The Relationship Between Bias and Swing Ratio in the Electoral College and the Outcome of Presidential Elections

Joshua N. Zingher
Assistant Professor
Old Dominion University
Department of Political Science and Geography
7000 Batten Arts and Sciences
Norfolk, VA 23529

Abstract: In this paper, I assess how the outcomes of presidential elections are affected by the presence (or lack) of partisan bias. There have been three instances (1876, 1888 and 2000) since the end of the Civil War where the party that lost the popular vote won the Electoral College. These instances raise the question of whether partisan bias in the Electoral College consistently influences presidential election outcomes? I answer this question by first measuring partisan bias and then using these estimates to assess how partisan bias affects a party's odds of winning a presidential election. I find that the presence of partisan bias provides a sizable, but not insurmountable, obstacle for the disadvantaged party.

The electoral rules that govern the translation of votes into seats are foundational for determining the nature and size of the party system. Many electoral systems are characterized by the presence of partisan bias (defined as the asymmetry in seat share when both parties obtain 50 percent of the vote), which allows one party to translate its votes into seats more efficiently than its competitor(s). The presence of partisan bias can significantly affect a party's long-term prospects for success (e.g. Brady and Grofman 1991; Johnston, Rossiter and Pattie 2006). The United States employs a particularly unique institutional arrangement, the Electoral College, to translate votes into seats in presidential elections. There is direct evidence that partisan bias exists in the Electoral College and that it can meaningfully affect election outcomes. This direct evidence comes in the form of the three instances (1876, 1888 and 2000) since the end of the Civil War where the party that lost the popular vote won the Electoral College.

These counter-majoritarian outcomes suggest that partisan bias plays a role in determining the outcome of at least some presidential elections. Yet, there has been a consistent alternation of the parties in power in spite of this partisan bias. The outcomes of presidential elections have been so unpredictable that the pattern of partisan wins and losses is statistically indistinguishable from a coin flip (Stokes and Iversen, 1962; Bartels 1998). This fact implies several possibilities: partisan bias might exist in some elections but not others, the magnitude and direction of partisan bias varies over time, and/or partisan bias does not generally represent a meaningful obstacle for the disadvantaged party.

In this paper, I analyze how partisan bias affects the outcome of presidential elections. This paper is organized into four sections. In the first section, I introduce the concepts of partisan bias and swing ratio, outline strategies for measuring these concepts, and identify three potential sources of partisan bias. In the second section, I estimate partisan bias and swing ratio for each election since 1872 using Tufte's (1973) logged odds method. In the third section, I turn towards answering the question: does partisan bias affect presidential election outcomes? I find that the presence of partisan bias significantly affects the outcomes of presidential elections—political parties are more likely to win when the Electoral College is biased in their favor. However, both the direction and the magnitude of partisan bias vary considerably from election to election. I conclude in the fourth section with a discussion of the Electoral College in relation to democratic principles and I briefly touch on arguments in favor of replacing the Electoral College with the national popular vote.

1. Bias and Responsiveness—Concept and Measurement

In two-party political competition, there are two basic concepts that characterize the relationship between seats and votes. These concepts are *partisan bias* and *swing ratio* (Grofman, Brunell and Campanga, 473). The swing ratio (β) is a measure of electoral responsiveness. The swing ratio is defined as the expected increase in the percentage of seats a party will win given a one-percentage point increase of the party's share of the vote (Tufte 1973, 542; Niemi and Fett 1986; Camapanga and Grofman 1990). A swing ratio of six implies that a one-percentage point increase of a party's share of the vote is associated with an expected six-percentage point increase of the party's share of the seats.

The standard definition of partisan bias (α) is the difference between the seat share a party with exactly k percent of the vote wins and one minus the seat share that would be expected to win if it received 100 – k vote percentage (Soper and Rydon 1958; Tufte 1973;

Gudgin and Taylor 1979; Grofman 1983; King and Browning 1987; King and Gelman 1991; King and Gelman 1994; Grofman, Koetzle and Brunell 1997; Thomas et al*.* 2012; Pattie and Johnston 2014). Partisan bias can be thought of as the asymmetry in how the parties' votes are translated into seats. In a system with no bias, a party that obtains 50 percent of the votes would also win 50 percent of the seats. However, in a system where partisan bias exists, a party that wins 50 percent of the vote might receive 55 percent of the seats, while the opposing party would receive only 45 percent of the seats despite both receiving 50 percent of the vote.

1.1 Three Potential Sources of Partisan Bias

Grofman, Koetzle and Brunell (1997) identified three potential sources of partisan bias in the Electoral College. These three potential sources are:

1.) Distributional Bias—Distributional bias relates to how efficiently a party's electoral support is distributed across districts. Winning districts by a wide margin results in a large number of wasted votes.
2.) Apportionment Bias—Apportionment bias stems from votes not being given equal weight across districts. In the context of the Electoral College, apportionment bias stems from voters in small states being overrepresented.[1]
3.) Turnout Bias—Turnout rates vary across jurisdictions. Therefore, it is possible for a party to win some low turnout districts with a very few votes. These 'cheap seats' (Campbell 1996) allow a party to win districts with fewer average votes than their opponents.

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[1] All states are guaranteed at least three electoral votes regardless of population (each state has two senators and one representative). In addition, additional apportionment bias is introduced due to rounding issues, a state cannot be afforded an additional half an electoral vote if there population would merit it. This is the so called 'integer problem' that arises in the apportionment process and leads to citizens receiving slightly different vote weights as a result of rounding.

All three of these sources of bias might have a consequential effect on election outcomes.[2] The key to assessing the degree to which partisan bias influences election outcomes is developing an effective measurement strategy.

The total amount of bias in the Electoral College is the sum of distributional, apportionment and turnout bias (in addition to any additional sources of residual bias). Measuring these potential sources of bias is straightforward. Apportionment bias is defined as the difference between a party's average vote shares (across all 50 states) when weighting each state's vote percentage by population versus weighting each state's vote percentage by the number of electoral votes it possesses. The logic here is that one party will receive a bonus in the Electoral College if they perform particularly well in states that are systematically overrepresented relative to their population. A second form of bias can emerge from the difference between a party's mean state-population weighted vote share and the party's share of the national two-party vote. Because a party's average state-population weighted vote share does not take turnout into account (or in other words, assumes turnout is equal in every state), a party's proportion of the average state-population weighted vote share might exceed the party's national two-party vote share if the party's base of electoral support is concentrated in states with low turnout.

A third source of partisan bias arises from how efficiently a party's electoral support is distributed geographically. Political parties can waste votes by winning states by large

[2] There are other potential sources of partisan bias in addition to the three sources outlined above. Others (Pattie and Johnston 2014) have demonstrated that the presence of third party candidates and the interactions between these sources might introduce additional bias into the system. I account for the presence of these additional sources of bias by lumping them in with turnout bias to form a 'residual bias' category. I also perform a more fine-grained analysis where I collect turnout data and separate residual bias from turnout bias. I find that turnout bias accounts for the vast majority of this 'residual bias' category.

margins. Since the Electoral College is a winner takes all system, a party obtains the same number of electoral votes whether they win a state by one vote or one million votes. More efficient distributions of electoral support involve winning many states by narrow margins opposed to winning one state by a wide margin. Distributional bias is reflected by the difference between the mean and median state vote percentage. A skewed distribution (where the mean and median are different values) indicates the presence of distributional bias, as on average one party is winning states by wider margins than the opposing party. Historically, the Republican Party did not seriously compete in the Deep South. As a result, the Democratic Party won the Southern states by huge vote margins. According to Grofman, Brunell and Campagna's (1997 pg. 479, as well as the estimates of distributional bias reported below) estimates of distributional bias, these state-level landslides created a distributional bias against the Democratic Party during the first half of the 20th century.

Yet, the Democratic Party managed to win 7 out of the 13 presidential elections between 1900 and 1948, which suggests several possibilities. One possibility is that distributional bias does not meaningfully affect the outcome of presidential elections. A second possibility is that the swing ratio was so high that the Democrats were able to overcome the effects of distributional bias by translating a small increase in vote share into a large increase in seat share. A third possibility is that while the Democrats were disadvantaged as a result of distributional bias, they were simultaneously advantaged by apportionment and turnout bias. Assessing these possibilities requires me to estimate each potential source of partisan bias and then generate a combined estimate of the total amount. I begin this task by replicating Grofman, Brunell and Campagna's estimates of distributional bias (and extending the time frame of their initial analysis from 1900-1992 to 1872-2012) before moving on to estimate apportionment bias and total bias. I use these three sets of estimates (distributional, apportionment, and total bias) to calculate an estimate of turnout bias.

1.2 Measuring Bias and Swing Ratio

In this section I outline a measurement strategy designed to estimate partisan bias and swing ratio. I use one of the best-known techniques, Tufte's (1973) logged odds method, to measure bias and swing ratio. [3] This method is election specific—estimates are derived from one hypothetical seats-votes curve for each election (Tufte 1973, 546). Tufte's logged odds method of estimating bias and swing ratio can be specified as an ordinary least squares (OLS) model in the following way:

Equation 1: $\log(\frac{S}{1-S}) = \log\alpha + \beta\log(\frac{V}{1-V}) + e$

Where,

S = Party A's proportion of total seats won (in this case electoral votes);

V= Party A's proportion of the total number of votes cast;

α= An intercept tem, which is represents the logged estimate of bias;

β= The swing ratio;

e= An error term.

