Jack W. Peltason Center for the Study of Democracy

20/20 Vision The Electoral College from 1868 to 2020 & Beyond

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Abstract: *This is a dissertation proposal to be defended on March 6, 2019.*

Replication Material: The data, code, and any additional materials required to replicate all analyses in this article are available at no data yet available.

Jonathan Cervas is a Ph.D. candidate in political science at UCI with an interest in elections and skills in geographic information systems. Together with Grofman, Cervas prepared the Remedial maps in service to the U.S. District Court of Utah for the County Commission and School Board for San Juan County (Navajo Nation et al v. San Juan County et al [12/21/2017]) and for the US District court of Eastern Virginia in Oct 2018-Feb 2019 (Bethune-Hill et al v. State Board of Elections), preparing Remedial legislative districts representing 25% of the body. Cervas's work on this dissertation was supported by both the Peltason Chair and the UCI School of Social Sciences.

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Contents

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List of Figures

List of Tables

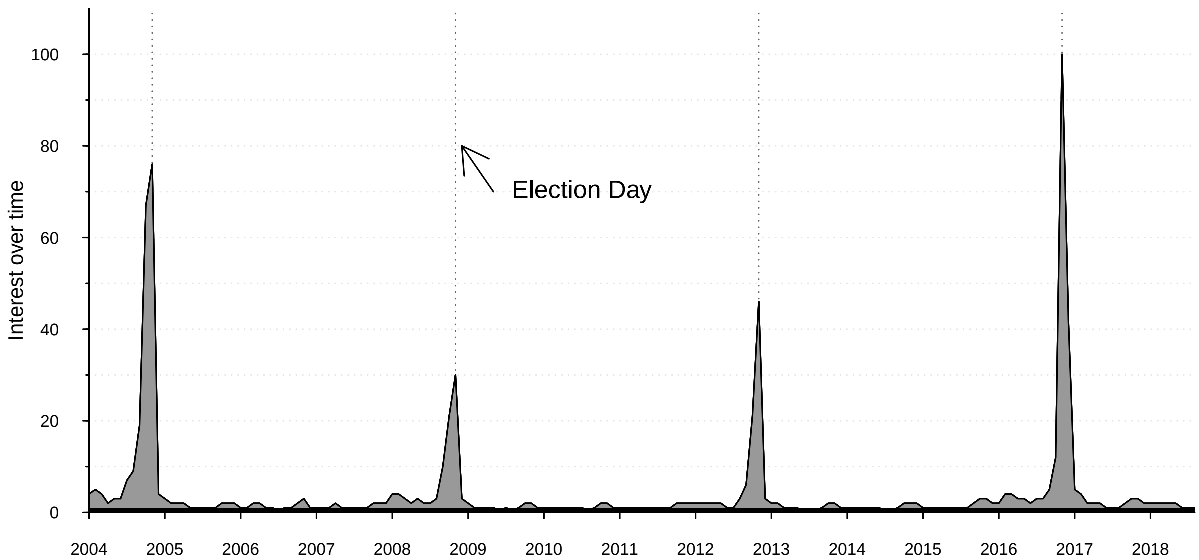
Introduction: Why Do We Have an Electoral College?

My dissertation is an in-depth quantitative and historical account of the US Electoral College institution. This project first got started as a lesson for my American Politics class I was instructing during the run up to the 2016 Presidential election. I created a plot showing the disparity between the weight of voters in California versus those in the least populated, and thus most over-represented states. Shocking due in no small part to comparing states as equally weighted, this chart only told a partial tale of the Electoral College. A more through investigation started to reveal how the Electoral College was operating in reality. Public interest in the Electoral College ebbs and flows, and is at it's highest in the lead-up to a presidential election. It quickly fades as the election passes, even when the candidate elected loses the popular vote (see Figure 1).

History of the Electoral College: What are its alleged faults and its alleged strengths?

In the first part of my dissertation, I will walk through the creation of the Electoral College, paying particular attention to the compromises made that enabled it to become part of the Constitution. Emphasis will be placed on the profound lack of debate on an institution that today plays a pivotal role in how campaigns are formed and executed. As the title of my dissertation suggests, contemporary theories indicate a poorly designed and fatally flawed institution. Evidence of criticism derives from presidential inversions – when the elected President fails to win the plurality

FIGURE 1 Electoral College term search Google Trends



Note: "Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term." – *Google Trends*
The term was at it's peak search in the days following the 2016 election (an inversion).

of votes. The academic literature is also full of attacks on the Electoral College (see e.g., Edwards 2011; Finkelman 2002; Dahl 2003; Bennett 2006; Abbott and Levine 1991 and reduce these results as simply anti-democratic. Others oppose the winner-take-all nature of the Electoral College, where the losing candidate's supporters in a state are 'wasted' (as are the votes of the winning candidate above the votes of the second place finisher). This is, of course, the primary source of inversions. Additional sources to inversions include malapportionment and turnout related disparities. As indicated in the introduction, malapportionment arises first because states have disproportionate population sizes and result in rounding errors that lead to apportionment remainders (some states benefit by having a population not equal to the *ideal* population, while others lose). Second, the two-seat Senate bonus creates additional imbalances between large states and small states. Still further, some critics argue that large states have a positive bias in that they represent such a large percentage of the total Electoral College, while others suggest a small state positive bias due to malappointment. To complicate things even further, some see the Electoral College as fundamentally racist, do largely because it's creation included a three-fifths clause that decrease the apportionment value of slaves (Because slaves didn't have franchise, this benefited slave-states by increasing their population while not increasing the number of voters.) No racial group in America has EVER constituted a plurality of eligible voters in any state. The winner-take-all rule effectively limits the representation of minority groups simply because their votes are never pivotal when racial-blocs vote together. In the few states that have no majority racial bloc **(CHECK THIS!)**, prospects of coalition with other racial groups give some ability for racial groups to be pivotal, thus increasing their influence. This type of situation where there is no majority racial group is extraordinarily rare in American history.

Yale academic Robert Dahl said of the electoral college that it had become "little more than a way of counting votes" (2003). Envisioned first as a deliberative body that would choose among the options representing the will of the states, it quickly evolved in a way that lacked both deliberation or effect. In *Federalist, no. 68*, Alexander Hamilton opined about the Electoral College, "I... hesitate not to affirm that if the manner of it be not perfect, it is at least excellent." Both then and now, most agree that the Electoral College is indeed far from perfect.

How Competition Shapes the Campaign

The first paper I published on the Electoral College (Public Choice, 2017) came about while listening to pundits and others criticize the institution for focusing *SOLELY* on competitive states. I found this argument to be a bit naive if not misleading. As I looked more at the data, it dawned on me that there is a simple explanation on why that premise is flawed – without non-competitive states, a candidate wouldn't have the requisite Electoral votes to win an election. To show how important these non-competitive states were, I replicated and extended a piece by Brams and Kilgour (Public Choice) which uses combinatoric measures to predict outcomes in presidential elections – in doing so, they show that, in a polarized environment, the party that has the disproportionate share of the non-competitive states, and thus their Electoral College votes, the more paths to victory via competitive states are available to them. I show that a much simpler measure, which I coined as Non-Competitive Advantage, more accurately predicted election outcomes in the period 1868-2016. The measure is

TABLE 1 Regressions with Non-Competitive Advantage and with Winningness to predict final Republican EC vote share

	Model 1	Model 2	Model 3 [Restricted]
Non-Competitive Advantage	0.530***		
	(-0.018)		
Winningness		0.553***	0.273***
		(-0.044)	(-0.067)
Constant	0.502***	0.230***	0.357***
	(-0.009)	(-0.031)	(0.033)
N	38	38	15
Adj. R-squared	0.958	0.806	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.

simply the percentage advantage in Electoral College shares between the two major parties. Simply running a regression shows it to be a reliable measure, yielding an R-squared of 0.96, an improvement on Brams and Kilgour's 0.81. The conclusion to be gleaned here is that non-competitive states dictate the terms in which the parties campaign, which affects both it's chances of victory and strategy employed. This chapter will feature the results found in the Public Choice paper, along with a detailed history of the ebbs and flows of competitiveness throughout time, with case study like treatment of the 2016 election, the 1876 election, and the 2000 election **(SUBJECT TO CHANGE)**.

