Are Presidential Inversions Inevitable? Comparing Eight Counterfactual Rules for Electing the U.S. President*

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Objectives. We offer a typology of possible reforms to the Electoral College (EC) in terms of changes to its two most important structural features: seat allocations that are not directly proportional to population and winner-take-all outcomes at the state level. This typology allows us to classify four major variants of "reform" to the present EC in a parsimonious fashion. Many of the proposals we consider have been suggested by well-known figures, some debated in Congress, and they include what we view as most likely to be taken seriously. We evaluate these proposals solely in terms of one simple criterion: "Would they be expected to reduce the likelihood of inversions between EC and popular vote outcomes?" *Methods.* We answer this question by looking at the data on actual presidential election outcomes at the state level over the entire period 1868–2016, and at the congressional-district level over the period 1956–2016. We consider the implications for presidential outcomes of these different alternative mechanisms, in comparison to the actual electoral outcome and the popular vote outcome. In addition, we consider the implications of a proposal to increase the size of the U.S. House (Ladewig and Jasinski, 2008). *Results.* Our results show that inversions from the popular vote happen under all proposed alternatives at nearly the same rate as under the current EC rules, with some proposals actually making inversions more frequent. *Conclusions.* The major difference between the present EC rule and alternative rules is not in frequency of inversions, but is in which particular years the inversions occur. As for the proposal to increase the size of the House, we show that any realistic increase in House size would have made no difference for the 2016 outcome.

"*The Electoral College is a disaster for democracy.*"
Donald Trump (November 6, 2012)

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"*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)

The Electoral College (EC) we know today is not the one envisioned by the founders. The founders believed its function would be to nominate candidates, from which nominees the House of Representatives would select. Today, *electors* are pledged in advance to particular candidates and *Electors* very rarely diverge from their pledged support, and they never have done so in a way that has proved consequential (Longley and Peirce, 1999:23–24). Moreover, outcomes are decided in the first stage of the process, in the EC itself. Only once has the responsibility for choosing the president shifted to the second runoff stage, which involves a congressional vote.[1]

As eminent scholar Robert Dahl (2003) noted, "the elaborate machinery of the electoral college [became] little more than a way of counting votes." Nonetheless, despite these differences in how the EC now operates, its two most basic features have remained in place: seat allocations that are not fully proportional to population, with allocations based on the combination of congressional seats and U.S. Senate seats in the state; and winner-take-all (*unit-rule*) outcomes at the state level—though now there are two states, Maine and Nebraska, where the winner-take-all feature operates at the level of congressional districts, with only the two "federal" seats allocated on the basis of the state-wide outcome.[2]

In *Federalist, No. 68*, Alexander Hamilton opined about the EC, "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 EC is indeed far from perfect.[3] The claim that it is "excellent" would be met with far more suspicion. In the United States, after each presidential election, especially those where popular and EC vote diverged,[4] or a third-party candidacy threatens to undermine the idea that a president should represent a clear majority, proposals to abolish/replace the EC are common. Indeed, Article II, Section 1 (i.e., the EC) is the provision of the U.S. Constitution that has most often had changes proposed to it (Longley and Braun, 1972:42–43; Hardaway, 1994; Longley and Peirce, 1999:133). The academic literature is also full of attacks on the EC (see, e.g., Edwards, 2011; Finkelman, 2002; Dahl, 2003; Bennett, 2006; Abbott and Levine, 1991),[5] though it does have a few defenders

[1]In 1824, John Quincy Adams became the only president to not receive a majority (a requirement for winning in the first stage) of the EC votes. The vote was splintered among multiple factions, with no candidate receiving the necessary plurality. In the election of 1876, where politicking in Congress determined which of several competing slates of electors were to be accorded legitimacy, the outcome of what has been called the "Compromise of 1877" was still recorded as a victory for Rutherford Hayes within the EC. He was awarded 20 disputed EC votes that gave him a one-elector victory in the EC despite not winning the popular vote.