The amount of total bias, defined in the disparity in seat shares when both parties obtain 50 percent of the vote, can be calculated using the following equation:

[3] There have been other methods developed to calculate bias and swing ratio in electoral systems. Gelman and King's (1991, 1994) Judgeit software features an algorithm designed to calculate bias and swing ratio via simulation. In addition, King and Browning (1987) and Garand and Parent (1991) utilized a bi-logit method to estimate partisan bias, but this method does not produce an estimate of swing ratio that is comparable to the logged odds method. Grofman, Brunell and Campanga (1997) demonstrated that the logged odds and Judgeit simulation method produced very similar results; the biggest difference was that the estimated swing ratio is generally higher when using the logged odds method than when it is estimated via simulation. For more on these other approaches, please consult the supplementary appendix.

Equation 2: $\frac{e^{\log\alpha}}{1+e^{\log\alpha}} - .5$

In *equation 2*, ***e*** is the base of the natural log and α is as defined in *equation 1*. When α equals 1 then logged α equals 0, and the entire equation equals zero as a result. When α is indistinguishable from zero then I can reject the hypothesis that there is bias. However, when α is significantly different from zero the system is biased in favor of one party. In the way that my equation is structured, negative numbers reflect a pro-Democratic bias while positive numbers reflect a pro-Republican bias.

This equation is applied to a hypothetical seats-votes curve, which is generated by assuming that vote changes occur uniformly across all states. For example, if the observed national two-party vote is 55-45 in favor of the Republican Party, a hypothetical seats votes curve is generated by sequentially adding or subtracting one percentage point from each state's observed two-party vote split.[4] This process is repeated until state level vote splits have been estimated for each national level vote split ranging from 40 to 60. The estimated two-party vote shares in each state are then used to determine how many electoral votes each party would win across a range of national two-party vote divisions (e.g. if the Republican Party won 42 percent of the national vote it could expect to win x number of electoral votes, compared to y percent at 43 and z percent at 44).[5] In the next section I use

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[4] As Grofman, Brunell and Campagna note (1997, fn 13), failure to center the seats-votes curve at the 50 percent threshold can result in improperly high estimates of bias using the logged odds method. Likewise, estimating the seats-votes equation on a range of values that extends beyond the 40 through 60 range can lead to depressed estimates of swing, because above and below these points it often not possible to win (or lose) additional seats in the Electoral College.

[5] Some scholars (e.g. King and Gelman 1991) have criticized the assumption that imposes a uniform vote-swing across every state. The criticism of this assumption stems from that vote swings are rarely uniform across states; rather, candidates perform better in some regions than others. I choose to implement this uniform vote swing assumption for two reasons: 1.) The method is transparent 2.) It is easily reproducible.

these simulated seats-votes curves to estimate the partisan bias and swing ratio for each presidential election between 1872 and 2012.

2. Estimating Bias and Swing Ratio in the Electoral College: 1872-2012

I begin my analysis by replicating Grofman, Brunell and Campagna's 1997 analysis of distributional bias and then I extend this analysis to cover two other (apportionment and turnout) potential sources of partisan bias. The data utilized for this analysis come from Dave Leip's *Atlas of U.S. Presidential Elections*.[6]

2.1 Measuring Potential Sources of Partisan Bias

Centering the distribution of the hypothetical seats-votes curve at different points reveals the presence of different types of bias. The total amount of bias is estimated by centering the distribution of the national two-party vote split at 50:50. Centering the seats votes curve at a popular vote tie reveals the total amount of bias in the system, because this allows me to assess which party would win the Electoral College in the event the parties split the total number of votes cast evenly. Ultimately, if the Electoral College as a whole is biased in favor of one party over the other, it is the result of some combination of distributional, apportionment, or turnout bias. I detect the existence of these biases by centering the seats-votes distribution at different points and then comparing these estimates to my estimates of total bias. I start with distributional bias.

Distributional bias arises from an inefficient distribution of electoral support across states (a large number of wasted votes due to state level landslides), so estimates of distributional bias are fundamentally evaluations of the mean level party support across

[6] See http://uselectionatlas.org/

states. I begin by first constructing the mean state-level Republican two-party vote share, as shown in *equation 3* below[7]:

Equation 3: $\bar{R} = \frac{\Sigma R_i}{N}$

Where;

R= The Republican share of the two-party vote in state (***i***).

I use this observed mean to construct a seats curve where I center the mean state-level two Republican two-party shares at 50 percent and then assess how many Electoral votes the Republican Party would win when I vary this mean level of Republican support from 40 to 60. I then apply the logged odds formula to this data in order to estimate distributional bias and swing ratio. The results of these OLS regression analyses are displayed in *table 1*. The results of this analysis closely resemble those of Grofman, Brunell and Campagna 1997 (when applicable, 1900-1992).[8] The pattern of results shown in *table 1* indicates that there was a consistent distributional bias in favor of the Republican Party from 1896 through 1944. Since 1944, the direction of the distributional bias has reversed in favor of the Democratic Party, although the magnitude of this distributional bias does not always reach levels of statistical significance.

(Table 1 Here)

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[7] It is important to note that the average state-level two-party vote share is not the same thing as the national two-party vote share due to the fact that average state-level two-party vote is not weighted by state population or turnout. For example, California and North Dakota receive the same importance when making this calculation, even though California contributes millions of more votes to the national total than does North Dakota.

[8] My results and those of Grofman, Brunell and Campagna (1997) are very similar but not identical. There are two potential sources of this discrepancy: the use of different rounding techniques or different approaches for dealing with instances where a presidential candidate did not appear on the ballot (which was relatively common for Republican candidates in the South during the first half of the 20th century and then again for Democratic candidates during the middle of the 20th century).

At first glance the direction of the distributional bias might seem counterintuitive. For example, in 2000 there was a statistically significant distributional bias in favor of the Democrats. This is counterintuitive because the Republican candidate, George W. Bush, was able to manufacture an Electoral College majority despite losing the popular vote; a fact that suggests the Electoral College was biased in favor of the Republicans. The 1876 and 1888 (the other two instances where the party that lost the popular vote won the Electoral College) elections were equally puzzling. In 1876 distributional bias cut in favor the Democrats despite the fact that the Republican Rutherford B. Hayes won the Electoral College without a plurality of the popular vote. Likewise, Republican Benjamin Harrison carried the Electoral College despite losing the popular vote to Grover Cleveland. This was in spite of the fact that there was no significant distributional bias in favor of the Republican. These findings suggest that apportionment and turnout bias significantly affect election outcomes, and at least in some cases (e.g. 1876, 2000), in a way that cuts against the effect of distributional bias.

This fact becomes clear when I calculate the total bias by replicating the logged odds analysis from *table 1*, where I center the distribution at a 50:50 split of the national two-party vote, opposed to the 50:50 split in the average state-level two-party vote. The national Republican two-party vote is effectively a 50 state average that is weighted by both state population and turnout. Constructing the seats votes curve in this fashion accounts for the combined effect of all three potential sources of bias, apportionment, distributional and turnout. Applying Tufte's logged odds method to data centered at a 50:50 split of the national two-party vote allows me to assess what proportion of the electoral vote each party would win in the event of a popular vote tie. I display these sets of estimates in *table 2* and depict them graphically in *figure 1*.

(Table 2 and Figure 1 Here)

Generally speaking, the swing ratios are uniformly higher when I center the seats-votes curve at a 50:50 split of the national two-party vote as opposed to when I use the average state-level two-party vote. Perhaps what is more interesting is the fact that in many instances the direction of the total bias is reversed from the original estimates of just distributional bias—in some cases this difference is quite significant. This finding suggests that apportionment and turnout bias are also present. I estimate apportionment bias by subtracting two electoral votes from each state's vote total to account for the Electoral College votes that correspond to each state's Senate seats, which are assigned to each state regardless of the population.[9] I then use these adjusted electoral vote totals to construct a third vote-seats curve. Again, I center the distribution at a 50:50 split of the national two-party vote, effectively replicating the set of models in table 2 using the adjusted electoral vote totals. This third set of estimates allows me to assess how partisan bias and responsiveness would change if the major source of apportionment bias were removed.[10] I calculate the total amount of apportionment bias by calculating the difference between my estimates of total bias and my estimates of bias using the adjusted electoral vote totals. The difference between these two numbers is the total amount of apportionment bias.

[9] This method does not perfectly account for the integer problem associated with districting plans, but it does address the major source of apportionment bias that occurs as a result of the two electoral votes that correspond with each state's Senate seats. Any unaccounted for apportionment bias will fall into the residual bias category

[10] Again, I am using Tufte's logged odds method. I have omitted the table containing these estimates from the manuscript due to space and clarity considerations. These results can be found in the supplementary appendix.

Now that I have estimates of total, distributional and apportionment bias I can now construct an estimate turnout bias.[11] I construct this estimate using the following algebraic formula:

Equation 4: **Turnout Bias (plus any residual bias) = Total Bias – (Distributional Bias + Apportionment Bias)**

I display the estimates of apportionment and turnout bias in *table 4* and depict these estimates graphically in *figure 2,* along with my previously constructed estimates of distributional and total bias.[12]

(Table 4 and Figure 2 Here)

2.2 The Evolution of Partisan Bias and its Components

The magnitude and direction of partisan bias has changed considerably over the past 140 years. The Electoral College was biased in favor of the Democratic Party during much of the late 19th and early 20th century. The sources of this bias were a combination of apportionment and turnout bias. It should be noted that the Electoral College typically worked to the Democrats advantage in spite of significant distributional bias that favored the Republican Party. This is a consistent feature of the Electoral College stems from the peculiar nature of Southern elections. Election outcomes in the South have typically been more lopsided compared to election outcomes in the rest of the country. The Republican

[11] Estimating turnout bias in this way effectively relegates turnout bias into a residual category that captures all remaining sources of bias. The vast majority of the bias captured in this residual category is attributable to turnout bias, but unaccounted for apportionment and third party biases may also be present. For more on this distinction, please consult the supplementary appendix.
[12] All of the calculations used to generate the hypothetical seats-votes curves used in this analysis were constructed using the Republican Party's share of the two-party vote as the cornerstone. I have made no concerted effort to assess the effects of serious third party candidacies; therefore, my estimate of turnout bias likely includes the effect of any third party bias that exists in years with strong third party candidacies. Therefore, estimates of bias and swing ratio in years where third parties mounted serious electoral challenges (e.g. 1912, 1968, 1992 and 1996) should be interpreted with some caution. For more on approaches that systematically incorporate the presence of third parties please consult the appendix.

