Extending the Brams-Kilgour Model Linking Partisan Imbalance in Non-Competitive States to Outcomes in the Electoral College Using Historical Data from 1868 to 2016

APPENDIX (FOR ON-LINE DISSEMINATION):

How Analyses Would Change if We Changed the Definition of Non-Competitive State

Brams and Kilgour (2017: 110-111) discuss their choice of the domain of competitiveness as plus or minus three percentage points of two-party vote. One justification is that this range is close to the usual margin of error in state polls.  A second justification for this choice of range is a pragmatic one: there are computability issues in that, when we expand the range of competition, we have many more combinations to analyze. But there is also a good theoretical reason to favor this choice: for this range, the assumption they use that all states in this range had an *a priori* equal probability of being won by either party seems plausible.  Nonetheless, it is useful to consider the robustness of their measures to alternative specifications of the range used to define a competitive seat. In Table A1, for the four elections they consider, and for 2016, we show the comparisons between the values they derive for a plus or minus three percentage point definition and the more conventional plus or minus five percentage point definition of a competitive state.

**<< Table A1 about here >>**

Changing the states that are considered non-competitive changes the number of seats from the competitive states a party needs to win the election. In the parlance of voting power literature, we might say such changes in the definition of competitive state changes the “effective” *quota*, i.e., the number of competitive EC seats a candidate needs to win above and beyond expected wins in “safe” seats (Banzhaf 1968). However, increasing the number of states defined as competitive does not give rise to an expectation of a monotonic change in the three B-K variables. It is possible that the new states are more (less) vulnerable or more (less) fragile than those previously included. Also, if a large state is just outside the competitive range under the narrow definition, but is now competitive under the less restrictive definition, it could increase the number of coalitions that are wins for the disfavored party, but not change anything for the leading party’s candidate.

From Table A1, we see that in some cases the changes in other variables are small, even though the number of competitive states may have changed considerably, while in other cases the differences are quite large.

In 2016, when we switch from a plus or minus 3 percentage point definition of competitive to a plus or minus 5 percentage point definition of competitive, the election previously characterized as very close now is seen as less close.Using Brams and Kilgour’s definition of competitive, Donald Trump had a one seat EC lead in non-competitive states, and by virtue of winning the majority of the competitive EC seats, won the election. Using the more traditional plus or minus 5% definition of a competitive seat, Clinton would have had a 50 EC seat starting advantage, having 182 safe EC seats toTrump’s 132. Shifting the definition of competitive state, *Winningness* would now have predicted a Clinton victory and, given the size of the *Winningness* score (0.77), she would be predicted to win by a large margin.[[1]](#footnote-1)

Even though the number of competitive states increases by just three in 2016, as judged by *Winningness*, the Republican candidate goes from a slight favorite to a big underdog! In the states that finished with the winning candidate garnering less than 53% of the vote, if results were determined simply by flipping a fair coin, Trump would have been expected to have won 3% more of the feasible coalitions than Clinton. In contrast, if we shift our definition of competitive state to plus or minus five percentage points, Clinton would have instead been expected to won 3.3 times more coalitions under the same equiprobability assumption.

A similar dramatic shift in estimated win probabilities occurs in 2000. Bush had a slight advantage in competitive states using the B-K definition of competitive state, but he had many fewer outlets to victory under the broader plus or minus five percent definition.

2004 and 2012 offer a different kind of result. Although the number of states counted as competitive drastically increases in both years when we change the definition of a non-competitive state, changes in results are minimal. The Republican candidates in each of these elections gain a slightly higher percentage of winning coalitions, while in both cases decreasing their *vulnerability* and *fragility* among those coalitions.

Finally, let us turn to 2008. Whereas Obama had enough EC seats in the non-competitive states in 2008 using the plus or minus 3% definition,[[2]](#footnote-2) he was twelve seats shy of victory using the less restrictive plus or minus 5% definition. While Obama remained the favorite even when we expand the definition of competitive states, under the former definition, Obama’s *quota* is effectively zero in the competitive states, while under the latter definition it becomes twelve.[[3]](#footnote-3) Nonetheless, in 2008, Obama remains far enough ahead in non-competitive states that McCain would be predicted to have had virtually no chance of victory.[[4]](#footnote-4)

Looking at the results reported in Table A1, what seems to us to be most important is that, in both 2000 and 2016, years in which the popular vote and the Electoral College diverge, when we change the definition of competitive state to plus or minus five percentage points, the candidate with the higher *Winningness* is no longer the winning candidate. This reduced predictive power for the plus or minus five percentage point definition provides us with further justification for the choice made in the text to retain the B-K plus or minus three percentage point definition of what constitutes a competitive state.