Electoral College Malapportionment

Malapportionment might be the most maligned characteristic of the Electoral College. Malapportionment showed up even as early as negotiations on how the new country would elect it's chief executive. The three-fifth's compromise granted additional weight to slave-holding states in the South by counting slaves for apportionment purposes as 3/5 of one person, all the while prohibiting their participation. While it might seem that counting slaves as *only* 3/5 of a person might be denying these states representation, it was in fact the Southern states that accepted this compromise. They would have preferred their slaves were counted as whole people in order to increase the relative number of representatives. Northern states preferred not counting slaves at all since they would be denied the franchise. [1] - [2] - [3]

[1] **(LOOK THROUGH FEDERALIST PAPERS AND ARCHIVES FROM THAT TIME TO FIND DEBATE QUOTES ON THIS)** Madison and Koch (1987)

[2] **(CALCULATE THE EFFECT OF THESE RULES ON THE ALLOCATION OF CONGRESSIONAL SEATS[EC]) MALAPPORTIONMENT ALSO SHOWED UP IN THE DEBATE ON THE UPPER CHAMBER OF CONGRESS.)**

[3] Dauster (2016) Madison and Koch (1987). **DESPITE THE EFFORTS OF DELEGATES, INCLUDING JAMES MADISON AND ALEXANDER HAMILTON, TO CREATE A CONGRESS PROPORTIONALLY REPRESENTATIVE OF THE POPULATION (EMBODIED IN THE VIRGINIA PLAN), BY JULY 2, 1787, THE CONVENTION DEADLOCKED, AS SMALLER STATES DEMANDED**

TABLE 2 Extending Brams and Kilgour's three measures of setup power

	Winningness		Vulnerability		Fragility		Actual 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

Note: Entries left blank have undefined values. Values of "1" and "0" mean that the number of non-competitive states resulted in no paths to victory.

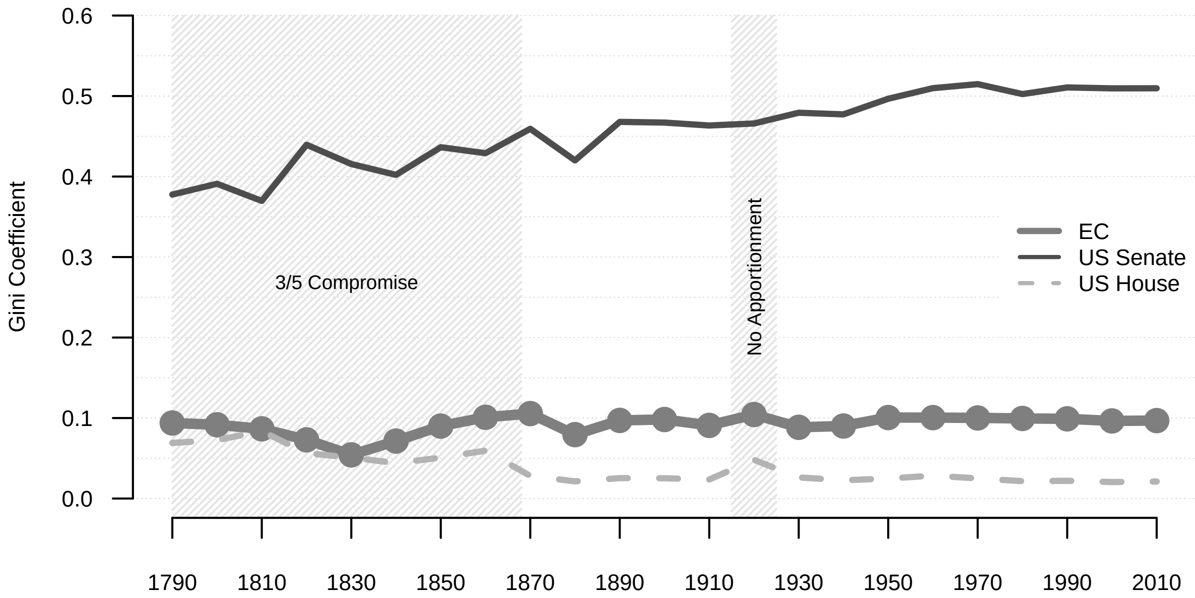
By allocating two Senators for every state, regardless of size, the Constitution introduced additional, and sometimes significant, malapportioment both in law making and in the election of the president. For instance, California with its 38 million residents have the same amount of representation as Wyoming, which has less than a million people. The ratio of these two is the *Max/Min*. Table 4 and Figure 3 show the over time data associated with this measure.

In the section that follows, I will use data to describe how malappointment has shaped electoral outcomes along with just how much malappointment exists and why the problem is overstated once you account for the totality instead of looking at individual differences in the states. I show this by borrowing measures of dis-proportionality and from economics then applying it to the Electoral College. I introduce a previously unused measure of inequality widely used in economics called the Gini Coefficient (Figure 2). This can also be shown using Lorenz curves (Figure 4). I also make use of the Loosemore-Hanbly and Gallagher indices (Table 3) and the Total Population Deviation (Figure 5). All of these measures show the same thing; malapportionment, when measured overall, creates very little by way of disproportionate influence in the Electoral College. It's only when you look at the absolute difference in voting power *ON AVERAGE* across states does it appear that malappointment is an issue that could result in anti-democratic outcomes. The Electoral College's malapportionment is more similar to the US House of Representatives than to the US Senate.

Figure 2 shows the over-time gini coefficients for the Electoral College, with the US Senate and US House shown for comparison purposes. The US Senate shows a disparity that has been increasing monotonically since the early 20th century, while the Electoral College and US House are both significantly lower and have not increased since the size of the House of Representatives was frozen at 435.

EQUAL REPRESENTATION IN CONGRESS BY EACH STATE (EMBODIED IN THE NEW JERSEY PLAN). ON JULY 5, 1787, A COMMITTEE OF THE CONVENTION PROPOSED THE GREAT COMPROMISE, WHICH THE CONVENTION DEBATED AND MODIFIED, FINALLY ON JULY 23, 1787, ADOPTING THE CONNECTICUT COMPROMISE, IN WHICH THE SENATE WAS MADE UP OF TWO SENATORS FROM EACH STATE, AS A POLITICAL EXPEDIENT.)

FIGURE 2 Gini Index Values for the Electoral College: 1790-2010



Note:

TABLE 3 Bivariate Correlations Among Measures of Disproportionality Between Population and EC Shares and Two Measures of Disproportionality Between Electoral and House-based Allocations

	Max/Min	Total Population Deviation	EC-Weighted Gallagher	EC-Weighted Loosemore Hanby	Minimum Population	Gini Index	(Average) House Weighted Deviation	(Average) EC Weighted Deviation	House Weighted Gallagher	House Weighted Loosemore-Hanby
Max/Min	1	0.9	-0.22	0.34	-0.34	0.44	-0.5	0.33	-0.5	-0.55
Total Population Deviation	0.9	1	-0.35	0.44	-0.47	0.55	-0.64	0.43	-0.65	-0.74
EC-Weighted Gallagher	-0.22	-0.35	1	0.49	-0.06	0.42	0.52	0.49	0.51	0.65
EC-Weighted Loosemore Hanby	0.34	0.44	0.49	1	-0.7	0.99	-0.33	1	-0.33	-0.28
Minimum Population	-0.34	-0.47	-0.06	-0.7	1	-0.71	0.63	-0.7	0.63	0.59
Gini Index	0.44	0.55	0.42	0.99	-0.71	1	-0.38	0.98	-0.38	-0.34
(Average) House Weighted Deviation	-0.5	-0.64	0.52	-0.33	0.63	-0.38	1	-0.33	1	0.96
(Average) EC Weighted	0.33	0.43	0.49	1	-0.7	0.98	-0.33	1	-0.33	-0.27
House-Weighted Gallagher	-0.5	-0.65	0.51	-0.33	0.63	-0.38	1	-0.33	1	0.96
House-Weighted Loosemore-Hanby	-0.55	-0.74	0.65	-0.28	0.59	-0.34	0.96	-0.27	0.96	1

Note:

For simplicity of exposition, we present below definitions of these four measures for the case of single seat constituencies. Let $\bar{p} = ideal\ population$, i.e., the total population divided by the number of seats in the legislature, $p_i = population$ in the ith constituency, $p_L = population$ in the constituency with the largest population, $p_S = population$ in the constituency with the smallest population, $n = number\ of\ constituencies$.

The total population deviation (Equation 1) is simply the population of the largest state subtracted by the population of the smallest state, divided by the ideal population.