Party often did not contest elections in the American South between the end of Reconstruction and the beginning of the civil rights movement. The Democratic Party won these states by huge margins, leading to distributional bias in favor of the Republican Party (winning by such large margins is inefficient). However, it should also be noted that the Democratic Party captured these states with a minimal number of votes actually cast. These "cheap seats" in the South allowed the Democrats to win a number of states with a very small amount of votes (Key 1949), creating a turnout bias in favor of the Democrats during much of the early 20th century. Even today, states in the South have a lower rate of turnout than most other states. As a result, this pattern of distributional and turnout bias reversed following the Southern realignment, when the Republican Party began to first compete in and then consistently win presidential elections in the Deep South by lopsided margins.

One consistent feature of the Electoral College is that the direction of distributional and turnout bias typically have cut in opposite partisan directions (they are correlated at r=-.73). There is no logical or mathematical reason why turnout and distributional bias has to cut in opposite directions. Rather, this is a peculiarity of the geographic distribution of partisan support in American elections. The party that has controlled the South has done so by winning by large margins and with a minimal number of votes cast, creating biases that have the opposite partisan effects. The pattern of apportionment bias has been consistent. Apportionment bias afforded neither party a consistent advantage during the latter half of the 19th and early part of the 20th century.[13] However, as the Republican Party

[13] The one important exception to this was 1896, when William Jennings Bryan swept the small states (seven new states entered the Union between the 1892 and 1896 election, each with three or four electoral votes apiece. Bryan won six of these seven new states, in addition to Nevada (3),

has become firmly entrenching in the sparsely populated Great Plains and Mountain West states during the middle of the 20th century, it has maintained a small (one to three points) but consistent vote bonus as a result of bias in the apportionment process.

Distributional, apportionment, and turnout bias aggregate up into total bias, which is the total partisan slant of the Electoral College. My estimates of total bias are listed in the fifth column of *table 4*. Following the Civil War, the Electoral College generally worked in favor of the Democratic Party, with the exception of 1896 and 1924 (or had no discernable partisan effect). Following the Southern realignment, the direction of total partisan bias reversed in favor of the Republicans, although the magnitude of this total partisan bias has declined over time.[14] The decline in the total amount of bias in the system is likely due to the increasing competitiveness of and turnout in presidential elections in the South. While election outcomes in the South are more lopsided than average, and turnout is still lower on average, politics in the South resemble the nation at large much more closely than it did in the 19th or early 20th centuries (Erikson 1995, 389-292; Cassel 1979). All told, from 1872 though 2012 there are 13 elections with a significant Democratic bias, 14 elections with no discernable bias, and nine elections with significant Republican bias.

Florida (4), and Colorado (4). Nearly sweeping the small states afforded Bryan a considerable and to date unmatched vote bonus. However, Bryan was not able to maintain his previous dominance in the Great Plains in Mountain West when he ran again four years later.

[14] A way of assessing these estimates is to compare them to the three instances where there is known bias in the Electoral College, 1876, 1888 and 2000. In all three of these instances the elections were razor close and the party that lost the popular vote won the Electoral College. My analysis did not indicate the presence of a statistically significant partisan bias in either direction in 1876 or 1888. There is reason to suspect a distortion of the seat-votes relationship by widespread electoral fraud and the eventual allocation of 20 disputed electoral votes to Hayes by an Electoral Commission set up by Congress. In instances like 1876, where a number of Electoral votes were awarded by a Commission to Hayes (opposed to Tilden, who won the popular vote in many of these disputed states) means there was a disjunction between the popular vote and the Electoral College winners and losers in the states. As a result, Hayes won the Electoral College not because of partisan bias but because a dispute over the popular vote led to Electoral College votes being allocated on the basis of something other than the popular vote in certain states.

3. The Electoral Effects of Partisan Bias

The preceding analysis demonstrated that the both the magnitude and direction of partisan bias have varied substantially over the past 140 years of American political history. But how much does the presence of partisan bias actually affect election outcomes? Does the presence of partisan bias present a meaningful obstacle for the disadvantaged party? Or is the responsiveness of the system so high that parties are able to overcome partisan bias without much difficulty? I test this possibility in this next section. I do this by regressing Republican wins and losses in presidential elections on the magnitude and direction of partisan bias in any given election.

There are several ways to operationalize partisan bias in this analysis. The first way to test this possibility is to include a variable coded is 1 for the presence of Republican bias, 0 for the presence of no statistically significant bias, and -1 for a significant Democratic bias (model 1). A second operationalization is to include the estimate of total partisan bias as an independent variable, regardless of whether there is a significant amount of bias in any given election. This second specification accounts for the magnitude (e.g. the difference between a Republican bias of five and a Republican bias of 10) and the direction of partisan bias and allows for both to matter (model 2). Given the binary nature of the dependent variable (Republican wins and losses) I specify this regression as a logit model. The results of these two analyses are presented in *table 5*.

(Table 5 Here)

The results of both models suggest that the presence of partisan bias exerts a statistically significantly impact on the odds that the Republican Party will win a given election. How big of an impact? I utilize the predicted probabilities from model 1 to assess this question. I estimate the Republican Party has 28.7 percent chance to win an election given the existence of significant Democratic bias. The Republican's chances improve to 61 percent in the absence of partisan bias and increase further yet to 85.8 percent in the presence of a significant pro-Republican bias. The results of this analysis suggest that partisan bias plays an important role in determining the outcomes of presidential elections—a party wins the majority of elections when the Electoral College is tilted in its favor (although there are certainly exceptions, 1880, 1928, 1952, 1956 and 1964). Since the popular vote in presidential is often close to an even 50:50 split, even a small amount of bias can be politically consequential. Yet there is reason to think that the effect of partisan bias on election outcomes might not be constant. The responsiveness of the Electoral College (β) varies considerably from election to election. It is possible that partisan bias is less important when responsiveness is high, and a small increase in the popular vote translates into a large increase in a party's share of the electoral vote.

3.1 Accounting for the Potential Effects of the Swing Ratio

How does the swing ratio moderate the electoral effects of partisan bias? I assess the relationship between responsiveness, bias and electoral outcomes by introducing the swing ratio as a right-hand side variable, building on the basic analyses presented in *table 4*. I present the results of this second set of analyses in *table 6*. The inclusion of the swing ratio as a right hand side variable does little to change the basic relationship between partisan bias and electoral outcomes established in *table 5* (models 3 and 4). This finding is unsurprising, given that there is no reason to expect one party to disproportionately benefit from a particularly high or low swing ratio. The key question is whether the swing ratio moderates the effect of partisan bias to any degree? In order to test this possibility, I include an interaction between partisan bias and swing ratio (models 5 and 6). The inclusion of the interaction term is not significant, nor does it improve the fit of either model, which suggests that the swing ratio does not affect the political ramifications of partisan bias.

(Table 6 Here)

3.2 The Electoral Ramifications of Partisan Bias

So what conclusions can be drawn from the preceding analysis? The first conclusion that can be drawn is that bias matters; a political party is much more likely to win when its sources of electoral support are efficiently distributed. A party that wastes fewer votes than its opponent can expect a significant (but not insurmountable) advantage in the Electoral College. This would seem to open up the possibility that a party could create a "lock" on the Electoral College that would allow it dominate presidential elections for an extended period of time. Yet, these long periods of one-party dominance have failed to occur. This analysis highlights two primary reasons why partisan bias has not created long periods of sustained one-party control of the White House.

The first reason is that both the magnitude and direction of partisan bias fluctuates considerably from election to election, and in fact, in many elections there is no meaningful partisan bias to speak of. Partisan bias is not something that a party can count on in any given election. Bias is engendered by a specific set of circumstances that exist in some elections but not others. Some candidates might attract or repel support in such a way that alters the partisan slant of the Electoral College in idiosyncratic ways. Moreover, it is unclear what factors actually cause the changes in the pattern of electoral support necessary to increase or decrease partisan bias, so it is unlikely that a political party can promote bias in its favor other than what occurs naturally as a result of the party simply trying to win electorally important states. The electoral advantages and disadvantages created by partisan bias in the Electoral College are fleeting.

The second reason why partisan bias in the Electoral College has failed to generate a one party 'lock' on the presidency is that the magnitude of the partisan bias is generally not insurmountable even when it exists. The longest sustained period of partisan bias in the Electoral College stretches from 1928 through 1956, during which the Electoral College was significantly biased in favor of the Democrats by an average of 9 points (meaning 50 percent of the popular vote would be expected to translate into 59 percent of the electoral vote). However, the Democratic Party only managed to win five out of these eight elections, losing to Hoover in 1928 and Eisenhower in both 1952 and 1956. While the Electoral College was certainly slanted in the Democrats favor, it was certainly not enough to derail a Republican candidate in a good Republican year. Partisan bias certainly provides an advantage, but the magnitude of this advantage should not be overstated.