[2]Maine adopted this rule in advance of the 1972 presidential election, while Nebraska enacted it starting with the 1992 election. A split has occurred once in each of these states. In 2008, Barack Obama won Nebraska's second congressional district, picking up a Democratic electoral vote in that state for the first time since 1964. In 2016, Donald Trump won Maine's second congressional district.

[3]Other than the United States, there are no presidential democracies currently using an EC to elect their president. Argentina and Bolivia once had ECs (Matthew Shugart, personal communication, February 2018). Many first-past-the-post elections have a runoff procedure to select a president in a multicandidate contest such that, if no candidate receives a certain percentage of the vote, there will be a second round involving two or more of the candidates with the most votes (Birch, 2003). All parliamentary democracies choose their executive via an indirect form of election. While the prime minister will normally need to command majority support in the national parliament, a prime minister can sometimes govern with only minority support. Minority governments can be quite common in some countries, for example, Denmark.

[4]"Diverge," "reverse," "wrong winner," "misfire," "divided verdict," "reversal of winners," "representative inconsistency," "compound majority paradox," "referendum paradox," "majority defeat," and "inversion" have all been used to describe a situation when the winner of the most votes does not win the presidency (Miller, 2012a).

[5]Bickel (1968) warned against sudden structural reforms, though he ultimately supported reforming the EC.

(see, e.g., Best, 1975; Diamond, 1977; Hardaway, 1994; Miller, 2012b; Polsby et al., 2012; Ross, 2012). And yet, since the adoption of the 12th amendment, there have been no further changes to its structure, and attempts to eliminate the EC have proved unavailing.[6]

There are many reasons why reformers have been unsuccessful. First, the winner of the previous election has little incentive to change the rules that elected him (see the Trump quotes above; see also Bowler, Donovan, and Karp, 2006). Second, large states think that they benefit from the EC because the winner-take-all rule makes their state more likely to be pivotal (Banzhaf, 1968), while small states think they benefit from the EC because of the two-seat Senate "bonus."[7] Third, public opinion is closely divided (with a strong partisan split).[8] Fourth, as noted above, the academic and journalistic community has its skeptics about EC reform, with those in opposition to change noting, among other things, that proposed remedies have unknown qualities and are unlikely to cure problems such as a campaign focus on the larger states, and may bring new problems with them, for example, party proliferation, and blackmail potential by minor parties now able to win pledged electors whose vote switches could determine a presidential election outcome (see, e.g., Ross, 2012; DeWitt and Schwartz, 2016; see also Grofman and Feld, 2005). Fifth, there is little innovation by way of unique ideas for reform (Longley and Braun, 1972), and it is far from clear what constituency a reformer would be trying to persuade.[9] Finally, after an election, attention quickly shifts to other more pressing issues and EC reform goes off the political agenda.[10]

There are many complaints about the EC, such as the claim that virtually all presidential campaign activity is focused on a very limited number of battleground states in a way that affects turnout and interest in politics such as to depress both; and there are always renewed

[6]Since the Electoral College process is part of the original design of the U.S. Constitution it would be necessary to pass a Constitutional amendment to change this system . . . Under the most common method for amending the Constitution, an amendment must be proposed by a two-thirds majority in both houses of Congress and ratified by three-fourths of the States. (National Archives and Records Administration)

[7]Both sides are right (Longley and Peirce, 1999:153). However, when we look at the likelihood that an individual voter in any given state will be pivotal (e.g., using game-theoretic indices of pivotality such as the Banzhaf index, Banzhaf, 1965; or the Shapley–Shubik value, Shapley and Shubik, 1954; see also Mann and Shapley, 1962); as far back as Owen, 1975, it has been recognized that these two effects—greater large state pivotality and small state overrepresentation relative to population tend in opposite directions, making the a priori "power" scores of individual votes to influence EC outcomes much more similar across states than one might think (see Gelman, Silver, and Edlin, 2012; cf. discussion in Grofman and Feld, 2005; Strömberg, 2008).