Total population deviation (TPD) =

$$\frac{(p_L - p_S)}{\bar{p}} \tag{1}$$

The TPD measure is sometimes written as

$$\frac{\bar{p} - p_S}{\bar{p}} + \frac{p_L - \bar{p}}{\bar{p}} \tag{2}$$

Total population ratio (TRD) =

$$\frac{p_L}{p_S} \tag{3}$$

Average absolute level malapportionment =

$$\sum \frac{|p_i - \bar{p}|}{n} \tag{4}$$

Finally, to find the minimum population share needed to control a majority of the seats in the legislature, for the case of single seat constituencies, we order the districts from smallest to largest in population. We find the population of the districts up to and including the median district and then divide by the total population to obtain the proportion we seek (see Figure 6).

The minimum population needed to win a majority of seats is a measure that is often neglected but should be a focus of malapportionment-based criticisms of electoral institutions. If the criterion for a democracy is majority rule, we should be interested of when the majority doesn't rule. Figure 6 indeed shows the *hypothetical* minimum needed to win the Electoral College, with comparisons of the US House and US Senate. Indeed, as the other measures of malapportionment show, the minimum needed to win the Electoral College is quite near the 50% mark. While the popular vote is guaranteed to elect the majority winner (in two-party contest), the Electoral College shows that nearly a majority is needed as well. Although we have seen five instances where this isn't the case in American politics, institutional malapportionment will only rarely lead to this reersal, and only when the two-party vote margin is slim.

Partisan Bias in the Electoral College

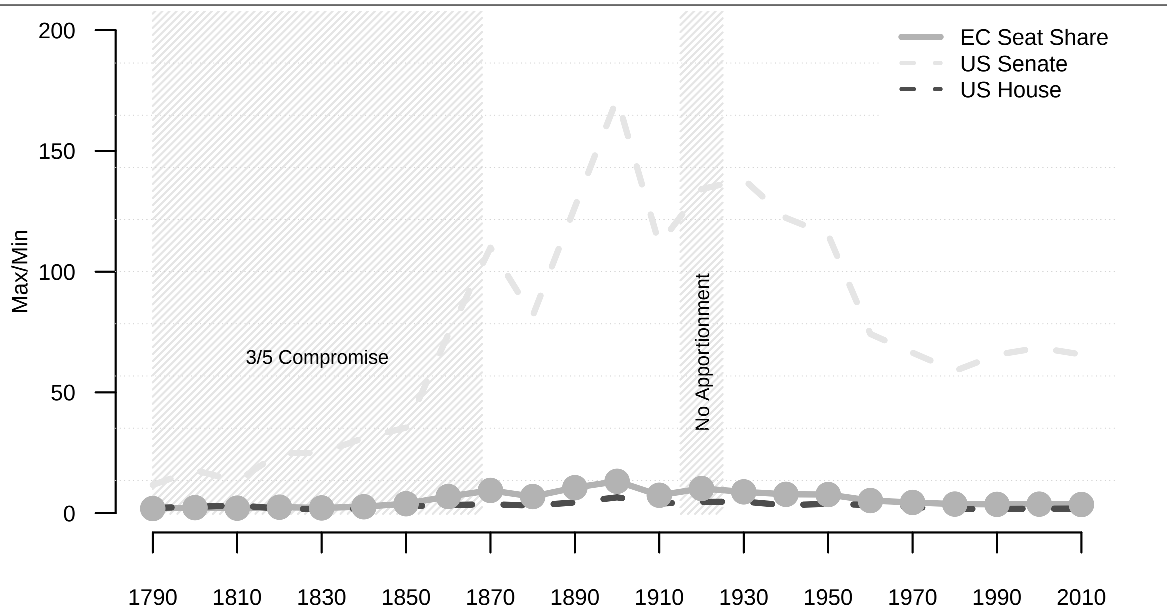
Claims of partisan bias in the Electoral College. Critics come from all partisan stripes, and appear to alternate between Democrats and Republicans depending on

TABLE 4 Measures of Discrepancy between Largest and Smallest Average Electoral Populations (Total Population Ratio)

Year	(Min) Persons/Seat	(Max) Persons/Seat	(Ideal) Persons/Seat	Max/Min	Total Population Deviation
1790	17206	32949	27713	1.915	0.568
1800	15122	34559	28709	2.285	0.677
1810	18168	37738	31134	2.077	0.629
1820	18404	45704	36226	2.483	0.754
1830	24300	52835	43600	2.174	0.654
1840	26028	69139	60642	2.656	0.711
1850	23149	90618	76843	3.915	0.878
1860	17488	120525	99584	6.892	1.035
1870	13288	125222	103402	9.424	1.083
1880	20755	142763	123121	6.878	0.991
1890	15785	166755	139167	10.564	1.085
1900	14112	186382	156738	13.208	1.099
1910	27292	202525	172582	7.421	1.015
1920	25802	263605	198254	10.216	1.199
1930	30353	267831	230298	8.824	1.031
1940	36749	286790	246716	7.804	1.013
1950	42881	330819	280305	7.715	1.027
1960	75389	392930	333314	5.212	0.953
1970	100127	444804	377717	4.442	0.913
1980	133950	503572	421089	3.759	0.878
1990	151196	551112	462286	3.645	0.865
2000	165101	616924	524157	3.737	0.862
2010	189433	678945	575809	3.584	0.850

Note:

FIGURE 3 Ratio of the Largest and the Smallest State by EC Seat Share versus State Population Share: 1790-2010, with Comparisons to the U.S. House and the U.S. Senate



Note:

who won (or is likely to win) the nearest election. Those who favor a losing candidate, especially in a close election, often deploy partisan bias in the Electoral College as a scapegoat. Take for instance the tweet by then TV personality Donald Trump –

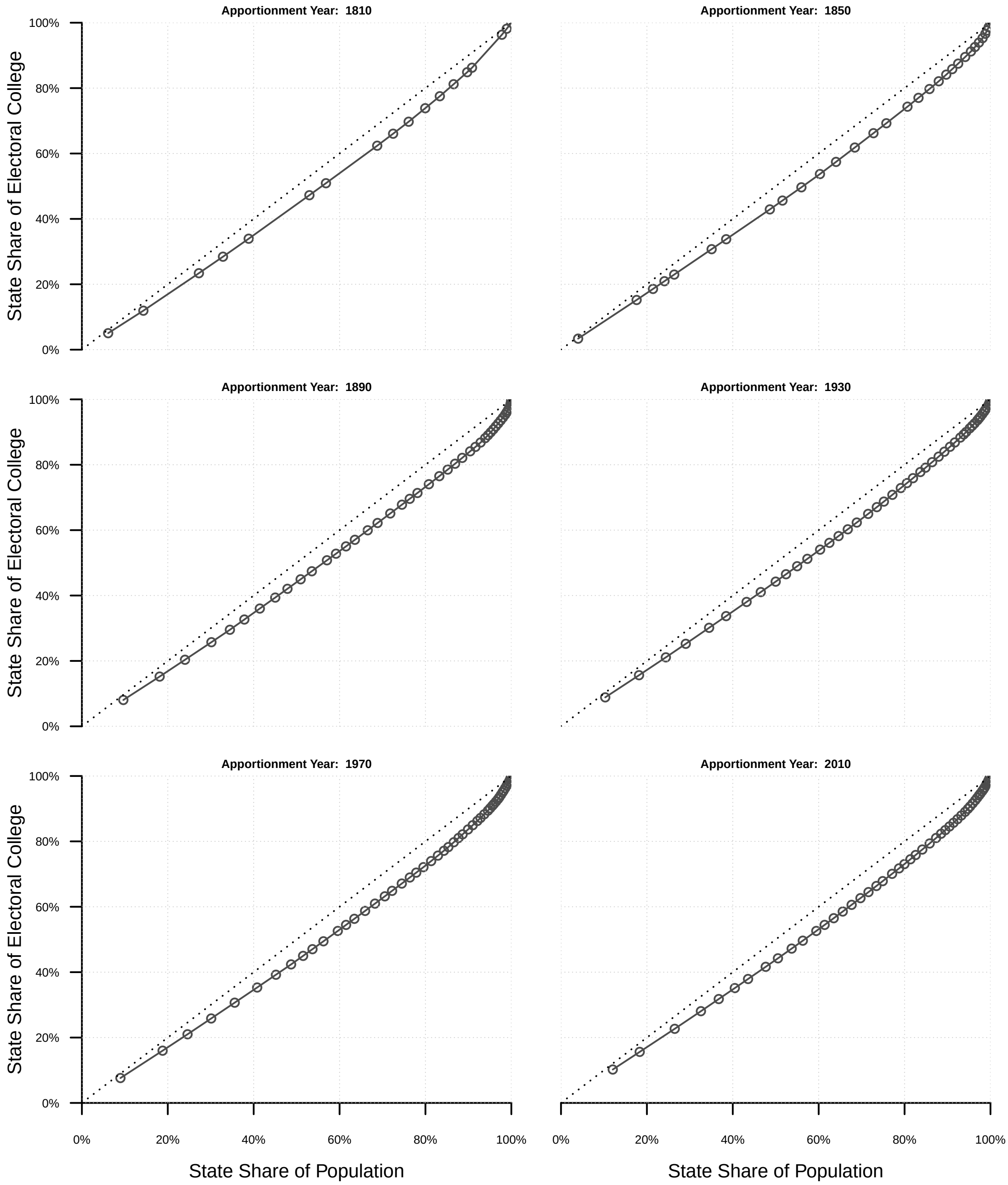
> *"The Electoral College is a disaster for democracy"*
> – Donald Trump, November 6, 2012