In this analysis I demonstrated that partisan bias in the Electoral College can be an important force in presidential elections, but it is a mercurial and inconsistent force. As a result, U.S. political history has not been marked by long periods of sustained one-party control of the presidency (unlike Congress, where sustained periods of partisan control are the norm, likely in part to the presence of partisan bias), but by a frequent alternation of the party in power. In the final section, I conclude by discussing these results in the context of the debate of whether the potential counter-majoritarian tendencies of the Electoral College present a serious challenge to democratic principles.

4. The Electoral College in Relation to Democratic Principles

The translation of votes into seats is one of the key determinants of the type of party system that is likely to form in a given country (Budge and McDonald 2007). In the case of the United States, I have demonstrated that the translation of votes into seats is often systematically biased. As a result, there has been an ongoing debate mainly originating in the legal community, over whether the Electoral College violates the democratic principle of 'one man, one vote (e.g. Best 1996; Fullerton 2001; Chang 2007; Gringer 2008; Hendricks 2008; Edwards 2011; among numerous others).' Arguments against the continued use of the Electoral College rest on the claim that the Electoral College systematically violates the 'one man, one vote' principle due to the various sources of partisan bias (and associated unequal vote weights between individuals in different states), election outcomes can violate the majoritarian principles that structure American elections. However, the results of this analysis presented here suggest that these fears might be overblown. While the Electoral College can translate votes into seats in a biased way, the direction and sources of this bias are not consistent, so no group of voters is permanently disadvantaged as a result of unequal vote weights. This pattern of inconsistent bias departs from patterns of bias found in the U.S. House of Representatives as well as the electoral systems in many other countries, where bias often consistently favors of one party over the other for a generation or more (Jackman 1994; Brunell 1999)

Moreover, critics of the Electoral College often point to instances like the 2000 election, where Bush won the Electoral College despite losing the popular vote by over 500,000 votes, and state 'that if it was not for the Electoral College, Gore would have won.'[15] These claims rest on the counterfactual that voting patterns would have been the same if presidential elections were decided to popular vote opposed to the Electoral College, which makes them dubious. As multiple observers (e.g. Shaw 1999; Shaw 2006; Hill and McKee 2005; Stromberg 2008) have noted, candidate strategies and allocation of resources are designed to maximize a candidate's share of the electoral vote, not the popular vote. This fact implies that using the popular vote split in presidential elections held under the Electoral College as a counterfactual baseline for what would have happened if the election was decided by the popular vote is problematic, as the candidates would have employed vastly different strategies. The Democrats currently have no incentive to spend resources in an effort to maximize turnout in California or New York, the same is true with the Republicans in Texas or Alabama. Obviously these incentives would be altered if the election were decided by the national popular vote. Therefore, there is no guarantee that Gore would have defeated Bush if the election were decided by the popular vote. The potential political and governance consequences of utilizing the popular vote, opposed to the Electoral College, are harder to evaluate than it might initially seem.

Overall, this analysis revealed that a party's distribution of electoral support across states is a key determinant of its odds of success. A candidate is likely to win when their sources of electoral support are distributed more efficiently than their opponent's. Yet, a candidate cannot count on being advantaged or disadvantaged by partisan bias in the Electoral College, as these advantages and disadvantages have proven to be fleeting.

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[15] This was a topic discussed at length by Nate Silver as well. See: http://fivethirtyeight.blogs.nytimes.com/2011/09/20/would-al-gore-have-won-in-2000-without-the-electoral-college/?_php=true&_type=blogs&_r=0

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Table 1: Distributional Bias and Swing Ratio Estimates for the U.S. Electoral College 1872-2012

	1872	*1876*	*1880*	*1884*	*1888*	*1892*	*1896*	*1900*	*1904*	*1908*	*1912*	*1916*	*1920*	*1924*	*1928*	*1932*	*1936*	*1940*
Swing	**5.51**	**5.58**	**4.81**	**6.50**	**6.06**	**5.06**	**2.78**	**3.44**	**2.30**	**3.25**	**3.07**	**2.56**	**1.96**	**1.46**	**5.15**	**3.08**	**4.34**	**3.53**
	(0.31)	(0.29)	(0.29)	(0.29)	(0.49)	(0.33)	(0.18)	(0.20)	(0.09)	(0.17)	(0.30)	(0.19)	(0.06)	(0.09)	(0.22)	(0.17)	(0.38)	(0.46)
Alpha	**0.36**	**-0.20**	**-0.19**	-0.06	0.15	**-0.81**	**0.76**	**0.50**	**0.36**	**0.47**	**0.44**	**0.77**	**0.55**	**0.47**	**0.30**	**0.55**	**0.39**	**0.51**
	(0.08)	(0.071)	(0.07)	(0.07)	(0.12)	(0.08)	(0.04)	(0.05)	(0.02)	(0.04)	(0.07)	(0.05)	(0.02)	(0.02)	(0.05)	(0.04)	(0.09)	(0.11)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.942	0.951	0.936	0.963	0.891	0.927	0.925	0.938	0.969	0.952	0.844	0.907	0.981	0.928	0.968	0.947	0.873	0.760

	1944	*1948*	*1952*	*1956*	*1960*	*1964*	*1968*	*1972*	*1976*	*1980*	*1984*	*1988*	*1992*	*1996*	*2000*	*2004*	*2008*	*2012*
Swing	**4.86**	**6.44**	**7.36**	**8.06**	**8.49**	**5.77**	**7.98**	**6.60**	**9.15**	**7.77**	**8.82**	**9.68**	**8.85**	**6.69**	**4.84**	**5.22**	**3.68**	**3.70**
	(0.53)	(0.50)	(0.28)	(0.43)	(0.34)	(0.32)	(0.22)	(0.27)	(0.32)	(0.33)	(0.24)	(0.45)	(0.54)	(0.25)	(0.19)	(0.24)	(0.13)	(0.11)
Alpha	**0.32**	**-0.06**	**-0.29**	-0.06	**-0.33**	**-0.45**	**-0.14**	-0.03	**-0.14**	**-0.16**	**-0.17**	-0.17	-0.06	**-0.19**	**-0.39**	**-0.27**	**-0.32**	**-0.25**
	(0.13)	(0.12)	(0.067)	(0.11)	(0.08)	(0.08)	(0.06)	(0.07)	(0.08)	(0.08)	(0.06)	(0.11)	(0.13)	(0.06)	(0.05)	(0.06)	(0.03)	(0.03)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.817	0.897	0.973	0.948	0.970	0.945	0.985	0.968	0.978	0.968	0.986	0.961	0.934	0.974	0.970	0.963	0.977	0.983

Table Note: Statistically Significant Entries (p<.05) in Bold

Table 2: Total Bias and Swing Ratio Estimates for the U.S. Electoral College 1872-2012

	1872	*1876*	*1880*	*1884*	*1888*	*1892*	*1896*	*1900*	*1904*	*1908*	*1912*	*1916*	*1920*	*1924*	*1928*	*1932*	*1936*	*1940*
Swing	**5.15**	**5.54**	**4.88**	**6.56**	**6.79**	**5.47**	**3.72**	**5.00**	**2.63**	**4.40**	**5.83**	**6.46**	**2.63**	**1.86**	**5.49**	**4.35**	**6.55**	**6.04**
	(0.33)	(0.27)	(0.25)	(0.29)	(0.41)	(0.26)	(0.11)	(0.41)	(0.08)	(0.28)	(0.26)	(0.76)	(0.24)	(0.18)	(0.20)	(0.22)	(0.45)	(0.48)
Alpha	0.06	-0.09	**-0.28**	**-0.16**	-0.18	**-0.15**	**0.06**	-0.14	0.01	-0.08	**-0.94**	**-0.41**	0.06	**0.19**	**-0.25**	**-0.29**	**-0.59**	**-0.36**
	(0.08)	(0.07)	(0.06)	(0.072)	(0.10)	(0.06)	(0.03)	(0.1)	(0.02)	(0.07)	(0.06)	(0.19)	(0.06)	(0.05)	(0.05)	(0.05)	(0.11)	(0.12)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.927	0.958	0.953	0.963	0.934	0.96	0.983	0.888	0.981	0.930	0.963	0.791	0.86	0.843	0.974	0.956	0.916	0.894

	1944	*1948*	*1952*	*1956*	*1960*	*1964*	*1968*	*1972*	*1976*	*1980*	*1984*	*1988*	*1992*	*1996*	*2000*	*2004*	*2008*	*2012*
Swing	**6.63**	**7.14**	**7.28**	**8.51**	**8.34**	**6.49**	**7.52**	**6.84**	**9.32**	**8.02**	**9.21**	**9.91**	**9.09**	**6.65**	**5.03**	**4.98**	**4.40**	**3.90**
	(0.47)	(0.48)	(0.29)	(0.40)	(0.38)	(0.29)	(0.19)	(0.31)	(0.33)	(0.30)	(0.35)	(0.46)	(0.45)	(0.24)	(0.13)	(0.22)	(0.42)	(0.17)
Alpha	**-0.41**	**-0.50**	**-0.17**	**-0.36**	-0.15	**0.17**	**0.18**	**0.45**	-0.015	**0.20**	**0.31**	0.17	0.038	-0.08	**0.15**	**0.13**	0.06	0.05
	(0.12)	(0.12)	(0.07)	(0.1)	(0.09)	(0.07)	(0.05)	(0.08)	(0.08)	(0.07)	(0.09)	(0.11)	(0.11)	(0.06)	(0.03)	(0.05)	(0.1)	(0.04)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.912	0.921	0.972	0.959	0.963	0.963	0.988	0.961	0.976	0.973	0.973	0.961	0.956	0.975	0.988	0.965	0.855	0.965