We can also look at how a change in the definition of competitive state will change the various regression results we offer in Table 3, but the results are not especially interesting. The changes are minor and parallel the insights we gain from analyzing results in Table A1, namely that going from a plus or minus 3 percentage point definition of competitive seat to a plus or minus 5 percentage point definition of competitive seat reduces the predictive accuracy of *Winningness*. And this shift also reduces the predictive power of the *Non-competitive advantage* variable. [[5]](#footnote-5) However, it does not affect the relative predictive power of *Winningness* and *Non-competitive advantage;* the latter still does better at predicting seat share, while the former apparently does (marginally) better at predicting EC outcomes treated dichotomously. [[6]](#footnote-6) These results can be found in Table A3.

**Table A1: Comparisons of Results for the Winningness, Vulnerability, and Fragility Variables for the Republicans for a Plus or Minus Three Percentage Point and a Plus or Minus Five Percentage Point Definition of Competitive State: 2000-2016**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Competitive States**  **(ECvotes)** | | **Winningness**  **(Ratio)** | | **Vulnerability**  **(Ratio)** | | **Fragility**  **(Ratio)** | |
| **±3** | **±5** | **±3** | **±5** | **±3** | **±5** | **±3** | **±5** |
| 2000 | 16 (178) | 21 (221) | 1.71 | 0.50 | 0.76 | 1.47 | 0.59 | 2.00 |
| 2004 | 12 (142) | 20 (209) | 2.64 | 2.9 | 0.61 | 0.55 | 0.38 | 0.35 |
| 2008 | 7 (102) | 15 (159) | 0 | 0 |  | 125.92 |  | 1187.27 |
| 2012 | 8 (114) | 15 (193) | 0.24 | 0.35 | 2.09 | 1.85 | 4.22 | 2.83 |
| 2016 | 12 (163) | 16 (224) | 1.03 | 0.31 | 0.99 | 1.89 | 0.97 | 3.22 |
| *Note: All ratios are REP over DEM, therefore when the ratio is 1, both candidates have the same number of winning coalitions among the competitive states.* | | | | | | | | |