[8]In nearly every poll in the Roper Center for Public Opinion Research iPOLL data bank, the public is split about eliminating the EC, especially along partisan lines, albeit with majorities favoring a change to popular vote. After the bitterly fought 2000 election, 41 percent of Republicans would have amended the Constitution while 75 percent of Democratic respondents would have liked to see a change, with an overall support for change of 59 percent and with 3 percent of those polled with no opinion (Cable News Network, *USA Today*. Methodology: Conducted by Gallup Organization, December 15 to December 17, 2000 [USAIPOCNUS2000-56]). After the even more bitterly fought 2016 election, Gallup asked again about the EC, this time 49 percent choose the option to amend the Constitution (Gallup Poll 2016 [USGALLUP.120216.R01]. November 28–29, 2016). Again, there was a strong partisan split. Republican support of the current system significantly increased after the election. Gallup found that only 19 percent of Republicans or leaning Republicans favor a system where the winner is the candidate who wins the popular vote (compared to 81 percent of their Democratic counterparts). Aldrich, Reifler, and Munger (2014) have modeled the circumstances where we might expect changes in preferences about the desirability of the EC.

[9]In reviewing the history of the Electoral College, it quickly becomes clear how little anybody has to offer that is new. All the plausible reform ideas, and all the arguments for and against them, have been debated and rehashed for well over a century, in terms that have remained virtually unchanged. (Schwarz, 2000)

[10]Google Trends reveals spikes in the popularity of searches of the term "Electoral College" in the months before a presidential election; search numbers quickly diminish to near zero shortly after the election. Some of these data are displayed in Figure A1.

fears about wayward electors,[11] however, we believe it fair to say that far and away the single most important criticism of the EC is that it does not guarantee the election of the national popular vote winner.[12] We also recognize that a direct popular vote election for the presidency also has its critics (Best, 1975; Gringer, 2008). Opponents of change to the popular vote note the possibility of a bitterly divided and close election, not unlike those we have experienced much of the past few decades and reminiscent of the late 1800s.[13] The EC delivers decisive victories,[14] while a close direct vote might lead to a nationwide recount that might take months or even years to complete, leaving the country in a constitutional crisis.[15] Another issue is based on the expectation that a national popular vote would dramatically increase the incentives for candidate proliferation.

While we recognize that there are many dimensions along which the EC and proposed alternatives to it could be evaluated, both in normative and empirical terms, here we evaluate eight key alternative proposals, and in Appendix C, a proposed change in size of the House of Representatives, solely in terms of one simple criterion: "Would they be expected to reduce the likelihood of inversions between EC and popular vote outcomes?" Although this criterion serves double duty, we eschew the normative standard and focus on the empirical. We address the empirical question by looking at the data on actual presidential election outcomes at the state level[16] over the entire period 1868–2016, and at the congressional-district level over the period 1956–2016, taking turnout levels and vote choice as given.[17] The normative aspect is well-plowed ground in the previous EC literature and is not repeated here.[18] There are a number of books and articles comparing the present EC rules to proposed alternatives, but none of which we are aware that both use a time series going back to 1868 and include the 2016 election, and none that empirically evaluate as many alternatives to the present EC rules as are considered here (see, e.g., Longley and Braun, 1972; Hardaway, 1994; Grofman and Feld, 2005; Polsby et al., 2012; Koza et al., 2013; cf. Barthélémy et al. 2014, whom we consider among the most thoughtful and detailed empirical analysis and the one most closely resembling this article's analyses). Moreover, many studies only write about the EC in normative, legal, and theoretical terms, or discuss the prospects for change, and provide no attempt at empirically estimating how a particular change in rule would have affected past voting outcomes (Wilmerding, 1958;

[11] "The people know the candidates of president and vice president; rarely do they know the identity of the electors for whom they actually vote. Such 'go-betweens' are like the appendix in the human body. While it does no good and ordinarily causes no trouble, it continually exposes the body to the danger of political peritonitis" (Henry Cabot Lodge, as cited in Longley and Peirce, 1999:110).

[12] For issues of problematicity of the meaning of "popular vote winner," see Gaines (2001).