This quote comes on the heels of an Electoral lose by Republican candidate Mitt Romney. Despite the fact that Romney had only won five million fewer votes than Mr. Obama, Mr. Trump apparently thought the institution was flawed, perhaps because the perceived bias against Republicans. In 2016, when the Electoral College elected Mr. Trump, this time him losing by three million votes, he responded by tweeting –

> *"The Electoral College is actually genius in that it brings all states, including the smaller ones, into play"*
> – President-Elect Donald Trump, November 15, 2016

Partisan bias is distinct from malapportioment reported in the early chapter. While malapportionment characterizes the nature of the institutional characteristics that give residents of one state (or several states cumulatively) disproportionate power to elect the president, partisan bias deals with the structural advantages given to some parties over others. Partisan bias can enter into the Electoral College in many of the same ways, and a few additional ways. The most important way it can create problems for a party is when a party's supporters are "packed" into some states, and "cracked" into others. This parallels partisan gerrymandering, which usually is a deliberative attempt to concentrate the voters of on party into the fewest number of legislative districts while spreading out the other party's voters such that they win many more seats

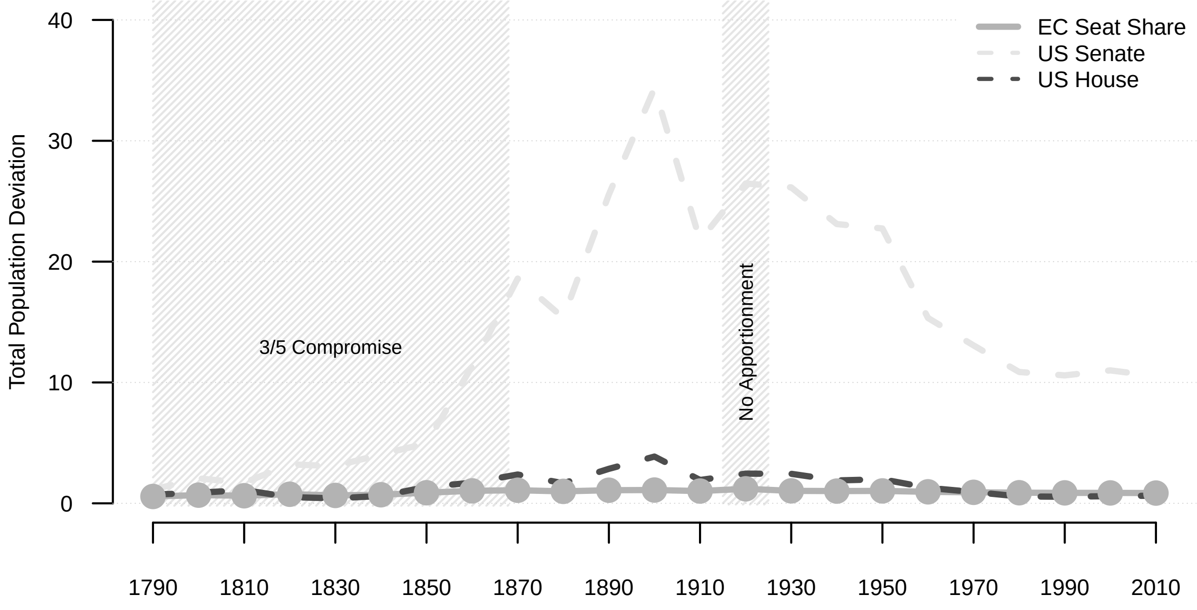
FIGURE 4 Illustrative Lorenz Curves for 1810, 1850, 1890, 1930, 1970, and 2010



Note: Perfect inequality means that all the points fall on the 45 degree line (line of equality). The further the points fall below the line, the more inequality in the voting power of individuals.

then they would if seats and votes were proportional. The measure of partisan bias is most widely championed by Gary King, who along with collaborators, has developed a measure that separates bias and responsiveness (to be defined later) by simulation of electoral outcomes. These models produce counterfactual electoral results which

FIGURE 5 Total Population Deviation for Electoral College Votes, 1790-2010, with Comparisons to the U.S. House and the U.S. Senate



Note:

are used to determine the amount of asymmetry in the ability of parties to elect given a voting threshold (Gelman and King 1994; Grofman, Brunell, and Campagna 1997). This approach is an advanced application of Tufte's seats/votes curve (Tufte 1973), which itself is an application of the most basic form. This basic form is a linear model that regresses the percentage of votes on the percentage of seats. It was first used by Dahl (1956) in *A Preface to Democracy*. This can be seen in equation 5.

Bias and Responsiveness

Linear Fit:

$$PercentofSeatsforPartyA = \beta(percentofvotesforthatparty) + \epsilon \tag{5}$$

Logit Fit:

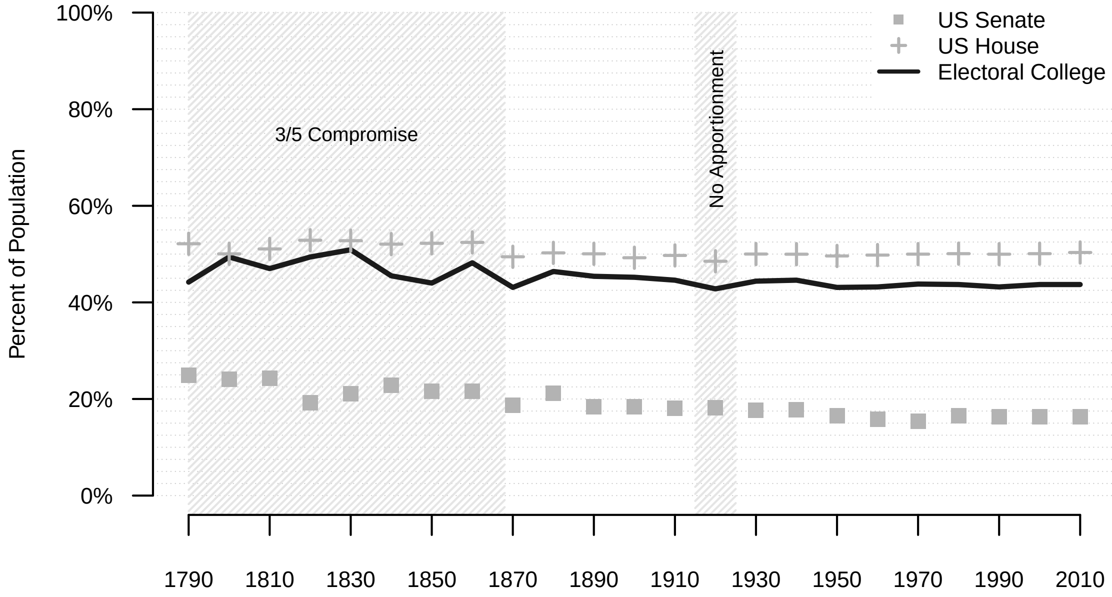
$$\log e\frac{S}{1-S} = \beta 0 + \beta 1 \log e\frac{V}{1-V} \tag{6}$$

Setting the vote share in in the fitted equation 5 to 50%, we can estimate the bias when the vote is tied. Additionally, we can measure the expected rate in which votes are translated to seats, responsiveness, by taking the slope of the equation (β). If β = 2, we could say that on average for every additional 2% of vote that Party A gets, they also get 1% more seats.