Table Note: Statistically Significant Entries (p<.05) in Bold

Table 3: Total Bias and its Components 1872-2012

	Distributional Bias	*Apportionment Bias*	*Turnout Bias (plus any Residual Bias)*	*Total Bias*	*Direction*
1872	**.090**	.051	-.126	.015	~
1876	**-.050**	.012	.016	-.022	~
1880	**-.071**	.007	-.005	**-.069**	+D
1884	-.015	.015	-.039	**-.039**	+D
1888	.039	.014	-.098	-.045	~
1892	**-.191**	.028	.126	**-.037**	+D
1896	**.180**	-.110	-.056	**.014**	+R
1900	**.123**	-.003	-.155	-.035	~
1904	**.089**	.005	-.092	-.002	~
1908	**.116**	.006	-.141	-.019	~
1912	**.107**	.014	-.340	**-.219**	+D
1916	**.184**	-.008	-.293	**-.101**	+D
1920	**.134**	.039	-.158	.014	~
1924	**.115**	-.007	-.061	**.047**	+R
1928	**.067**	.009	-.128	**-.062**	+D
1932	**.134**	-.013	-.193	**-.072**	+D
1936	**.095**	.013	-.251	**-.143**	+D
1940	**.124**	.008	-.221	**-.089**	+D
1944	**.079**	.017	-.197	**-.101**	+D
1948	-.016	.011	-.117	**-.122**	+D
1952	**-.071**	.030	-.001	**-.042**	+D
1956	-.015	.023	-.097	**-.089**	+D
1960	**-.081**	.017	.027	-.037	~
1964	**-.11**	.013	.14	**.043**	+R
1968	**-.035**	.021	.059	**.045**	+R
1972	-.001	.015	.0965	**.111**	+R
1976	**-.035**	.048	-.01	.003	~
1980	**-.039**	.029	.059	**.049**	+R
1984	**-.041**	.034	.084	**.077**	+R
1988	-.043	.025	.06	.042	~
1992	-.016	.032	-.007	.009	~
1996	**-.047**	.027	-.001	-.021	~
2000	**-.096**	.026	.107	**.037**	+R
2004	**-.067**	.023	.076	**.032**	+R
2008	**-.078**	.019	.074	.015	~
2012	**-.062**	.023	.05	.011	~

Table Note: Statistically Significant Entries (p<.05) in Bold

Table 4: Logit Models Regressing Presidential Election Outcomes on Partisan Bias

VARIABLES	*Model 1*	*Model 2*
Partisan Bias	**1.35**	
(Rep Bias =+1, No Bias =0, Dem Bias =-1)	(0.58)	
ln(alpha)		**4.51**
		(1.82)
Constant	0.44	0.64
	(0.40)	(0.41)
Observations	36	36

Table Note: Statistically Significant Entries (p<.05) in Bold

Table 5: Logit Models Regressing Presidential Election Outcomes on Swing Ratio and Partisan Bias

VARIABLES	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Swing Ratio	-0.20	-0.22	-0.19	-0.23
	(0.20)	(0.21)	(0.21)	(0.21)
Partisan Bias	**1.36**		2.73	
(Rep Bias =+1, No Bias =0, Dem Bias =-1)	(0.55)		(2.67)	
ln(alpha)		**4.52**		3.37
		(1.83)		(8.86)
Swing Ratio * Partisan Bias			-0.21	
			(0.40)	
Swing Ratio*ln(alpha)				0.18
				(1.32)
Constant	1.68	2.00	1.66	2.02
	(1.34)	(1.38)	(1.39)	(1.38)
Observations	36	36	36	36

Table Note: Statistically Significant Entries (p<.05) in Bold

Figure 1: Estimates of Total Partisan Bias in the Electoral College 1872-2012

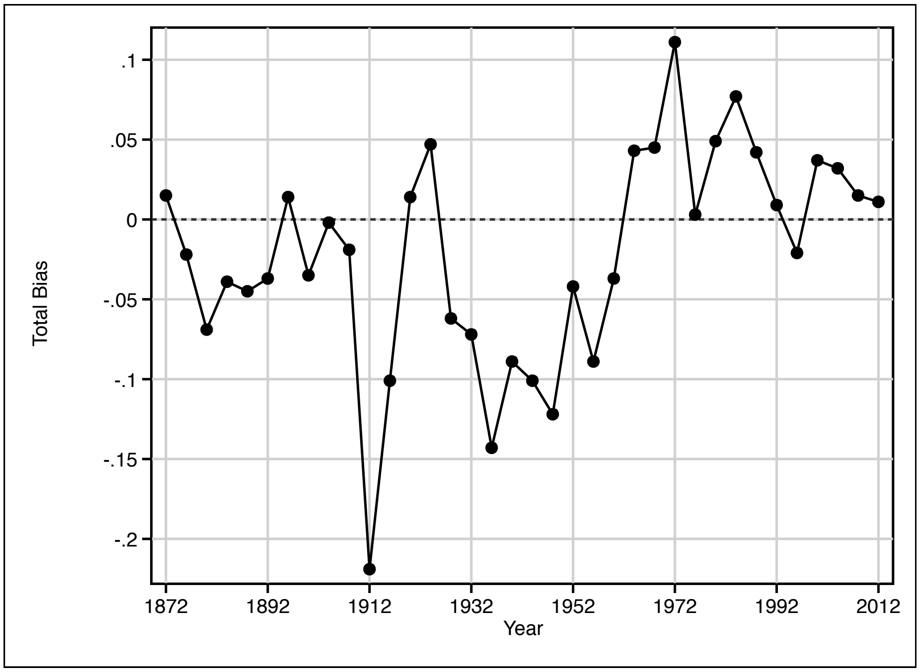

Figure 2: Estimates of Distributional, Apportionment and Turnout Bias in the Electoral College 1872-2012

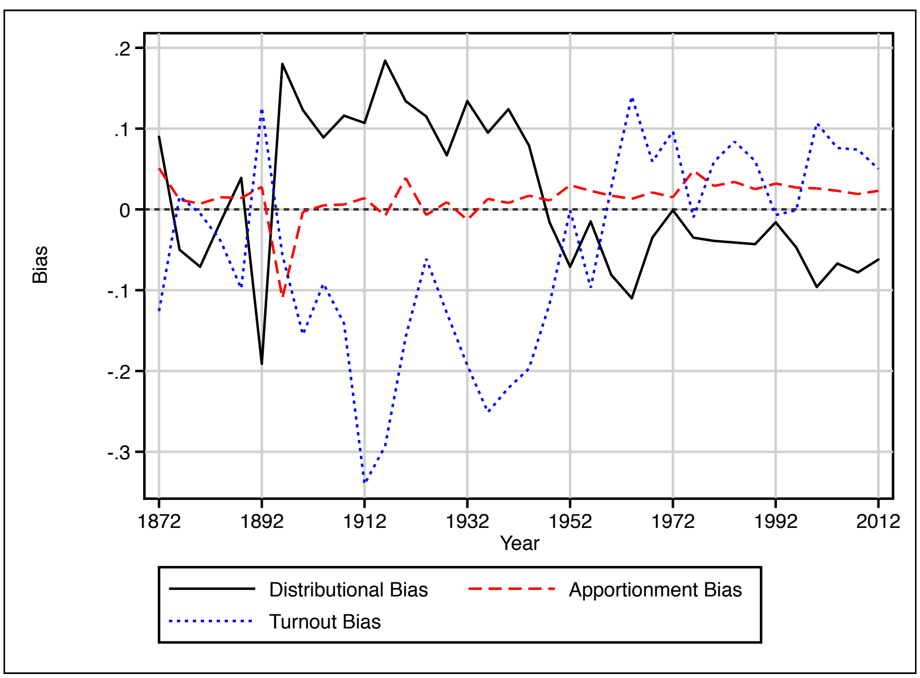

Figure Note: Positive numbers reflect pro-Republican bias while negative numbers reflect pro-Democratic bias.

Supplementary Appendix

1.1. Directly Estimating Turnout Bias with a Demonstration from the 2000 Presidential Election

In this paper I develop an algebraic method of estimating turnout bias, which I define as the residual category that arises once I subtract distributional and apportionment bias from total bias. The strength of this method is that it is easy to calculate and does not require state turnout or population data.[1] One potential critique of the algebraic method of estimating turnout bias is that these estimates also include residual sources of bias introduced by the presence of third party candidates or the interactions between the various sources of bias. In this appendix, I assess the degree to which residual sources of bias shape my algebraic estimates of turnout bias. I do this by developing a direct estimate of turnout bias and then assessing how this estimate compares to the algebraically derived alternative. I find that the two methods produce broadly similar results.

I directly measure turnout bias by comparing the difference in the intercepts from two sets of logged odds equations run on two sets of seat-vote curves, one centered a 50:50 distribution of the mean state-level vote share (the estimate of just distributional bias) and the second centered a 50:50 distribution of the mean state-level population-weighted vote share (which is effectively distributional bias plus turnout bias). Turnout bias arises when there is a difference between a party's

[1] This method also has the advantage of sidestepping the question of how to measure turnout rates. The difficulty with measuring turnout is determining what the denominator of the turnout (e.g. percent of CVAP over 18 that cast a ballot vs. the percent of eligible voters that cast a ballot vs. the percent of registered voters that cast a ballot). This method effectively accounts for any potential registration biases by treating turnout bias as a residual category.

mean state-population weighted vote share and the party's share of the national two-party vote. Because a party's average state-population weighted vote share does not take turnout into account (or in other words, assumes turnout is equal in every state), a party's proportion of the average state-population weighted vote share will be higher than the party's national two-party vote share if the party's base of electoral support is concentrated in states with low turnout.