**Table A1: Electoral College Data 1868-2016**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Non-Competitive  EC Seats | | |  | | --- | | Electoral College | | |  |  | | --- | --- | | Seats | Percent | | | | | | Differences | |
|  | Rep | Dem | Rep | Dem | Rep | Dem | Seats | Percent |
| 1868 | 153 | 37 | 211 | 80 | 0.725 | 0.275 | 116 | 0.399 |
| 1872 | 269 | 34 | 300 | 66 | 0.82 | 0.18 | 235 | 0.642 |
| 1876 | 64 | 119 | 182 | 184 | 0.497 | 0.503 | -55 | -0.15 |
| 1880 | 95 | 125 | 213 | 156 | 0.577 | 0.423 | -30 | -0.081 |
| 1884 | 93 | 123 | 182 | 219 | 0.454 | 0.546 | -30 | -0.075 |
| 1888 | 112 | 100 | 233 | 168 | 0.581 | 0.419 | 12 | 0.03 |
| 1892 | 112 | 150 | 173 | 271 | 0.39 | 0.61 | -38 | -0.086 |
| 1896 | 203 | 126 | 273 | 174 | 0.611 | 0.389 | 77 | 0.172 |
| 1900 | 258 | 122 | 292 | 155 | 0.653 | 0.347 | 136 | 0.304 |
| 1904 | 317 | 120 | 343 | 133 | 0.721 | 0.279 | 197 | 0.414 |
| 1908 | 283 | 120 | 327 | 156 | 0.677 | 0.323 | 163 | 0.337 |
| 1912 | 8 | 467 | 23 | 508 | 0.043 | 0.957 | -459 | -0.864 |
| 1916 | 171 | 213 | 255 | 276 | 0.48 | 0.52 | -42 | -0.079 |
| 1920 | 382 | 114 | 404 | 127 | 0.761 | 0.239 | 268 | 0.505 |
| 1924 | 366 | 136 | 395 | 136 | 0.744 | 0.256 | 230 | 0.433 |
| 1928 | 379 | 52 | 444 | 87 | 0.836 | 0.164 | 327 | 0.616 |
| 1932 | 8 | 413 | 59 | 472 | 0.111 | 0.889 | -405 | -0.763 |
| 1936 | 8 | 519 | 8 | 523 | 0.015 | 0.985 | -511 | -0.962 |
| 1940 | 27 | 290 | 82 | 449 | 0.154 | 0.846 | -263 | -0.495 |
| 1944 | 31 | 215 | 99 | 432 | 0.186 | 0.814 | -184 | -0.347 |
| 1948 | 37 | 215 | 200 | 331 | 0.377 | 0.623 | -178 | -0.335 |
| 1952 | 379 | 53 | 442 | 89 | 0.832 | 0.168 | 326 | 0.614 |
| 1956 | 446 | 47 | 457 | 74 | 0.861 | 0.139 | 399 | 0.751 |
| 1960 | 132 | 86 | 220 | 317 | 0.41 | 0.59 | 46 | 0.086 |
| 1964 | 47 | 463 | 52 | 486 | 0.097 | 0.903 | -416 | -0.773 |
| 1968 | 175 | 94 | 320 | 218 | 0.595 | 0.405 | 81 | 0.151 |
| 1972 | 511 | 17 | 521 | 17 | 0.968 | 0.032 | 494 | 0.918 |
| 1976 | 66 | 114 | 241 | 297 | 0.448 | 0.552 | -48 | -0.089 |
| 1980 | 344 | 19 | 489 | 49 | 0.909 | 0.091 | 325 | 0.604 |
| 1984 | 498 | 3 | 525 | 13 | 0.976 | 0.024 | 495 | 0.92 |
| 1988 | 289 | 42 | 426 | 112 | 0.792 | 0.208 | 247 | 0.459 |
| 1992 | 73 | 263 | 168 | 370 | 0.312 | 0.688 | -190 | -0.353 |
| 1996 | 66 | 348 | 159 | 379 | 0.296 | 0.704 | -282 | -0.524 |
| 2000 | 189 | 171 | 271 | 267 | 0.504 | 0.496 | 18 | 0.033 |
| 2004 | 213 | 183 | 286 | 252 | 0.532 | 0.468 | 30 | 0.056 |
| 2008 | 145 | 291 | 174 | 364 | 0.323 | 0.677 | -146 | -0.271 |
| 2012 | 191 | 233 | 206 | 332 | 0.383 | 0.617 | -42 | -0.078 |
| 2016 | 188 | 187 | 305 | 233 | 0.567 | 0.433 | 1 | 0.002 |