For Equation 6, when the fitted $\beta 0 = 0$, the election is unbiased. The coefficients derived from logit model is not as easily explicated as the linear form. They must first be transformed back to their original form.

INSERT FIGURE SHOWING SCATTER OF SHARE OF EC ON X SHARE OF

FIGURE 6 The Minimum Percentage Necessary to Get to a Majority Seats



Note: Calculations based on the combinations of units that lead to a majority with the smallest amount of the population. For instance, the United States Senate is simply the sum of the populations in states below the median, including the median and one additional. If the Senate has 100 members from 50 states, 51 are needed for a majority. Therefore the minimum percentage needed to win is the sum of the population in the smallest 25 states plus 1/2 the population of the 26th state.

POPULAR VOTE ON Y OVER TIME

Figure 7 shows the amount of bias for each election along with the 95% confidence interval. When the confidence interval does not cross the 50% mark, partisan bias is statistically significant. Although the point estimate is almost never at 50%, partisan bias is only significant in 18 out of 38, and only two of the past eight.

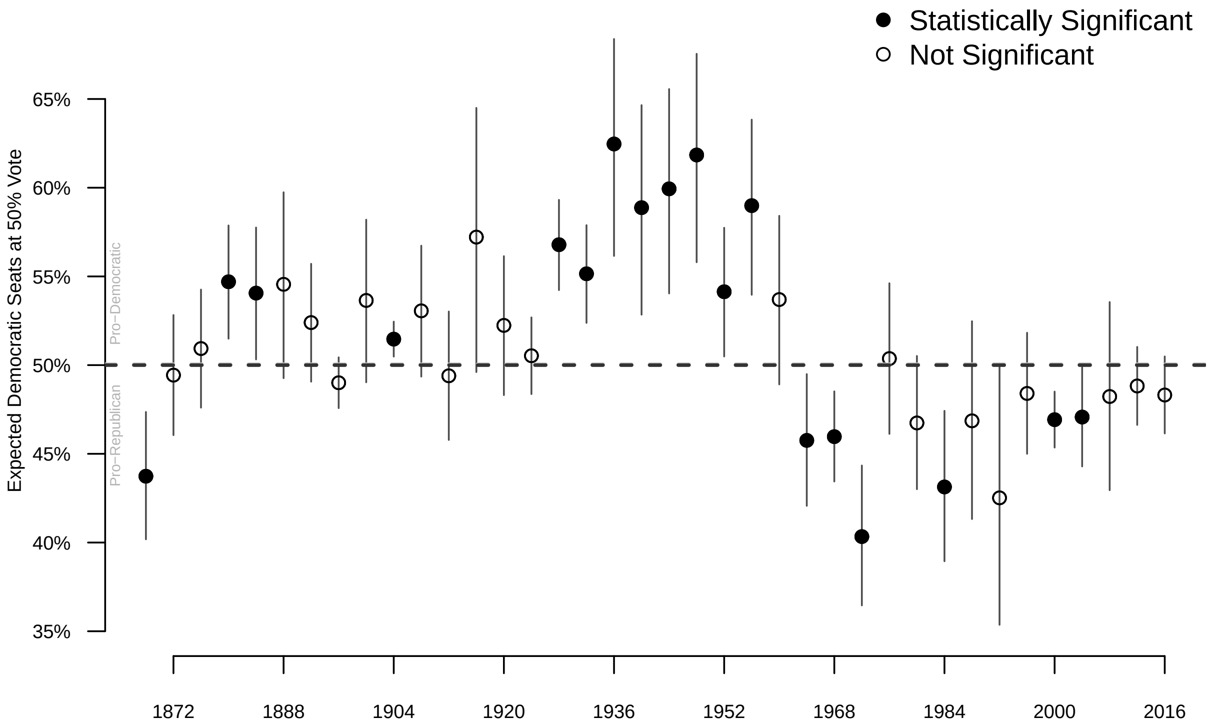
Bias can also be separated by the various components Grofman, Koetzle, and Brunell (1997). These include malapportionment, turnout, and distributional. Table 5 provides the data for the 1868-2016 period. The partisan bias generated from these various measures is usually small and rarely significant.

TABLE 5 Three Forms Of Partisan-linked Bias

Year	R	P	M	H	Malapportionment Bias	Turnout Bias	Distributional Bias
1868	47.30%	47.00%	47.20%	47.30%	0.20%	0.10%	-6.30%*
1872	44.10%	43.70%	44.10%	44.00%	0.40%	0.00%	-0.60%
1876	51.50%	51.40%	51.90%	51.90%	0.50%	-0.40%	0.90%
1880	49.90%	50.90%	51.00%	50.90%	0.10%	-1.10%	4.70%*
1884	50.30%	51.30%	51.40%	51.40%	0.10%	-1.10%	4.10%*
1888	50.40%	52.20%	52.10%	52.20%	-0.10%	-1.70%	4.60%
1892	51.70%	52.10%	53.30%	53.10%	1.20%	-1.60%	2.40%
1896	47.80%	50.40%	49.70%	49.60%	-0.70%	-1.90%	-1.00%
1900	46.80%	50.00%	49.80%	49.80%	-0.20%	-3.00%	3.60%
1904	40.00%	45.50%	45.90%	45.80%	0.40%	-5.90%	1.50%*
1908	45.50%	49.50%	49.30%	49.50%	-0.20%	-3.80%	3.10%
1912	64.30%	67.50%	67.60%	67.50%	0.10%	-3.30%	-0.60%
1916	51.60%	56.20%	55.80%	55.90%	-0.40%	-4.20%	7.20%
1920	36.10%	41.00%	41.00%	40.80%	0.00%	-4.90%	2.20%
1924	34.80%	40.60%	40.20%	40.50%	-0.40%	-5.40%	0.50%
1928	41.20%	44.00%	43.70%	44.10%	-0.30%	-2.50%	6.80%*
1932	59.10%	63.20%	63.00%	63.00%	-0.20%	-3.90%	5.20%*
1936	62.50%	66.00%	66.20%	65.90%	0.20%	-3.70%	12.50%*
1940	55.00%	59.20%	59.10%	59.10%	-0.10%	-4.10%	8.90%*
1944	53.80%	57.50%	57.60%	57.60%	0.10%	-3.80%	9.90%*
1948	52.40%	54.00%	53.90%	54.00%	-0.10%	-1.50%	11.80%*
1952	44.50%	45.40%	45.80%	45.70%	0.40%	-1.30%	4.10%*
1956	42.20%	43.50%	43.50%	43.60%	0.00%	-1.30%	9.00%*
1960	50.10%	50.30%	50.60%	50.50%	0.30%	-0.50%	3.70%
1964	61.30%	59.60%	59.80%	59.80%	0.20%	1.50%	-4.20%*
1968	49.60%	49.30%	49.40%	49.40%	0.10%	0.20%	-4.00%*
1972	38.20%	37.40%	37.70%	37.50%	0.30%	0.50%	-9.70%*
1976	51.10%	51.10%	51.20%	51.20%	0.10%	-0.10%	0.40%
1980	44.70%	44.70%	45.10%	44.90%	0.40%	-0.40%	-3.30%
1984	40.80%	40.50%	40.80%	40.70%	0.30%	0.00%	-6.90%*
1988	46.10%	46.00%	45.90%	46.00%	-0.10%	0.20%	-3.10%
1992	53.50%	53.20%	53.40%	53.40%	0.20%	0.10%	-7.50%
1996	54.70%	54.50%	54.50%	54.70%	0.00%	0.20%	-1.60%
2000	50.30%	50.00%	50.40%	50.40%	0.40%	-0.10%	-3.10%*
2004	48.80%	48.40%	48.70%	48.80%	0.30%	0.10%	-2.90%*
2008	53.70%	53.50%	53.50%	53.80%	0.00%	0.20%	-1.80%
2012	52.00%	51.50%	51.90%	51.90%	0.40%	0.10%	-1.20%
2016	51.10%	50.60%	51.20%	51.20%	0.60%	-0.10%	-1.70%

Note: R=Actual Popular Vote, P= EC-weighted vote, M = Population-weighted vote, H= House-weighted vote

Figure 7 95% Confidence Limits For Partisan Bias In The Electoral College



Note: Calculations are the outputs from log-log regressions on a seats/votes curve derived from Presidential Election results centered at 50/50.