I work through how to do these calculations using the 2000 presidential election as an example. Turnout bias arises from one party winning states with lower average turnout compared to the turnout in states won by the opposing party. In 2000, Republican George W. Bush narrowly lost the two-party popular vote to Democratic Al Gore 49.5 to 50.5 despite winning the Electoral College 271 to 266. The disjunction between the popular vote and Electoral College outcome indicates that the Electoral College was biased in favor of the Republican Party. As I noted in the main body of the text, there is evidence that distributional bias (an inefficient distribution of electoral support) cut against the Republican Party in 2000, which suggests that apportionment and/or turnout bias worked in the Republicans favor.

A comparison of the mean Republican state-level two-party vote shares and the Republican national two-party vote helps to illustrate why this is the case. As I noted in the preceding paragraph, Republican George W. Bush won 49.5 of the national two-party vote. However, Bush's mean two-party vote share was 51.9 (the median was 50), almost two and a half points higher than this national two-party vote share. This number implies that on average Bush won states by a larger margin than did his Democratic opponent Al Gore, a fact that is confirmed by figure A1.

Figure A1 displays the vote margin in each state during the 2000 and 2004 presidential elections (positive numbers reflect pro-Republican vote margins). The notable feature of this figure is the left-skewed distribution of vote margins. Democrat Al Gore won three states (and DC) by a margin of 20 points or greater in 2000. Comparatively, George W. Bush won 11 states by more than 20 points, meaning the Bush's distribution of votes was less efficient than Gore's, who typically won states by a smaller margin than his opponent. This inefficient distribution of votes led to distributional bias in favor of the Democrats.

I investigate this possibility in more detail in columns one and two in table A1. Column two contains an estimate of total bias using Tufte's (1973) logged odds method applied to a hypothetical seats-votes curve centered on an even 50:50 split of the national two-party vote. Column three contains an estimate of distributional bias, again using Tufte's logged odds method applied to a hypothetical seats-votes curve, the difference being this hypothetical distribution is centered at a mean state-level two-party vote share of 50 percent. The first equation estimates there was a 3.37-point total bias in favor of the Republican Party; however, the second equation estimates there was a 9.6-point distributional bias in favor of the Democrats. The discrepancy between estimates of total and distributional bias indicate that other forms of bias (apportionment, turnout, and potentially from the presence of Ralph Nader, a third party candidate), were working in favor of the Republican candidate.

(Figure A1 Here)

Malapportionment is an obvious source of pro-Republican bias in the 2000 election. Republican George W. Bush won 30 of the 51 (counting the District of

Columbia) states despite failing to capture a plurality of the popular vote. Bush performed especially well in the states with small populations, which are systematically overrepresented in the Electoral College. This is evidenced by the candidates' respective electoral vote totals if I subtract the two electoral votes each state receives regardless of their population. Removing these two votes helps to bring a states number of electoral votes closer in line with its population. Removing these two votes from each state would shift the candidates total Electoral vote totals from 271/266 to 211/224, reversing the outcome of the election.

I analyze the degree of apportionment bias in greater depth with a third analysis of a hypothetical seats-votes curve. The difference between this analysis and the previous analysis of total bias is that I remove two electoral votes from each state's total (the seats-votes curve is still centered on an even distribution of the national two-party vote) in an effort to remove the main source of apportionment bias from the analysis.[2] Removing the electoral votes associated with each state's senate seats reveals the presence of apportionment bias. There is an estimated 1.15-point pro-Republican bias once the major source of apportionment bias is removed, compared to the estimated 3.37-point overall bias in favor of the Republicans. This discrepancy means that there is 2.22-point (3.37-1.15) apportionment bias in favor of the Republican Party, which is ultimately rooted in the Republican Party's strong performance in the sparsely populated Great Plains and Mountain West states.

[2] Like I mentioned in the main text, this procedure removes the major source of apportionment bias, but not all potential sources of apportionment bias. This second set of apportionment bias stems from the integer problem that exists in the apportionment process.

However, there is still a considerable amount of unexplained pro-Republican bias even after I account for the main source of malapportionment. This finding suggests that additional sources of bias are present. The most obvious additional source of bias stems from differences turnout levels across constituencies. Partisan bias would arise from George W. Bush winning states with lower average turnout than the Democrat Al Gore. Figure A2, which plots state-level turnout among the voting eligible population (VEP) against the Republican share of the two-party vote, lends support to this possibility (evidenced by the cluster of states located in the bottom right quadrant of the figure). [3] On average, turnout in states won by Bush was considerably lower turnout compared to the states won by Gore, at 53.7 percent versus 58.4 percent respectively. The discrepancy between the average turnout rate in Democratic and Republican states opens up the possibility that turnout bias was a critical factor in explaining the overall pro-Republican bias in the 2000 election.

(Figure A2 Here)

I investigate this possibility with a fourth and final logged odds analysis of a hypothetical seats-votes curve. The results of this analysis are reported in column five of table 1A. The seats-votes curve is centered at a mean population-weighted state-level two-party vote share of 50 percent. Centering the distribution at the population weighted state-level two-party vote share assumes that each state contributed to the overall average at a rate commensurate with the state's population. Stated differently, this analysis assumes that turnout rates are equal

[3] Turnout data was obtained from Michael P. McDonald's United States Elections Project: http://www.electproject.org/2000g

across jurisdictions. The average VEP-weighted two-party Republican vote share is 49.8, which is lower than the unweighted average of 51.9 but still higher than the national Republican two-party vote share of 49.5. This estimate can then be directly compared to the estimate of distributional bias alone and the difference between the two estimates (if any) is directly attributable to the presence of turnout bias.[4]

(Table A1 Here)

The analysis in column four in confirms that turnout bias played a significant role in shaping total bias. The analysis of distributional bias alone revealed the presence of a significant distributional 9.7-point bias in favor of the Democrats. The joint estimate of distributional and turnout bias reveals a net bias of .75 in favor of the Democratic Party. This estimate is statistically indistinguishable from zero and implies an 8.95-point pro-Republican turnout bias. The interpretation of this finding is that in the 2000 presidential election, the partisan effects of distributional and turnout bias effectively canceled one another out. Figures A1 and A2 illustrate why this was the case. The Republican Party won states by a larger average margin than the Democrats; however, the states the Republican Party won had lower turnout than the states carried by the Democrats. The analysis presented in the main text of the paper suggests that the partisan direction of distributional and turnout bias have historically cut in opposite directions. This in depth analysis of the 2000 presidential election illustrates exactly why this is the case.

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[4] In this analysis, the primary source of apportionment bias, the two electoral votes that correspond with each state's Senate seats, have been removed from the total number of electoral votes. This is done in an effort to isolate only distributional and turnout bias.

So what proportion of the residual bias I derive algebraically in the main text is explained by the presence of turnout bias? My preceding analysis of the 2000 election revealed there is a 1.9-point gap between the summed effect of these three estimates of distributional, apportionment, and turnout bias and the overall estimate of pro-Republican bias. This unexplained difference might be evidence a fourth and unaccounted for source of bias arising from third party votes or simply a product of the uncertainty associated with my measurement procedure. The core takeaway here is that the vast majority of my algebraically derived estimate of residual bias is explained by the presence of turnout bias. Other sources of bias make up a very small proportion of the residual bias category.

Overall, the evidence that I have presented here indicates that distributional, apportionment, and turnout bias were all factors in 2000. On the balance, these partisan biases favored the Republican Party.

1.2 Comparing My Estimates with Those of Johnston and Pattie (2014)

As readers that are versed in the literature on bias and responsiveness as well as the literature on the Electoral College will note, my estimates of total bias and its constituent sources differ from those of Pattie and Johnston (2014), who developed their own estimates of partisan bias in the article, '"The Electors Shall Meet in their Respective States:" Bias and the U.S. Presidential Electoral College, 1960-2012,' which appeared in *Political Geography* in 2014. Some of the most notable differences between my estimates and the author's estimates occur in 2000, where the author's argue the Republicans benefitted from a substantial amount of efficiency bias (what I term distributional bias). In fact, the authors argue that efficiency bias provided the Republicans a 50 plus seat advantage in the Electoral College (Johnston and Pattie 2014, page 43, figure 8). The authors also argue that apportionment bias worked in favor of the Republicans to the degree of a 15-seat advantage and there was no discernable amount of turnout bias (page 42, figure 6).

Pattie and Johnston's estimates conflict with the estimates I provided in the main text of the paper and the detailed analysis of the 2000 election in the previous section. This raises the question of which set of estimates is correct? I laid out the rationale for both my estimation strategy and the specific estimates of bias in the 2000 election. In this section I lay out simple, but I argue compelling, reasoning as to why Johnston and Pattie's estimates of the components of bias are implausible.

The reason for doubt is simple. In 2000, Johnston and Pattie project a 50 plus seat Republican advantage as a result of efficiency/distributional bias in addition to the presence of a smaller but still significant pro-Republican apportionment bias and no discernable turnout bias. However, in 2004, according to the authors' estimates, the patterns of bias in the Electoral College fundamentally change. The authors estimate that in 2004, there was a massive shift in efficiency bias in favor of the Democrats. The authors estimate over a 100 electoral vote shift in efficiency bias (page 43, figure 8), which is close to a 20 percent swing of the *total* seats in the Electoral College. Such a shift is implausible. This kind of shift in the partisan bias in the Electoral College would require a considerable shift in the distribution of the parties' bases of electoral support. The problem with this is that there was hardly any substantive shift in the parties' bases of support from 2000 to

2004, let alone a major one. The results of the 2004 election are extremely similar to the results of the 2000 election.