**Table A2: Extending Brams and Kilgour’s Three Measures of Setup Power**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Winningness | | Vulnerability | | Fragility | | Actual EC Outcomes |
|  | Democratic | Republican | Democratic | Republican | Democratic | Republican | Republican EC Share |
| 1868 | 1 | 0 | 0 |  | 0 |  | 0.725 |
| 1872 | 1 | 0 | 0 |  | 0 |  | 0.82 |
| 1876 | 0.191 | 0.809 | 0.917 | 0.446 | 4.554 | 1.097 | 0.497 |
| 1880 | 0.308 | 0.692 | 0.881 | 0.611 | 3.061 | 1.365 | 0.577 |
| 1884 | 0.315 | 0.685 | 0.862 | 0.569 | 3.519 | 1.62 | 0.454 |
| 1888 | 0.575 | 0.425 | 0.667 | 0.785 | 2.144 | 2.905 | 0.581 |
| 1892 | 0.27 | 0.73 | 0.895 | 0.534 | 4.005 | 1.499 | 0.39 |
| 1896 | 0.979 | 0.021 | 0.095 | 1 | 0.159 | 7.419 | 0.611 |
| 1900 | 1 | 0 | 0 |  | 0 |  | 0.653 |
| 1904 | 1 | 0 | 0 |  | 0 |  | 0.721 |
| 1908 | 1 | 0 | 0 |  | 0 |  | 0.677 |
| 1912 | 0 | 1 |  | 0 |  | 0 | 0.043 |
| 1916 | 0.158 | 0.842 | 0.824 | 0.319 | 5.464 | 1.028 | 0.48 |
| 1920 | 1 | 0 | 0 |  | 0 |  | 0.761 |
| 1924 | 1 | 0 | 0 |  | 0 |  | 0.744 |
| 1928 | 1 | 0 | 0 |  | 0 |  | 0.836 |
| 1932 | 0 | 1 |  | 0 |  | 0 | 0.111 |
| 1936 | 0 | 1 |  | 0 |  | 0 | 0.015 |
| 1940 | 0 | 1 |  | 0 |  | 0 | 0.154 |
| 1944 | 0.009 | 0.991 | 1 | 0.05 | 9.85 | 0.093 | 0.186 |
| 1948 | 0.012 | 0.988 | 1 | 0.067 | 9.146 | 0.115 | 0.377 |
| 1952 | 1 | 0 | 0 |  | 0 |  | 0.832 |
| 1956 | 1 | 0 | 0 |  | 0 |  | 0.861 |
| 1960 | 0.699 | 0.301 | 0.496 | 0.799 | 1.861 | 4.325 | 0.41 |
| 1964 | 0 | 1 |  | 0 |  | 0 | 0.097 |
| 1968 | 0.824 | 0.176 | 0.383 | 0.874 | 1.053 | 4.848 | 0.595 |
| 1972 | 1 | 0 | 0 |  | 0 |  | 0.968 |
| 1976 | 0.306 | 0.694 | 0.775 | 0.494 | 4.714 | 2.092 | 0.448 |
| 1980 | 1 | 0 | 0 |  | 0 |  | 0.909 |
| 1984 | 1 | 0 | 0 |  | 0 |  | 0.976 |
| 1988 | 1 | 0 | 0 |  | 0 |  | 0.792 |
| 1992 | 0.00004 | 1 | 1 | 0.001 | 15.333 | 0.001 | 0.312 |
| 1996 | 0 | 1 |  | 0 |  | 0 | 0.296 |
| 2000 | 0.631 | 0.369 | 0.549 | 0.727 | 2.198 | 3.724 | 0.504 |
| 2004 | 0.725 | 0.275 | 0.52 | 0.854 | 1.45 | 3.773 | 0.532 |
| 2008 | 0 | 1 |  | 0 |  | 0 | 0.323 |
| 2012 | 0.191 | 0.809 | 0.939 | 0.449 | 3.592 | 0.85 | 0.383 |
| 2016 | 0.507 | 0.493 | 0.694 | 0.703 | 2.638 | 2.711 | 0.567 |

**Table A3a: Correlations among the *Winningness*, *Vulnerability*, and *Fragility* variables for the Republican and Democratic Parties and with Republican EC seat share: 1868-2016**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Democratic Party Correlations** | | | | | |  | **Winningness** | **Vulnerability** | **Fragility** | **EC Outcome**  **(DEM)** | | **Winningness** | 1 | -0.957 | -0.981 | 0.901 | | **Vulnerability** | -0.957 | 1 | 0.910 | -0.855 | | **Fragility** | -0.981 | 0.910 | 1 | -0.718 | | **EC Outcome** | 0.901 | -0.855 | -0.718 | 1 | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Republican Party Correlations** | | | | | |  | **Winningness** | **Vulnerability** | **Fragility** | **EC Outcome**  **(REP)** | | **Winningness** | 1 | -0.978 | -0.876 | 0.901 | | **Vulnerability** | -0.978 | 1 | 0.804 | -0.883 | | **Fragility** | -0.876 | 0.804 | 1 | -0.774 | | **EC Outcome** | 0.901 | -0.883 | -0.774 | 1 | |

