	.052	.990
11	4.886	4.886	.010	1.000

Table 2. Correlation of States' Distances Computed Along Dimensions of Figure 5 and Votes Loading Most Heavily on the Retrieved Factors

		Distance Computed Using . . .		
		Factor 1 (Representation)	Factor 2 (Office Holding)	Factor 3 (Executive/Aristocracy)
Observed Distance along MDS Dimension	Vertical (Party)	–.166	.008	.626***
	Horizontal (Size)	.451***	.348***	–.010

*** $p < .001$ (two-tailed test).

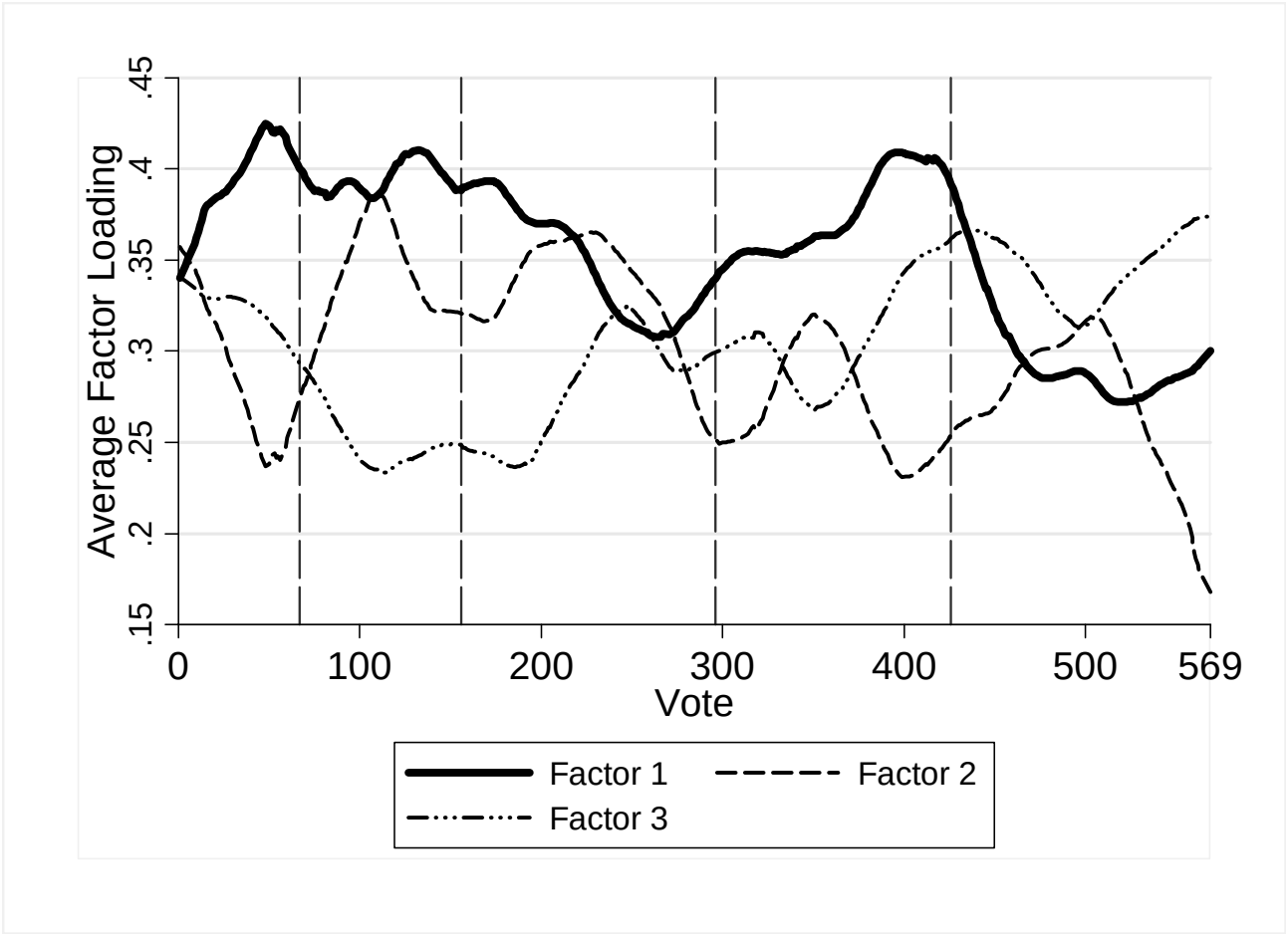

Figure 1. Running Average of Factor Loadings Across the Convention

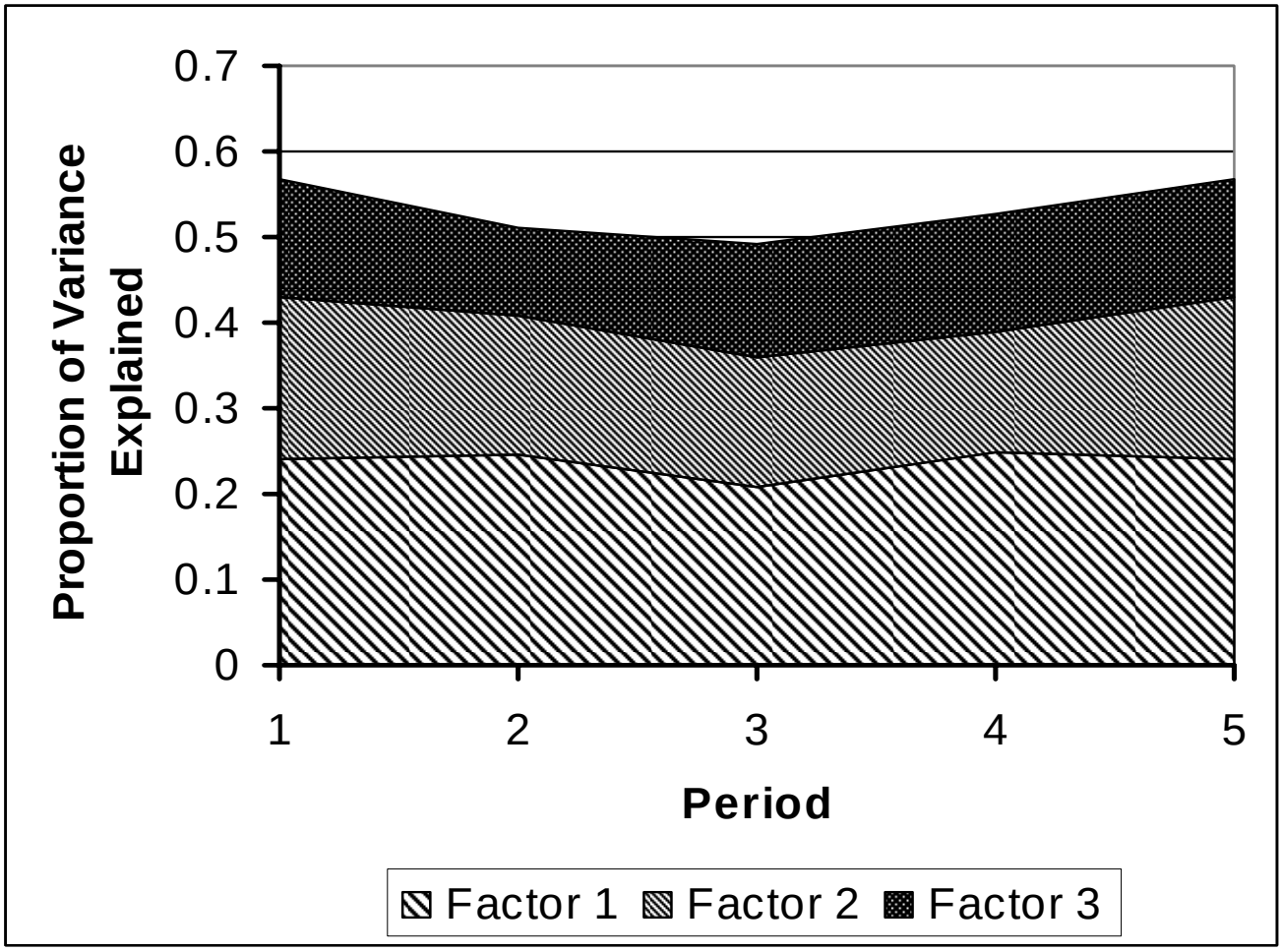

Figure 2. Cumulative Proportion of Variance Explained by Three-Factor Analyses by Period