Figure A3 contains three scatter plots. The first is the linear fit between the state level Republican vote margins 2000 and 2004. The second panel is the linear fit between the Republican two-party vote in 1996 and 2000. The third is the linear fit between the Republican two-party vote in 1996 and 2004. In addition, table A2 contains three regressions, each assessing the bivariate relationship between the state-level two-party vote outcomes in the three aforementioned pairs of elections. The most notable feature of the relationship between all three of these pairs of elections is the tight linear relationship between the state-level vote outcomes. As the regression model in Table A2 demonstrates, regressing the 2000 Republican two-party vote shares on the 2004 Republican vote shares produces a coefficient of one—there is literally a *one to one* relationship between the state-level vote outcomes. In addition, the R-squared of this bivariate relationship is .95, which indicates a tight linear fit (evidenced by the plot) with very little noise. Bush did roughly 1.5 points better across the board, with no systematic shift in the parties' state-level bases of electoral support. The relationship between the 1996 and 2000 election outcomes is also fundamentally similar, with a coefficient of 1.13 and a R-squared of .915. Even the relationship between the 1996 and 2004 election returns are highly stable, with a coefficient of 1.08 and a R-squared of .897.

(Figure A3 and Table A2 Here)

The point of showing these figures and regression models is to illustrate that there was a remarkable level of consistency in state level election returns between

1996 and 2004. The idea that a constant cannot explain a change is a simple logical precept. State-level Republican vote shares remained virtually constant between 2000 and 2004, and highly stable between 1996 and 2004.[5] Yet, Johnston and Pattie estimate that there were massive shifts in the patterns of total and efficiency/distributional bias from 1996 to 2004, with both total and efficiency/distributional bias running in favor of the Democrats in 1996, then heavily in favor of the Republicans in 2000, before dramatically shifting once again back in favor of the Democrats in 2004. [6]

There is no way that these fundamentally similar election returns could produce such fundamentally different patterns of distributional bias. The authors' estimates are simply not plausible given the continuity in the parties' geographic base of support that characterizes the elections in question.

1.3 Dealing with the Presence of Third Party Candidates

One of the weaknesses of Tufte's logged odds methods of estimating partisan bias and swing ratio is that it is difficult to account for the presence of third party

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[5] Note that my estimates of total bias and its constituent sources are stable throughout this time period, a finding that lends credibility to the validity of my estimation method.

[6] Moreover, Johnston and Pattie estimate that turnout bias played a negligible role in the 2000 election. This finding stands in stark contrast to both the data displayed in figure A2 that suggests important differences in turnout in states won by Bush versus those won by Gore. The importance of these turnout differentials is confirmed by the logged odds analysis presented in column four in table A1. What is even more troubling is that Johnston and Pattie estimate that there was a significant turnout bias in favor of the Republicans in 2004. This finding is in spite of the fact that the turnout gap between Republican and Democratic states shrank between 2000 and 2004 (4.7 versus 4.2). Thus, it not only seems that turnout bias had a large relatively sizeable effect during both the 2000 and 2004 elections, but the magnitude of this bias should decrease between 2000 and 2004, not increase (this pattern is in line with my estimates of turnout bias presented in the main text).

candidacies. Third party candidates generally do not exert a great deal of influence in most American elections, although there have certainly been exceptions to this general statement. The exceptions to this general trend come in two forms. The first are instances where a third party candidate won a large proportion of the vote (e.g. 1992, 1968, etc.). The second are the instances where a third party candidate won a small but ultimately pivotal number of votes in a key state (such as Nader did in Florida in the 2000 election), which had the effect of tipping the state and ultimately the entire election. The question here is how I can incorporate the effects of these third party candidacies into my estimates of bias and responsiveness? The answer is that it is relatively easy to account for the presence of small third parties but more difficult to utilize the logged odds method when third parties win a substantial proportion of the vote.

Dealing with the presence of small third parties, such the Green Party (led by Ralph Nader) in 2000 is relatively straightforward, although it requires altering the setup of the logged odds models. The logged odds models reported in the paper all rely on the Republican share of the two-party vote as the empirical cornerstone. I assume that the Republican Party wins a state's electoral votes when its share of the two-party vote exceeds 50 percent. Obviously, the two-party vote explicitly excludes the votes obtained by all third parties. Therefore, in order to account for the presence of these third party candidacies it is necessary to move from using the two-party vote to using a party's share of the overall vote. This also requires shifting the standard of winning from "did the Republican Party win a majority of the two-party vote?" to "did the Republican Party win a plurality of the vote?" When calculating the hypothetical seats-votes curved, the third party's share of the vote is fixed, and the Republican and Democratic shares are allowed to vary. Other than that, the procedure remains largely the same.

The challenge with applying the logged odds method to elections that involve three or more relevant parties (and what has thus far limited the applicability of the logged odds method in many European elections) relates to the how to calculate the hypothetical seats-votes curve. The 2015 British election illustrates this challenge quite well. Four parties won more than 5 percent of the vote in the 2015 UK general election and a fifth, the Scottish National Party, won 4.7 percent of the vote, although its vote was geographically concentrated almost entirely in Scotland. The problem here is how to calculate how many seats a particular party will win across a range of national-level vote shares. If the third party candidacy is strong enough, this will require shifting the centering point of the distribution away from the 50 percent mark to some lower threshold. This requirement introduces some challenges. For instance, if I were to vary Labour's share of the vote from 20 to 40 percent (Labour's actual vote share was just over 30 percent) should I assume that Labour gains or loses support exclusively to/from the Conservatives or is it better to assume that Labour gains or loses support equally from/to all other parties? There is not an immediately clear answer. Estimating the relationship between changes in a party's share of the vote and its corresponding share of the seats becomes more complicated when there are more than two parties.

One potential solution to this problem is through the use of simulations. Right now the primary problem with applying the logged odds method to multiparty elections is there is no method to determine degree to which a party loses or gains support from all other parties when constructing a hypothetical seats-votes curve. Does a party gain or lose support from/to all other parties equally or predominately from one rival party. A simulation-based approach based on thousands of automated iterations is one method to address this problem (a version of this approach, the Judgeit program, has already been developed by Gelman and King and is available as an R package). Each simulation would allow the tradeoffs between a party's gain (loss) in support and the corresponding loss (gain) in other parties' support to vary (ranging from pulling support entirely from one party to pulling from all other parties equally).   One could then assess the central tendency of the distribution of simulated seats-votes curves to determine the degree of partisan bias and responsiveness.

This method is more computationally intensive than Tufte's basic logged odds analysis, but it can incorporate estimates of swing and bias derived from wide range of scenarios. Incorporating these wide range of scenarios is necessary given the large number of potential tradeoffs when calculating vote swings with more two relevant parties.

Table A1: Four Logged Odds Estimates of Bias and Responsiveness

	Total Bias	*Distributional Bias*	*Removing Apportionment Bias*	*Distributional +Turnout Bias*
Swing	**5.03**	**4.84**	**5.15**	**5.01**
	(0.13)	(0.19)	(0.14)	(0.13)
Alpha	**0.15**	**-0.39**	.046	-.03
	(0.03)	(0.05)	(.033)	(.030)
N	21	21	21	21
R^2	0.988	0.970	0.985	0.988
Total Bias	3.37	-9.6	1.15	-.75

Table Note: Statistically Significant Entries (p<. 05) in Bold

Table A2: Bivariate OLS Models Estimating the Relationship Between State-Level Vote Outcomes

	2000	*2000*	*2004*
Republican Two-Party Vote 2004	**1.00**		
	(0.033)		
Republican Two-Party Vote 1996		**1.13**	**1.08**
		(0.049)	(0.052)
Constant	-0.013	-0.0026	0.028
	(0.018)	(0.023)	(0.025)
Observations	51	51	51
R-squared	0.950	0.915	0.897

Table Note: Statistically Significant Entries (p<. 05) in Bold

Table A3: Total Bias and Swing Ratio Estimates for the U.S. Electoral College 1872-2012 while Removing the Major Source of Apportionment Bias

	1872	*1876*	*1880*	*1884*	*1888*	*1892*	*1896*	*1900*	*1904*	*1908*	*1912*	*1916*	*1920*	*1924*	*1928*	*1932*	*1936*	*1940*
Swing	**5.07**	**5.87**	**5.16**	**6.97**	**7.23**	**6.06**	**3.87**	**5.16**	**2.77**	**4.67**	**4.42**	**5.87**	**3.04**	**2.28**	**5.45**	**4.29**	**6.96**	**6.39**
	(0.32)	(0.29)	(0.29)	(0.35)	(0.46)	(0.30)	(0.12)	(0.45)	(0.076)	(0.31)	(0.32)	(0.70)	(0.35)	(0.19)	(0.22)	(0.24)	(0.61)	(0.56)
Alpha	**-0.14**	**-0.14**	**-0.31**	**-0.21**	**-0.24**	**-0.21**	**0.15**	-0.15	**-0.095**	**-0.15**	0.0010	-0.23	-0.040	0.0025	**-0.30**	**-0.16**	**-0.54**	**-0.39**
	(0.08)	(0.07)	(0.07)	(0.08)	(0.11)	(0.07)	(0.03)	(0.11)	(0.02)	(0.08)	(0.08)	(0.17)	(0.09)	(0.05)	(0.05)	(0.06)	(0.15)	(0.14)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.93	0.96	0.94	0.96	0.93	0.96	0.98	0.87	0.99	0.92	0.91	0.79	0.80	0.89	0.7	0.94	0.87	0.87

