Vote Swings: What we can learn from compositional models

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Overview

Many political science theories predict how support for a party changes between elections. Common explanatory variables include economic conditions, incumbent performance, and institutional changes. But a higher vote share for one party means a lower vote share for another party (since vote shares must add up to 100% and vote share changes must sum to zero). This project aims to use this **compositional** feature of voting data to better test these theories.

- Accurately modelling the compositional data generation process;
- Simulating meaningful quantities of interest with predictions which fall within the bounds of compositional variables;
- Testing more specific theory predictions, i.e. not just who gains vote share but **flows** of vote share from one party to another;
- Visualizing vote share changes.

Compositional Models of *Vote Share Change*

Step 1: Vote Share Changes are subject to bounds and an adding-up constraint, since gains for one party must be losses for other parties:
$V_{ij,t}$ is the vote share in constituency i for party j in time t

$$\Delta V_{ij} = V_{ij,t} - V_{ij,t-1}$$

$$-1 < \Delta V_{ij} < 1$$

$$\sum_{j=1}^{J} \Delta V_{ij} = 0$$

Step 2: To model vote share change with the compositional model (Katz and King 1999) we apply a linear transformation so the components sum to one (instead of zero). We also take the log-odds ratio to identify changes relative to a baseline party:

Transformations:

$$\Delta W_{ij} = \frac{\Delta V_{ij} + 1}{J}$$

$$0 < \Delta W_{ij} < \frac{2}{J}$$

$$\sum_{j=1}^{J} \Delta W_{ij} = 1$$

Calculate $Y_{i,j} = ln\left(\frac{V_{i,j}}{V_{i,J}}\right)$

Log-Odds Ratio: $\forall j \in (1, J-1)$

Step 3: The resulting values can be modelled using a compositional variables model:

Stochastic Component: $Y_{i,j} \sim Y_{MVN}(\mu_i, \Sigma)$

Systematic Component: $\mu_i = X_i \beta$

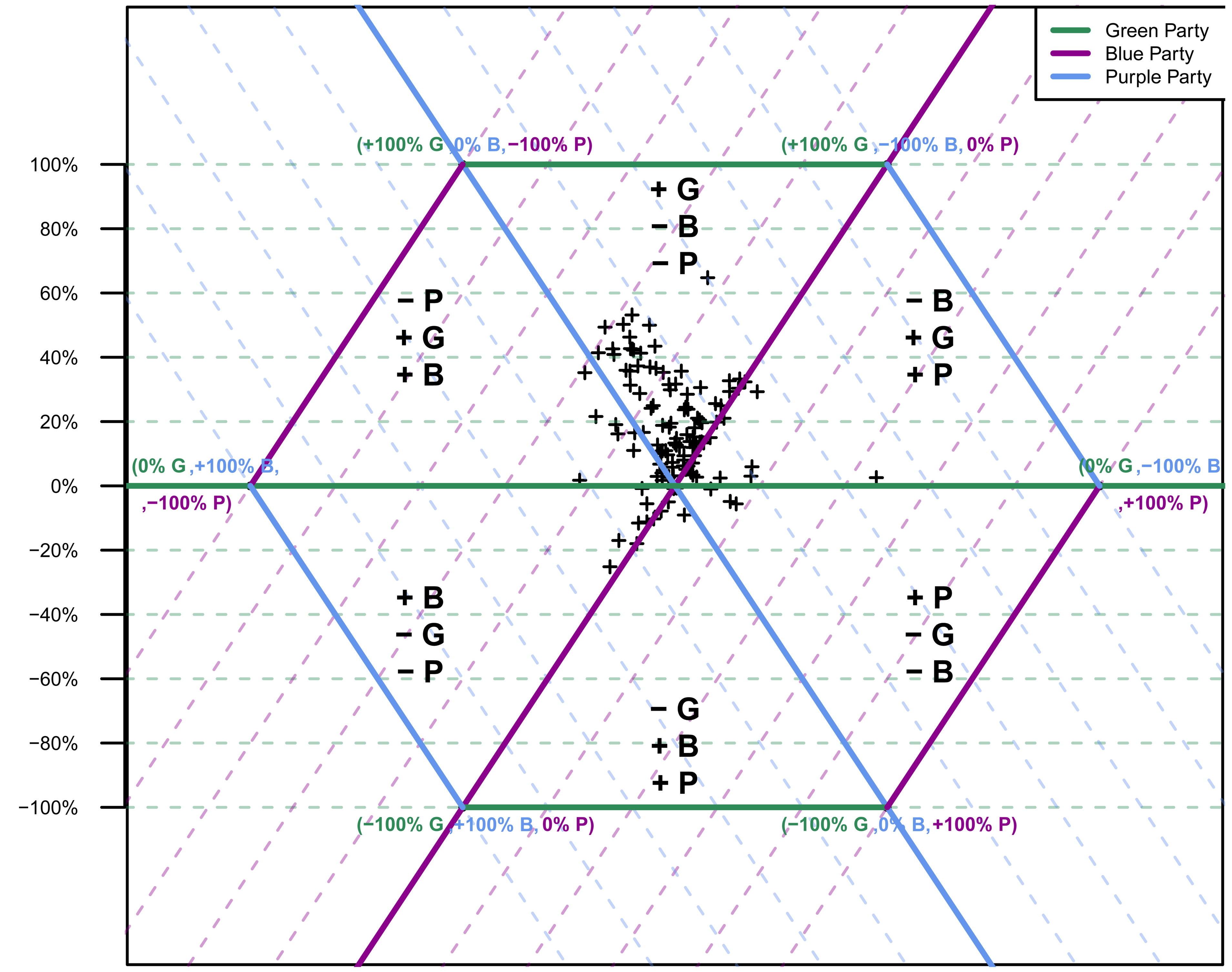
Step 4: The predicted values from this model have no natural interpretation, but can be converted back to meaningful vote share changes using the following un-transformations:

Untransformations:

$$\Delta W_{ij} = \frac{exp(Y_{ij})}{1 + \sum_{j=1}^{J-1} exp(Y_{ij})}$$

$$\Delta V_{ij} = J \cdot \Delta W_{ij} - 1$$

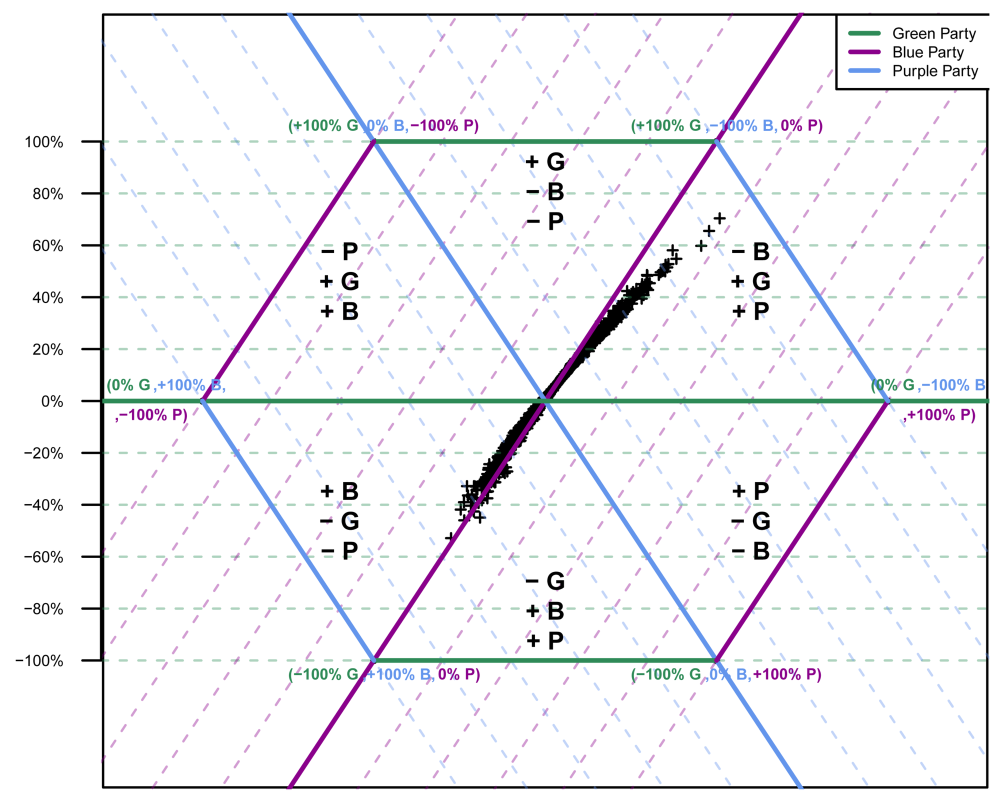
Hexagons: A Graphical Tool



Interpretation

1. Each point within the hexagon represents a potential election outcome;
2. For example, (+10% to party G, -5% to P, -5% to B);
3. The centre-point represents zero change in vote share from the previous election for all parties;
4. The three solid lines represent zero-change lines. Each point on a zero-change line means the corresponding party received exactly the same vote share as in the previous election;
5. Each dotted line represents a 20 %-point change for a particular party;
6. Each of the triangular segments then corresponds to a combination of net gains or losses for each party;

Quantities of Interest



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