[13] The last seven elections have been decided by under 5 percentage points.

[14] The EC often appears to give the president-elect a landslide victory even when the popular vote is close. This is a result of the winner-take-all rules that translate even small pluralities into 100 percent of the state's electoral slate. By definition, EC victories are always over 50 percent, while popular votes have been as low as 38 percent (in 1860). No president has won with a smaller percentage of the EC than aggregated national popular vote percentages (i.e., Lincoln won 59.4 percent of the EC, but only 39.65 percent of the popular vote).

[15] It is unclear who would lead the executive branch in a situation where no president is selected before inauguration day.

[16] The District of Columbia received three seats after the passage of the 23rd Amendment in 1961.

[17] Of course, we recognize that candidates will adapt strategies to the rules in use, but we still believe it a worthwhile exercise to examine how the previous voting patterns would have affected outcomes under different EC formulae.

[18] In reading the literature and in presentation of our results at conferences and colloquia, it is clear that many political scientists hold the popular vote principle to be sacrosanct. Nonetheless, it is useful to remind readers that only one state voted for the popular election of the president during the Constitutional Convention, while nine voted against. Popular election of the president was again brought up in Congress as a proposed amendment in 1816, and since then has been proposed in Congress at least 100 times, every time failing.

Bickel, 1968; Glennon, 1992).[19] The goal of this article is to examine possible reforms to the EC in terms of the consequence of changes to its two most important structural features: seat allocations that are not directly proportional to population and winner-take-all outcomes at the state level. This typology allows for a parsimonious way to classify the reforms that have been or are likely to be taken seriously, including those that have actually previously been debated in Congress. In addition, we examine the implications of a proposal to increase the size of the U.S. House (Ladewig and Jasinski, 2008). Quite to our surprise, our empirical results show that over the full time period, inversions from the popular vote happen under *all* proposed alternatives at nearly the same rate as under the current EC rules, with some proposals actually making inversions more frequent. The major difference between the present EC rule and alternative rules is not in frequency of inversions, but in which particular years they occur. As for the proposal to increase the size of the House, we show that any realistic increase in House size would have made no difference for the 2016 outcome.

We utilize only the Democratic and Republican two-party vote shares in looking at outcomes under different EC formulae. We make the choice of two-party vote despite the fact that third-party candidacies sometimes represent a large proportion of the total vote, such as in 1968, when the leading popular vote recipient, Richard Nixon, won just 43.42 percent of the total votes.[20] The effects of third-party candidacies on electoral outcomes is certainly worth further investigation but is beyond the scope of the present essay. Moreover, we expect that most, if not all, of the problems identified with third-party candidacies would be the same or greater under the alternative versions of the EC we consider here. Of course, we recognize that candidates will adapt strategies to the rules in use, and that a priori rules may affect candidate entry decisions, but we still believe it a worthwhile exercise to examine how the previous voting patterns would have affected outcomes in the 38 presidential elections we review. However, because of such estimation complexities, we must interpret the results, such as shown in Table 2, as ceteris paribus ones.[21]

Proposals for Electoral College Reform

The EC is often thought of as having two undesirable design features.[22] The first of these is the allocation of EC seats in each state on a winner-take-all basis rather than

[19]Bullock, Gaddie, and Wert (2009) examine the potential for a Voting Rights Act based challenge to the EC winner-take-all rule that would parallel voting rights challenges to at-large elections.

[20]That is, nearly 14 percent of the vote went to candidates who did not finish in the top two. If we had a good way of determining the preferences of voters for these other candidates had only the two mainstream candidates been on the ballot, we might find that Hubert Humphrey would have led in the popular vote among the top two candidates. George Wallace's independent campaign drew support primarily from the South, capturing 46 electoral votes from five southern states. Even had Humphrey won all 9.9 million of Wallace's voters and the 46 EC votes that accompanied them, he still would have lost in the EC.

