A Blue Wave: Predicting the Legislative Behavior of the 116th Congress

Connor McCaffrey, Nathaniel Goldammer, Christina Sheehan, Jinlin Guo
University of Virginia, STAT 3220

Introduction

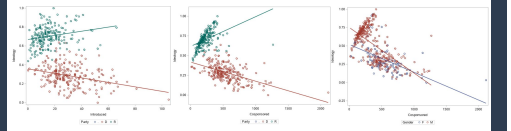
The 2018 "Blue Wave" saw 41 newly elected Democrats join the House of Representatives, the largest margin of any midterm election since 1946. Many wondered how the incoming freshman class would reshape the legislative behavior of the then Republican-controlled House.

Objective: Create a model that predicts the ideology of a member of the 116th House of Representatives given their recent legislative history.

Research Questions:

> Are members who introduce and cosponsor more bills further left leaning?
> Do members of higher leadership status tend to be further left leaning?
> Are gender and party significant factors in partisan bill creation?

Exploratory Data Analysis



The EDA revealed three interactions of interest:

- *Cosponsorship* x *Gender*
- *Cosponsorship* x *Party*
- *Introduced* x *Party*

Data Summary

Ideology	A score that characterizes a member between 0.0 (most left) and 1.0 (most right) based on their patterns of cosponsorship.
Cosponsored	The number of bills and resolutions sponsored by a member.
Introduced	The number of bills and resolutions introduced by a member.
Leadership	A score based on a member's ability to obtain cosponsors on their introduced bills.
Party	Democratic (D) or Republican (R).
Gender	Male (M) or Female (F).

Analysis

Three-Stage Model Analysis

Stage 1: Add Quantitative Variables & Interactions

$$Ideology = B_0 + B_1\,Cosponsored + B_2\,Leadership + B_3\,Introduced + B_4\,Cosponsored \cdot Leadership$$

Stage 2: Add Qualitative Variables & Interactions

$$Ideology = B_0 + B_1\,Cosponsored + B_2\,Leadership + B_3\,Introduced + B_4\,Cosponsored \cdot Leadership + B_5\,DP + B_6\,DG$$

where DP = {1 if Dem, 0 if Rep}, DG = {1 if Man, 0 if Woman}

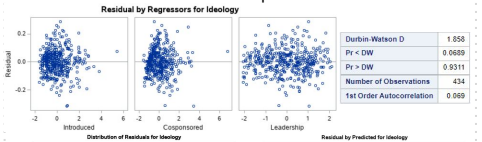
Stage 3: Add Quantitative-Qualitative Interactions

$$Ideology = B_0 + B_1\,Cosponsored + B_2\,Leadership + B_3\,Introduced + B_4\,Cosponsored \cdot Leadership + B_5\,DP + B_6\,DG + B_7\,Cosponsored \cdot DP$$

Final Model

$$Ideology^* = \text{sqrt}(Ideology) = B_0 + B_1\,\textbf{\textit{Cosponsored}} + B_2\,\textbf{\textit{Leadership}} + B_3\,\textbf{\textit{Introduced}} + B_4\,\textbf{\textit{Cosponsored}} \cdot \textbf{\textit{Leadership}} + B_5\,\textbf{\textit{DP}} + B_6\,\textbf{\textit{DG}} + B_7\,\textbf{\textit{Cosponsored}} \cdot \textbf{\textit{DP}}$$

Model Assumptions



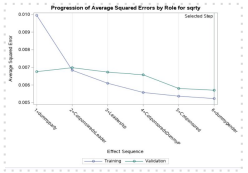
Durbin-Watson D	1.858
Pr < DW	0.0689
Pr > DW	0.9311
Number of Observations	434
1st Order Autocorrelation	0.069

Model Statistics

Adj-R^2: 0.8433

Global F-stat: 333.04
P-value: < 0.001

RMSE: 0.07228



Multicollinearity & Coding

Variable	Variance Inflation
Intercept	0
Introduced	2.40831
Cosponsored	1.71872
Leadership	2.28158
Years	1.08055

Introduced: $u_i = \frac{x_i - \bar{x}}{s_x} = \frac{x_i - 23.85}{15.03}$

Cosponsored: $u_i = \frac{x_i - \bar{x}}{s_x} = \frac{x_i - 402.3}{251.1}$

Years: $u_i = \frac{x_i - \bar{x}}{s_x} = \frac{x_i - 2.970}{1.308}$

Leadership: $u_i = \frac{x_i - \bar{x}}{s_x} = \frac{x_i - 0.4938}{0.2395}$

Variable Screening

Summary of Stepwise Selection

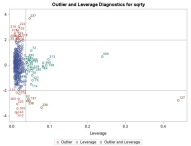
Step	Variable Entered	Variable Removed	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr > F
1	Cosponsored		1	0.4176	0.4176	65.0171	307.60	< .0001
2	Leadership		2	0.0595	0.4771	17.4908	48.68	< .0001
3	Years		3	0.0161	0.4931	5.9007	13.53	0.0003
4	Introduced		4	0.0045	0.4976	4.1214	3.79	0.0523

SLentry: set to 0.15

SLstay: set to 0.15

Stepwise Selection: *Cosponsored*, *Leadership*, *Years*, and *Introduced* are significant quantitative predictors.

Influential Observations



- #300, #127 and #237 are the most influential observations.

- Observation #127 was removed and the model was refitted.

Data Validation

Training Sample: 60% of data

Validation Sample: 40% of data

Training Sample Model:

- same predictors as Three-Stage MLR
- produces the smallest average squared errors value when applied to validation sample
- results reaffirmed by a second cross-validation test with predicted residual error sum of squares

AIC	-1115.21609
AICC	-1114.65577
SBC	-1358.13161
ASE (Train)	0.00523
ASE (Validate)	0.00571
CV PRESS	2.46252
Root MSE	0.07331

Conclusion

Prediction Equation:

$$\widehat{Ideology}^* = sqrt(\widehat{Ideology}) = 0.871 + 0.082 \cdot Cosponsored - 0.030 \cdot Leadership + 0.010 \cdot Introduced - 0.027 \cdot Cosponsored \cdot Leadership - 0.315 \cdot DP + 0.028 \cdot DG - 0.126 \cdot Cosponsored \cdot DP$$

Interpretation:

- *Cosponsored*, *Leadership*, *Introduced*, *Gender*, and *Party* are all significant predictors of *Ideology* score.
- a higher *Leadership* status is related with further left *Ideology* scores.
- a greater number of bills *Cosponsored* is related with more extreme *Ideology* scores.
- a greater number of bills *Cosponsored* is related with more left *Ideology* scores than right *Ideology* scores.
- *Introduced* is the least significant predictor, and higher values are related to further right *Ideology* scores.
- there is significant interaction between *Cosponsored* and *Party*.

Efficacy:

- the model accounts for roughly 84.333% of variation within the data.
- in context, the RMSE indicates a moderate level of accuracy.
- transformations and removal improved homoscedasticity, but violation may still be of concern.

Usage:

Let's predict the *Ideology* score of NY Rep. Alexandria Ocasio-Cortez.

- Observed *Ideology*: 0.0875
- Predicted *Ideology*: $(0.5362)^2 = 0.2876$
- Residual: -0.2001

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