Electoral Reform: Evaluating the Most Commonly Proposed Alternatives to Present Electoral College Arrangements

Calls for reform are numerous and often loud. I will spend the first part of this chapter explaining the various proposals. In addition to introducing these reforms, I will show their pros and cons and the possibilities for them to happen. Being that this is probably the most important substantive part of this thesis, it may end up becoming chapter 2 instead of 5. This section will also serve as a literature review of sorts, citing those who have previously written about the Electoral College and especially the calls for reform.

Predicting Electoral College Outcomes and the Expected Divergence Between Electoral College Outcomes and the Popular Vote

The 2016 election provided scholars with a host of additional questions. Among the most prescient came from the split result between the popular vote and the Electoral College. For only the fifth time in US history, the winner of the popular vote failed to ascend to the presidency. For many people, this represents a failure of democracy due to the non-majoritarian outcome. While the outcome certainly appears problematic on face, I've suggested that the phenomenon is both rare and irrelevant. Out of the 59 presidential elections in US history, only 5 have suffered from the reversal for a percentage of just 8.5%. Given that the Electoral College is part of the US Constitution and the practicality of abolishing it is slim given the advantages for the smaller states, a useful thought experiment seemed intriguing. If we were to have slightly varying rules for the election of the US president, while maintaining the Electoral College in some form, how often would these inversions happen. More specifically, would they be more rare. In a forthcoming paper in Social Science Quarterly, I show that under all winner-take-all Electoral College variants, inversions occur at approximately the same rate. The elections in which inversions happen, however, change depending on the rules used. Since there are two main structural features of the Electoral College, the winner-take-all (unit) rule and the non-proportional allocation of seats, we can create a typology that turns on and off those features. This results in a 2x2 table (see Table 6). By including some additional proposals and variants, we can get a sense of how likely inversions occur. Only the most proportional rules – the popular vote and those that resemble it – significantly reduce the number of reversals. Even changing the size of the House to more accurately capture a proportionality of the population fails to change the Electoral outcome, with the except of the closest Electoral and Popular vote elections, such as 2000. A rule that would award seats maintaining the winner-take-all would be more proportional, but because of gerrymandering effects, would end up generating more inversions, while all others rules that increase proportionality would do the opposite.

TABLE 6 Variants of Electoral College Reform

#	Name	Two-Seat Bonus	Unit Rule	Number of Inversions
1	EC	$\surd$	$\surd$	4
2	EC without 2 seat-bonus		$\surd$	3
3	State-Unit Population Proportionality		$\surd$	3
4	Whole-Number Proportionality with 2 seat-bonus	$\surd$		2
5	Whole-Number Proportionality without 2 seat-bonus			3
6	Fractional Proportionality with 2 seat-bonus	$\surd$		3
7	Fractional Proportionality without 2 seat-bonus			1
8	District-Rule with 2 seat-bonus	$\surd$	$\surd^{+}$	5^{*}
9	District-Rule without 2 seat-bonus		$\surd^{+}$	5^{*}
10	Direct Popular Vote			–

Note: $^{+}$ District-level Winner-Take-All Rule
* The number of inversion is 5 (31.25%) for the 16 elections for which we have district level data. In comparison, in the full set of 38 elections, there are at most 4 inversions (10.5%).

TABLE 7 Concordance of Popular Vote with Winner in Ten Variants of the Electoral College

	Popular Vote	Electoral College	Electoral College without Two Seat	Population Weighted State Unit	Whole Number Proportionality with Two Seat	Whole Number Proportionality without Two Seat	Fractional Proportionality with Two Seat	Fractional Proportionality without Two Seat	District Specific with Two Seat	District Specific without Two Seat
1868	47.337%	27.491%	28.444%	29.086%	46.048%	46.667%	46.999%	47.315%		
1872	44.062%	18.033%	18.493%	18.471%	42.35%	41.781%	43.712%	44.019%		
1876	51.518%	49.864%	51.195%	51.799%	51.22%	51.877%	51.398%	51.871%		
1880	49.949%	42.276%	40.273%	40.326%	50.407%	51.195%	50.857%	50.944%		
1884	50.295%	54.613%	55.077%	55.34%	50.623%	51.692%	51.25%	51.381%		
1888	50.43%	41.895%	40.615%	41.038%	52.369%	52%	52.16%	52.242%		
1892	51.69%	61.036%	63.202%	64.439%	52.252%	53.09%	52.059%	53.144%		
1896	47.793%	38.926%	36.415%	36.242%	50.336%	49.02%	50.414%	49.636%		
1900	46.832%	34.676%	33.894%	33.655%	50.336%	50.42%	49.983%	49.85%		
1904	39.988%	27.941%	28.238%	28.312%	44.118%	44.56%	45.485%	45.781%		
1908	45.495%	32.298%	31.714%	32.031%	49.482%	49.361%	49.47%	49.549%		
1912	64.344%	95.669%	96.092%	96.04%	70.433%	70.575%	67.456%	67.518%		
1916	51.644%	51.977%	49.655%	49.911%	57.25%	56.782%	56.16%	55.859%		
1920	36.118%	23.917%	24.138%	24.55%	39.171%	38.391%	41.008%	40.818%		
1924	34.785%	25.612%	25.747%	25.776%	38.795%	38.161%	40.596%	40.538%		
1928	41.202%	16.384%	16.322%	15.888%	42.75%	42.529%	44.05%	44.124%		
1932	59.149%	88.889%	89.195%	88.708%	65.348%	64.598%	63.183%	62.976%		
1936	62.459%	98.493%	99.08%	99.054%	67.985%	68.966%	65.99%	65.941%		
1940	55%	84.557%	85.747%	85.79%	60.64%	60.69%	59.185%	59.125%		
1944	53.774%	81.356%	82.759%	82.449%	58.945%	58.391%	57.494%	57.576%		
1948	52.37%	62.335%	61.839%	61.801%	55.367%	55.172%	53.995%	54.004%		
1952	44.548%	16.761%	16.322%	17.307%	43.879%	44.368%	45.395%	45.696%		
1956	42.248%	13.936%	13.793%	13.829%	42.185%	42.759%	43.547%	43.621%	22.659%	24.083%
1960	50.083%	59.032%	61.556%	61.685%	51.024%	50.801%	50.333%	50.545%	47.486%	47.368%
1964	61.346%	90.335%	90.826%	90.894%	61.524%	61.697%	59.6%	59.769%	85.688%	85.092%
1968	49.594%	40.52%	42.202%	42.573%	49.442%	49.541%	49.291%	49.44%	41.636%	43.578%
1972	38.214%	3.16%	2.982%	3.297%	35.13%	35.092%	37.394%	37.531%	11.896%	13.761%
1976	51.052%	55.204%	57.11%	57.366%	50.929%	50.917%	51.079%	51.204%	49.907%	50.575%
1980	44.695%	9.108%	8.028%	8.136%	43.309%	42.661%	44.69%	44.93%	26.58%	29.587%
1984	40.83%	2.416%	2.064%	2.081%	38.662%	38.303%	40.547%	40.738%	12.825%	14.908%
1988	46.098%	20.818%	20.642%	20.418%	45.167%	45.183%	45.958%	46.028%	29.926%	31.881%
1992	53.455%	68.773%	69.725%	71.517%	53.532%	54.358%	53.197%	53.361%	60.037%	58.945%
1996	54.735%	70.446%	72.248%	72.543%	54.647%	55.275%	54.523%	54.72%	64.126%	64.45%
2000	50.27%	49.628%	51.606%	51.713%	50.186%	49.771%	49.958%	50.385%	44.981%	45.413%
2004	48.756%	46.84%	48.624%	48.764%	47.955%	47.248%	48.439%	48.755%	41.078%	41.514%
2008	53.688%	67.658%	70.183%	69.946%	53.717%	54.587%	53.471%	53.775%	55.948%	55.734%
2012	51.965%	61.71%	63.761%	64.925%	50.929%	51.606%	51.534%	51.891%	48.885%	47.936%
2016	51.112%	43.309%	43.807%	43.692%	50.186%	50%	50.629%	51.247%	46.097%	47.248%

Note: Percentages are of the Democratic candidate using the alternative rules. All calculations are of the two-party vote. Cells shaded black are those in which the new rule disagrees with the popular vote.