[21]In the same tweet in which President Trump said that the EC was "genius," he also claimed that he would have won the popular vote if, rather than the present EC system, who won the popular vote decided who got elected president. Under that rule for deciding outcomes he said he would have campaigned in populous states that were being conceded to the Democrats under the present winner-take-all feature of the EC. But, of course, if he had changed his strategy so, too, would his Democratic opponent have been able to do a better job of motivating turnout among her supporters. Gaines (2001:75) has called the popular vote a "nebulous quantity."

[22]Longley and Braun (1972:18) identify five features, one of which (inversion) flows from the others, moving beyond the first stage, which is highly unlikely without a strong regional third-party candidate, and the faithless elector, which in our simulations, we do not address. The remaining two are those that we consider in this article.

either allocating candidate votes proportionally on a state-by-state basis, or nationally in the form of a direct popular vote. The second design feature is the way in which EC votes are allocated to each state, with objections to the two-state federal bonus as generating malapportionment, and thus overweighting or underweighting certain states. Many critics of the EC would be satisfied only if both features were eliminated and the EC was replaced with direct popular election of the president; others are prepared to see modifications made in one or both features.

While most of the current attention on EC reform has been centered on the state compact to bind electors to vote for the national popular vote winner,[23] many other more limited proposals for changing the EC have been introduced.[24] In addition to replacing the present EC either with an election based on winning the national vote (though usually with a runoff rule if the plurality victory margin is not above some threshold), or replacing it with a scheme that makes the EC allocation to the candidates in each state more proportional to each candidate's share of the state-wide vote, there have been many different alternatives proposed.[25] We aim for a simple and parsimonious means to classify proposed reforms. We do so by focusing on the two key structural feature of the present EC identified above: seat allocations that are not directly proportional to population and winner-take-all outcomes at the state level. However, we do not include in our set the proposals the interstate compact that binds the states to report a slate of electors consistent with the popular vote outcome, even though that proposal has recently attracted a lot of attention, since that is simply the popular vote outcome by another mechanism. We also do not include proposals that require voters to rank-order candidates because a lack of data on the preference ordering of candidates among the electorate makes it impossible for us to reliably estimate the implications of their use in past elections.

While this simple classification lends itself naturally to a 2×2 format, there are variants within each element that we wish to take into account, such as keeping the winner-take-all feature, but applying it at the level of congressional districts.[26] Similarly, when we consider ways to make EC results more proportional, we need to distinguish between allocations based on House seat share and allocations based strictly on population.[27] Additionally, we offer two types of proportional representation, one that allows for fractional shares of EC seats, the other awarding only whole seats. The whole-number proportionality rule used is the same that is used for apportionment of the House of Representatives, namely, the method of equal proportions.[28] In the latter, whole electors are allocated, which allows for the continued physical meeting of electors in December at their representative state legislatures.[29] Though not usually called so, the direct national popular vote is the most

[23] S.J. Res 28 1979; National Popular Vote Bill—enacted in 11 states.

[24] By some estimates, over 700 attempts to change or abolish the EC have been advocated or proposed (Hardaway, 1994). Most of these proposals are simply rehashing previously failed attempts (Schwarz, 2000).

[25] Proposals range from reasonable to absurd. Longley and Braun (1972:69) write about a proposal in 1808 by Sen. James Hillhouse (Federalist—CT) that would have had all senators elected to one three-year term, such that a third of them would retire each year; the president would then be chosen randomly among those retiring senators. Most proposals are written for political expediency (Bowler, Donovan, and Karp, 2006), such as the Democrats pushing for a direct vote in the 2000s because it is seen as being more favorable to their electoral chances. While the Democrats have won the popular vote in four of the previous five elections, they have only won the EC twice (in 2008 and 2012).

[26] Winner-take-all and two-seat bonus, winner-take-all and no bonus, no winner-take-all (proportional) and two-seat bonus, no winner-take-all and no bonus.

[27] For states that enter the Union after a census has been taken but are still allocated EC seats, we take the population in the subsequent census.

[28] The U.S. Census has used this method since 1940. For more details, see 2 U.S.C. §2a (1941).