	1944	*1948*	*1952*	*1956*	*1960*	*1964*	*1968*	*1972*	*1976*	*1980*	*1984*	*1988*	*1992*	*1996*	*2000*	*2004*	*2008*	*2012*
Swing	**7.04**	**7.42**	**7.86**	**9.14**	**8.75**	**6.64**	**8.21**	**7.04**	**10.1**	**8.78**	**9.83**	**10.1**	**9.59**	**6.83**	**5.15**	**5.07**	**4.65**	**4.01**
	(0.54)	(0.56)	(0.34)	(0.48)	(0.40)	(0.32)	(0.23)	(0.36)	(0.37)	(0.26)	(0.30)	(0.44)	(0.56)	(0.33)	(0.14)	(0.23)	(0.49)	(0.18)
Alpha	**-0.48**	**-0.53**	**-0.29**	**-0.47**	**-0.22**	0.12	0.074	**0.33**	**-0.16**	-0.0033	0.13	0.044	0.15	-0.040	0.046	0.037	-0.0076	-0.034
	(0.13)	(0.14)	(0.08)	(0.12)	(0.10)	(0.08)	(0.06)	(0.09)	(0.09)	(0.06)	(0.07)	(0.11)	(0.14)	(0.08)	(0.03)	(0.06)	(0.12)	(0.05)
N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
R^2	0.90	0.90	0.97	0.95	0.96	0.96	0.99	0.95	0.97	0.98	0.98	0.97	0.94	0.96	0.99	0.96	0.82	0.96

Table Note: Statistically Significant Entries ($p < .05$) in Bold

Figure A1: the Distribution of Vote Margins in the 2000 and 2004 Presidential Elections

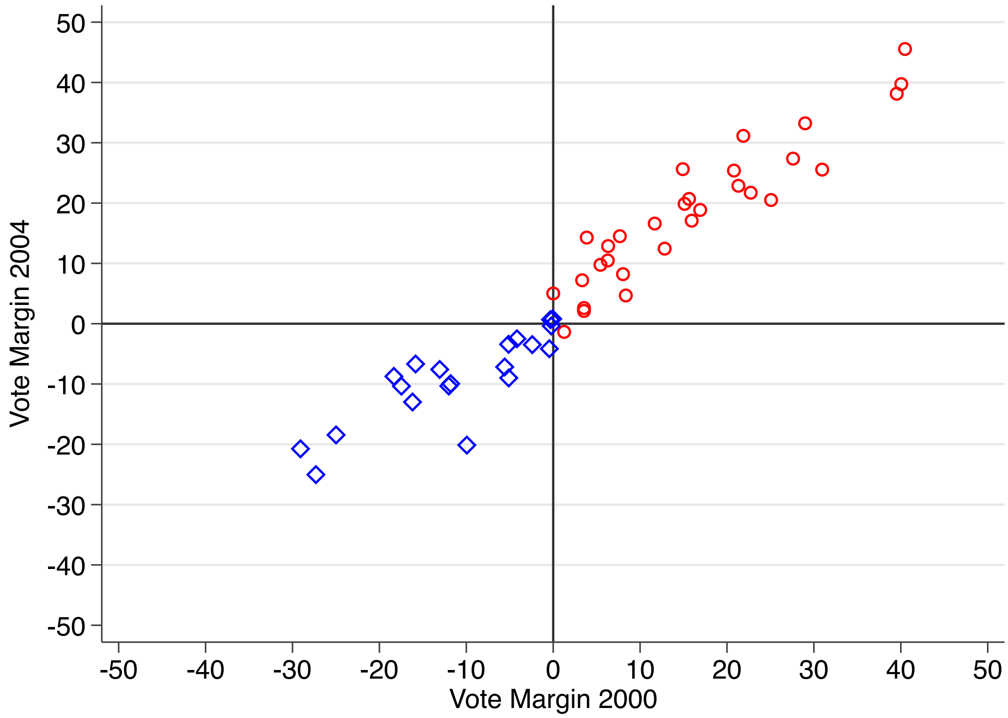

Figure Note: States won by Gore are colored blue and states won by Bush are colored red. One notable outlier, the District of Columbia, has been omitted to enhance the presentation.

Figure A2: the Distribution of Turnout Rates Across States by Republican Two-Party Vote Share in the 2000 Election

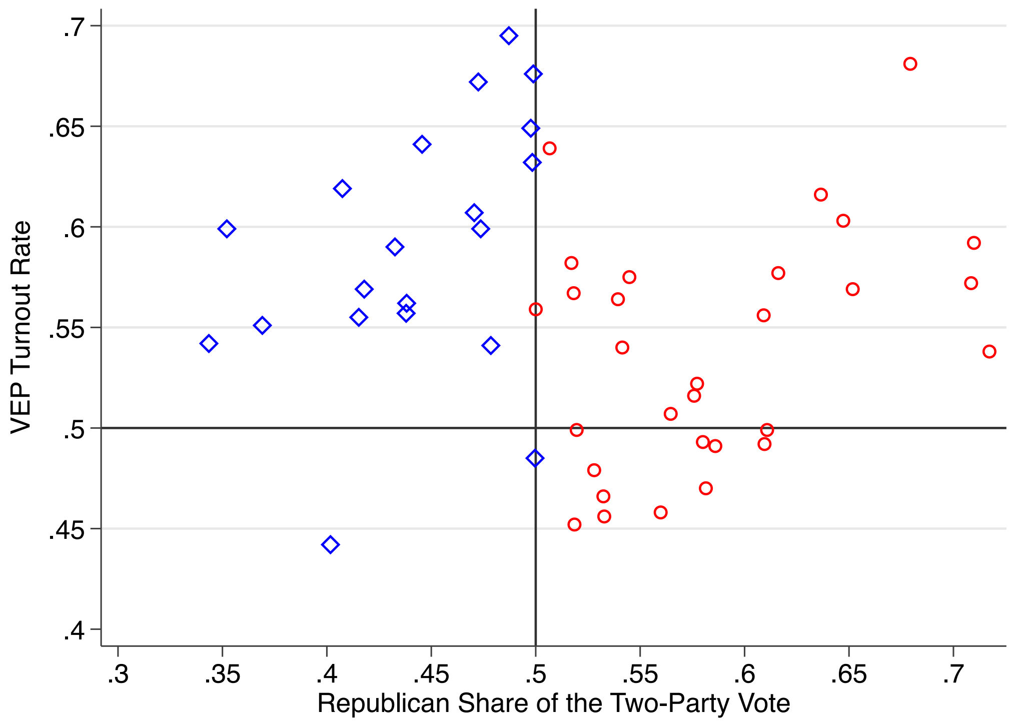

Figure Note: States won by Gore are colored blue and states won by Bush are colored red. One notable outlier, the District of Columbia, has been omitted to enhance the presentation.

Figure A3: The Relationship Between State Two-Party Vote Shares, 2000-2004, 1996-2000, and 1996-2004

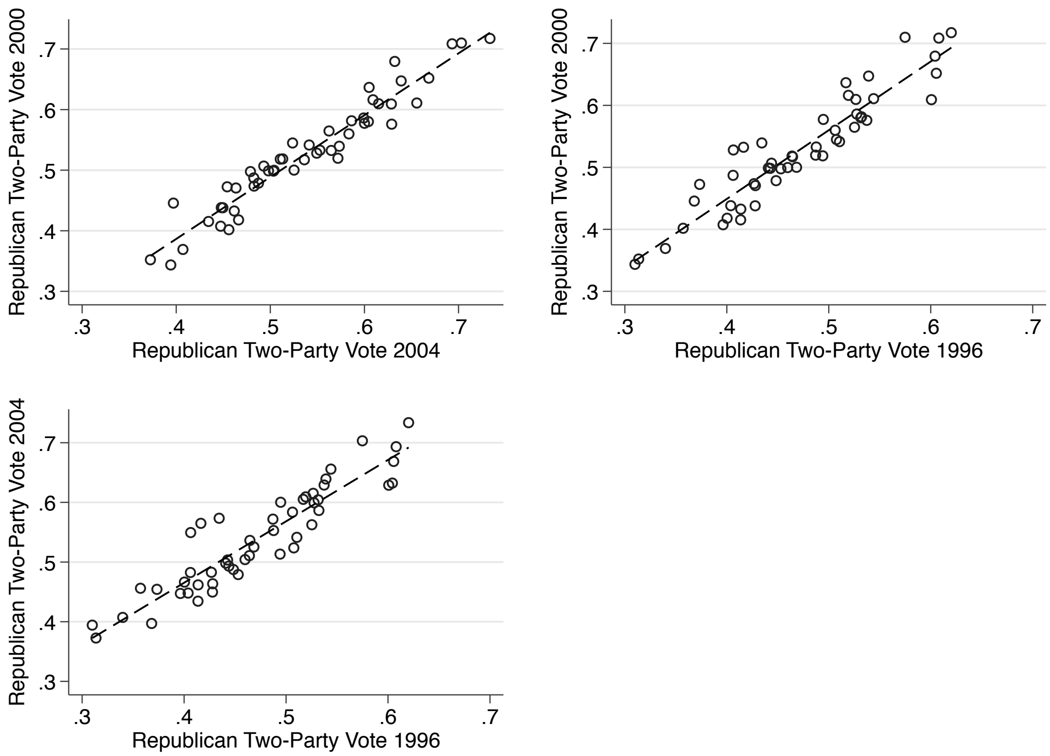

Figure Note: One notable outlier, the District of Columbia, has been omitted to enhance the presentation.