TABLE 8 Cube Root Adjusted Electoral College

Year	EC #	Popular Vote	Electoral College	Cube Root Electoral College	Cube Root Whole Number Proportionality with Two Seat	Cube Root Whole Number Proportionality without Two Seat	Cube Root Fractional Proportionality with Two Seat	Cube Root Fractional Proportionality without Two Seat
1868	305	47.337%	27.491%	28.852%	46.900%	46.230%	47.593%	48.055%
1872	315	44.062%	18.033%	18.73%	42.416%	42.857%	44.183%	44.699%
1876	336	51.518%	49.864%	51.786%	51.214%	52.381%	51.959%	52.655%
1880	336	49.949%	42.276%	40.179%	50.971%	51.19%	50.988%	51.125%
1884	366	50.295%	54.613%	54.918%	51.584%	52.186%	51.271%	51.422%
1888	366	50.430%	41.895%	40.437%	53.620%	52.459%	52.115%	52.195%
1892	369	51.69%	61.036%	64.228%	52.954%	53.659%	53.730%	55.628%
1896	396	47.793%	38.926%	36.616%	51.029%	49.747%	49.739%	48.632%
1900	396	46.832%	34.676%	34.091%	50.000%	50.505%	49.901%	49.72%
1904	420	39.988%	27.941%	28.095%	44.314%	44.524%	45.874%	46.327%
1908	424	45.495%	32.298%	32.075%	48.45%	49.528%	49.565%	49.684%
1912	425	64.344%	95.669%	96.000%	69.482%	70.353%	67.404%	67.471%
1916	450	51.644%	51.977%	50.222%	56.960%	56.667%	55.969%	55.546%
1920	450	36.118%	23.917%	24.444%	39.194%	38.444%	40.952%	40.703%
1924	472	34.785%	25.612%	25.424%	38.908%	38.983%	40.185%	40.013%
1928	472	41.202%	16.384%	15.890%	42.958%	42.797%	43.954%	44.015%
1932	472	59.149%	88.889%	88.771%	65.493%	65.042%	63.128%	62.874%
1936	496	62.459%	98.493%	98.992%	68.581%	68.548%	65.905%	65.831%
1940	496	55.000%	84.557%	85.685%	60.304%	60.081%	59.084%	58.995%
1944	507	53.774%	81.356%	82.446%	58.375%	58.383%	57.574%	57.679%
1948	507	52.37%	62.335%	61.933%	54.561%	54.635%	53.973%	53.978%
1952	507	44.548%	16.761%	17.160%	44.776%	45.168%	45.866%	46.293%
1956	531	42.248%	13.936%	13.936%	42.584%	42.185%	43.733%	43.849%
1960	531	50.083%	59.032%	61.77%	50.555%	50.847%	50.555%	50.82%
1964	563	61.346%	90.335%	91.119%	60.902%	61.634%	59.882%	60.104%
1968	563	49.594%	40.520%	42.629%	49.173%	49.556%	49.555%	49.754%
1972	563	38.214%	3.160%	3.197%	35.789%	35.524%	37.684%	37.878%
1976	587	51.052%	55.204%	57.411%	50.943%	50.937%	51.279%	51.434%
1980	587	44.695%	9.108%	8.007%	43.977%	43.612%	45.050%	45.341%
1984	609	40.830%	2.416%	2.135%	39.100%	39.737%	40.803%	41.019%
1988	609	46.098%	20.818%	20.525%	45.992%	45.813%	46.058%	46.138%
1992	609	53.455%	68.773%	71.757%	53.586%	53.695%	53.501%	53.703%
1996	628	54.735%	70.446%	72.452%	54.932%	55.255%	54.819%	55.040%
2000	628	50.270%	49.628%	51.592%	49.726%	50.159%	50.469%	50.923%
2004	655	48.756%	46.840%	48.855%	47.952%	48.702%	48.701%	49.000%
2008	655	53.688%	67.658%	70.076%	53.765%	54.198%	53.758%	54.051%
2012	655	51.965%	61.710%	65.038%	51.651%	52.214%	52.131%	52.523%
2016	676	51.112%	43.309%	43.787%	50.900%	51.183%	51.212%	51.785%

Note: Column 2 (EC#) is the total number of electors awarded based on the cube-root of the population. In 1912, the cube-root and actual House size are essentially the same. Since then, the size of the House, which was frozen after this, is smaller than ideal. Cells shaded black are those in which the new rule disagrees with the popular vote.

Probability of Inversion

In an unpublished work, I also show that as an election grows increasingly close both in the popular vote or the Electoral College, the probability of inversion increases to nearly 50%. The logic behind this intuition is simple; if an election is decided by one vote – for the Electoral College, one vote in one state by virtue of the winner take all rule – there will be a reversal by adding one additional vote. In essence, short of abolishing the Electoral College in favor of the popular vote, there will always be instances of inversions, and this is especially true while national elections are closely contested. Table 9 shows the two-party vote when the Electoral College is tied, ie, the moment of reversal. In nearly one-third of all elections, the electoral result would have inverted if the popular vote shifted less than one percent of the actual result. Additionally, column five shows that had votes shifted in such a way to produce a split Electoral College, the popular vote margin would normally be less than two-percent. In most elections, that margin is even closer. In *toto*, close elections will sometimes produce majoritarian reversals.

Experiments with a Simplified Electoral College Game

This is perhaps the least developed part of the thesis. The basic premise is that presidential candidates make campaign choices about where to spend their resources. In doing so, they weigh the trade-offs of campaigning in some states more than others. The consequences of these decisions can be consequential. The Clinton campaign made the deliberative choice to campaign in Arizona and focus resources on turning out the Hispanic vote while neglecting the rust belt states. Clinton lost Arizona, along with the pivotal states of Michigan, Wisconsin, and Pennsylvania.

The experiment will be divided into two parts. First, a very simple game will be played where a "candidate" will choice to subdivide their funds among seven states in any way they choice. Each state will have a different weight. In the first game, all seven states are competitive, and a candidate wins a state by spending more resources in that state than the opponent. In the second variation, the probability of winning a state is varied such that a candidate has either an advantage or disadvantage that can be overcome by additional spending.

The following points give greater detail to the experiment:

Colonel Blotto is a two player non-cooperative game in which each player decides how to allocate their resources across n battlefields.

The player's objective is to win a majority value of the n battlefields.

In a stochastic asymmetric game, the deterministic rule is replaced with a lottery contest such that the more resources allocated to a battlefield increases the chances of winning.

The payoff function is continuous in a stochastic game, and if a Nash equilibrium exists, it is unique and in pure strategies.

In the Electoral College game, players have the same total endowment and allocate resources across seven states.

Each player has $1 billion, and for simplicity allocate in $25 million increments. Tie-breaking rule in our first simulations are simply splitting the Electoral Votes. There are

TABLE 9 Minimum Uniform Vote Shift To Change The Outcome

Year	Actual Two-Party Vote	Two-Party Vote when EC at 50%	Minimum Shift	Vote Margin When EC is at Reversal
1868	47.34%	50.75%	3.42%	0.75%
1872	44.06%	48.27%	4.21%	1.73%
1876	51.52%	51.78%	0.26%	1.78%
1880	49.95%	50.91%	0.97%	0.91%
1884	50.29%	50.24%	-0.05%	0.24%
1888	50.43%	50.99%	0.56%	0.99%
1892	51.69%	50.06%	-1.63%	0.06%
1896	47.79%	50.21%	2.42%	0.21%
1900	46.83%	51.17%	4.34%	1.17%
1904	39.99%	49.82%	9.84%	0.18%
1908	45.50%	50.81%	5.31%	0.81%
1912	64.34%	52.86%	-11.48%	2.86%
1916	51.64%	51.44%	-0.20%	1.44%
1920	36.12%	51.76%	15.64%	1.76%
1924	34.78%	50.57%	15.78%	0.57%
1928	41.20%	48.61%	7.41%	1.39%
1932	59.15%	50.10%	-9.05%	0.10%
1936	62.46%	51.75%	-10.71%	1.75%
1940	55.00%	51.54%	-3.46%	1.54%
1944	53.77%	51.26%	-2.51%	1.26%
1948	52.37%	51.95%	-0.42%	1.95%
1952	44.55%	50.32%	5.77%	0.32%
1956	42.25%	49.68%	7.43%	0.32%
1960	50.08%	49.68%	-0.40%	0.32%
1964	61.35%	49.00%	-12.35%	1.00%
1968	49.59%	50.91%	1.31%	0.91%
1972	38.21%	49.93%	11.71%	0.07%
1976	51.05%	50.19%	-0.86%	0.19%
1980	44.69%	49.04%	4.35%	0.96%
1984	40.83%	50.38%	9.55%	0.38%
1988	46.10%	50.08%	3.98%	0.08%
1992	53.45%	50.67%	-2.78%	0.67%
1996	54.74%	49.60%	-5.14%	0.40%
2000	50.27%	50.27%	0.00%	0.27%
2004	48.76%	49.83%	1.08%	0.17%
2008	53.69%	49.14%	-4.54%	0.86%
2012	51.96%	49.24%	-2.72%	0.76%
2016	51.11%	51.52%	0.41%	1.52%