**Table A3b: Correlations among the *Winningness*, *Vulnerability*, and *Fragility* [Restricted Models]: 1868-2016**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Democratic Party Correlations [Restricted Model]** | | | | | |  | **Winningness** | **Vulnerability** | **Fragility** | **EC Outcome**  **(DEM)** | | **Winningness** | 1 | -0.947 | -0.973 | 0.726 | | **Vulnerability** | -0.947 | 1 | 0.886 | -0.807 | | **Fragility** | -0.973 | 0.886 | 1 | -0.667 | | **EC Outcome** | 0.726 | -0.807 | -0.667 | 1 | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Republican Party Correlations** | | | | | |  | **Winningness** | **Vulnerability** | **Fragility** | **EC Outcome**  **(REP)** | | **Winningness** | 1 | -0.964 | -0.810 | 0.726 | | **Vulnerability** | -0.964 | 1 | 0.705 | -0.658 | | **Fragility** | -0.810 | 0.705 | 1 | -0.759 | | **EC Outcome** | 0.726 | -0.658 | -0.759 | 1 | |

**Table A4: Regressions with *Non-Competitive Advantage* vs *Winningness* to Predict Final Republican EC seat share**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | |  | **Model 1** | **Model 2** | **Model 3 [Restricted]** | | *Non-Competitive Advantage* | 0.530\*\*\*  (0.018) |  |  | | *Winningness* |  | 0.553\*\*\*  (0.044) | 0.273\*\*\*  (0.067) | | *Constant* | 0.502\*\*\*  (0.009) | 0.230\*\*\*  (0.031) | 0.357\*\*\*  (0.033 | | *N* | 38 | 38 | 15 | | *Adj. R-squared* | 0.958 | 0.906 | 0.495 | | \*\*\*p < .01; \*\*p < .05; \*p < .1 Standard Errors in Parenthesis | | | | | *Note: All Regressions calculated using plus or minus 3% as the definition of competitive state. Model 3 includes only elections where Winningness is greater than 0 and less and 1.* | | | | |

**Table A5: Regression Tables using the ± 5% Definition of Competitive**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Full Model** | | **Restricted Model** | | | *Non-Competitive Advantage* | 0.568\*\*\*  (0.026) |  | 0.696\*\*\*  (0.067) |  | | *Winningness* |  | 0.551\*\*\*  (0.046) |  | 0.432\*\*\*  (0.055) | | *Constant* | 0.522\*\*\*  (0.011) | 0.255\*\*\*  (0.031) | 0.530\*\*\*  (0.016) | 0.333\*\*\*  (0.032) | |  |  |  |  |  | | *Restricted Model* | NO | NO | YES | YES | | *N* | 38 | 36 | 24 | 22 | | *Adjusted R2* | 0.929 | 0.801 | 0.821 | 0.742 | | *Note: Restricted models only include elections where at least one competitive state could change the result* | | | | | |

1. Hillary Clinton won the popular vote by over 3 million votes, but still lost the Electoral College. [↑](#footnote-ref-1)
2. Few would, at the time, have believed that the outcome was certain. McCain did not; he raised and spent over $300 million dollars in his quest for the presidency, though considerably outspent by Obama**.** McCain raised $368 million to Obama’s $730 million, <http://www.opensecrets.org/pres08/> [↑](#footnote-ref-2)
3. Since we decreased the number of non-competitive states in 2008 by changing the definition, we have also increased the number of competitive ones, from 102 to 159. [↑](#footnote-ref-3)
4. McCain wins 22 of the coalitions out of 32,768 using ±5%, definition of a competitive state -- a percentage low enough to round to zero. [↑](#footnote-ref-4)
5. For example, using the plus or minus five percent definition of competitive, the *Non-Competitive Advantage* bivariate regression has an R2 of 0.92, as compared to 0.96 for the B-K definition. [↑](#footnote-ref-5)
6. Using the plus or minus five percent classification of competitive seat, *Non-Competitive Advantage* accurately predicts 33/38 elections (the errors are the 1880 and 1960 elections --ones that are also mispredicted when using the ±3% competitive definition -- and the 1880, 1888, 1960, and 2016 elections); while *Winningness* incorrectly predicts between 4 and 6 elections using the plus or minus five percent classification. The reason for the “uncertainty” about the predictive power of the *Winningness* variable is that due to computational difficulties in calculating results across 2k coalitions when k is large, we were unable to provide *Winningness* calculations for the plus or minus five percentage point definition of competitive seats for the years of 1960 (a year that *Non-Competitive Advantage* incorrectly predicts) and for 1976. [↑](#footnote-ref-6)