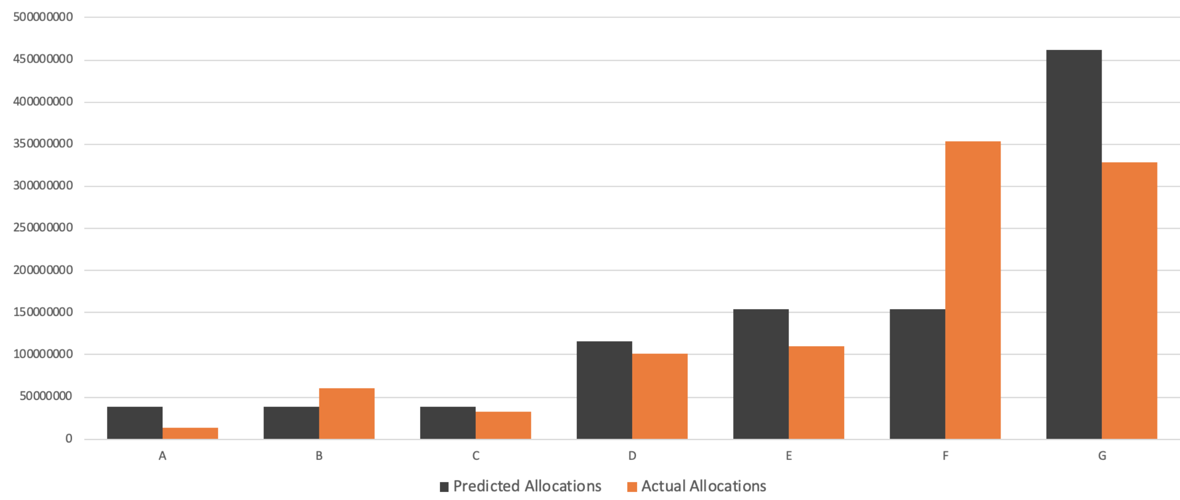
Note: Data generated by shifting the popular vote uniformly across all states by small percentage points until the point in which one vote would shift enough Electoral College votes such that the loser of the election becomes the winner.

TABLE 10 Simplified Electoral College Nash Equilibrium

State	EC Votes	Banzhaf Power	Nash Predicted Allocation
A	3	0.038	38,461,540
B	5	0.038	38,461,540
C	8	0.038	38,461,540
D	13	0.115	115,384,620
E	21	0.154	153,846,150
F	34	0.154	153,846,150
G	55	0.462	461,538,460

Note: The Banzhaf Power is equal to the proportion funds for each state. Here, the endowment is $1 Billion.

FIGURE 8 Results of Pilot Experiment



Note: Eleven Undergraduate students participated

a total of 135 votes, and 70 is needed to win.

First we must calculate the Banzhaf power index for the states. Banzhaf power index is the percent of times in which a state is included in a minimum winning coalition. Let Ki be the Banzhaf score for state i, and X is the total endowment. Therefore, the Nash equilibrium for each state x_i:

$$x_i = \frac{K_i}{K - i + \cdots + K_n} \times X \tag{7}$$

Game setup: Seven states, A, B, C, D, E, F, G, where each player has an equal probability of winning (0.50). Total allocation $1 Billion

Figure 8 shows the results of the game played between eleven sets of undergraduates.

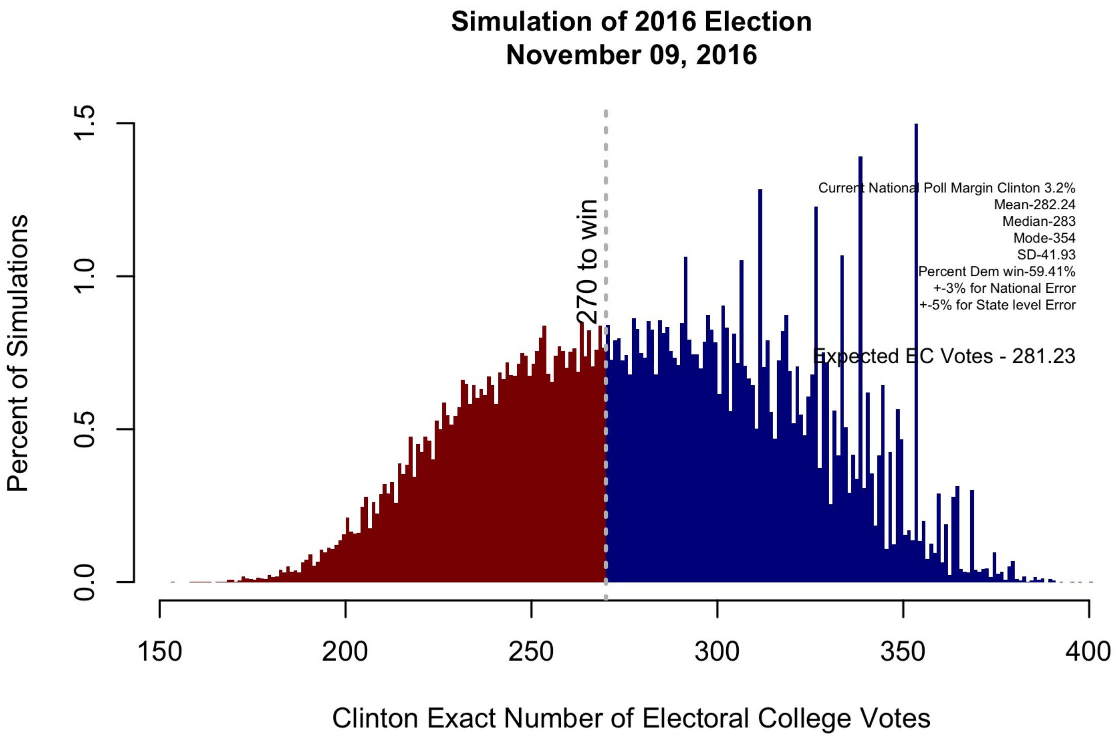
We matched up each student's allocation against every other student's allocation. The best performing allocation put $50 mil on state A (3 EC votes), $250 mil on state D (13), and $700 mil on state G (55). This student's allocation won in 9 out of 10 match ups. The second best performing allocation placed half their money on state F (34) and half on state G (55) – it won 7 out of 10 matchups.

Developing and Testing Predictive Models of Electoral College Campaign Strategy

In this section which is yet to be explored, I intend to look at the forces shaping the electoral environment, tackling issues as broad as immigration, demographic change, and especially the urban/rural divide. Analysis of the nationalization of US House and Senate races and the effect they have on the Presidential election will help motivate the final chapter, which is a prospective view on the 2020 election. I have very little to report on this section thus far, and it will indeed be the section the will require the most work.

Before the 2016 election, I developed an election simulator that used national polls and previous election results to make a prediction of the election results. I abandoned the model after it continued to indicate that Mr. Trump would be highly competitive. On election day, my simulator gave Mr. Trump a 40% chance to win the Electoral College, a far better prediction than rival models produced by the New York Times, FiveThirtyEight, and Princeton University (see Figure 9).

FIGURE 9 **Election Simulator on November 9, 2016**



Note: Model uses a national indicator from polls and adds up to 3% national random error and up to 5% random state error.

Electoral College in 2020 and beyond

In this concluding chapter, I will attempt to make predictions about the 2020 election. These predictions will be limited to base-line type suggestions, not accounting for candidate strength. I will incorporate the different items from the various chapters above, including Non-Competitive states, malapportionment, and campaign strategies.

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