[29] We recognize that there are many different formulas that can be used to allocate seats, and that the differences might, in the words of Gallagher (1991:33), "produce significantly different seat allocations for

TABLE 1

Variants of Electoral College Reform

No.	Name	Two-Seat Bonus	Unit Rule	Number of Inversions
1	EC	√	√	4
2	EC without two-seat bonus		√	3
3	State-unit population proportionality		√	3
4	Whole-number proportionality with two-seat bonus	√		2
5	Whole-number proportionality without two-seat bonus			3
6	Fractional proportionality with two-seat bonus	√		3
7	Fractional proportionality without two-seat bonus			1
8	District rule with two-seat bonus	√	√+	5*
9	District rule without two-seat bonus		√+	5*
10	Direct popular vote			–

+District-level winner-take-all rule.
*The number of inversion is five (31.25 percent) for the 16 elections for which we have district-level data. In comparison, in the full set of 38 elections, there are at most four inversions (10.5 percent).

pure form of proportional representation. It creates an EC the size of the electorate (with the exception of needing a majority, as a simple plurality would suffice), but since it is also winner-take-all, it appears as nonproportional.

What we end up with are 10 institutional procedures for aggregating votes, including the current EC and the popular vote. Using this simple classification scheme allows us to capture almost all the reforms that have been or are likely to be taken seriously, including those that have actually previously been debated in Congress. In *toto*, we offer three versions where the state-level unit-rule is maintained and seven variants where the unit-rule is eliminated or altered. These 10 total electoral rules include four that keep the state-wide two-seat bonus (1, 4, 6, 8 in Table 1), six that eliminate the bonus (2, 3, 5, 7, 9, 10), and three that eliminate electors (5, 7, 10). We provide in a section a procedure that reallocates the number of *Electors* based on the ideal size of the U.S. House, namely, one based on the cube root of the population. Table 1 identifies each of the 10 variants with their structural features identified. We provide a more technical description of each of these options in mathematical notation.

Table 2 shows actual popular vote and EC vote shares and also simulated seat share under each of our additional eight EC variants. Cells that are in bold Shaded cells show inversion years.

There are a number of interesting results shown in Table 2. First, malapportionment effects, and especially the effects of the two-state bonus, are not that large. For example, in

a given distribution of votes . . . " Similarly, Gaines and Jenkins (2009) observe that when the direct vote is particularly close, choice of apportionment method might be determinative (see, especially, Balinski and Young, 1982, for a full treatment of divisor methods). Gallagher (1991) observes that "each PR method minimizes disproportionality according to its own principles." For the purposes of this essay, we only look at the alternative results based on the apportionment currently used by the U.S. Census for determining EC seats.

TABLE 2

Concordance of Popular Vote with Winner in 10 Variants of the Electoral College

	Popular Vote (%)	Electoral College (%)	Electoral College Without Two Seats (%)	Population Weighted State Unit (%)	Whole-Number Proportionality with Two Seats (%)	Whole-Number Proportionality Without Two Seats (%)	Fractional Proportionality with Two Seats (%)	Fractional Proportionality Without Two Seats (%)	District Specific with Two Seats (%)	District Specific Without Two Seats (%)
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		

Continued

TABLE 2

Continued

	Popular Vote (%)	Electoral College (%)	Electoral College Without Two Seats (%)	Population Weighted State Unit (%)	Whole-Number Proportionality with Two Seats (%)	Whole-Number Proportionality Without Two Seats (%)	Fractional Proportionality with Two Seats (%)	Fractional Proportionality Without Two Seats (%)	District Specific with Two Seats (%)	District Specific Without Two Seats (%)
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. Shaded cells are those in which the new rule disagrees with the popular vote.

2016, Donald Trump would have been elected even had there been no two-seat bonus. In fact, he would have won in all the different unit-rule configurations, only losing when a proportional rule such as the popular vote is instituted. Indeed, as can be derived from the differences between Columns 2 and 3 of Table 2, in only three elections in American history has the two-seat bonus feature of the EC been decisive in reversing an election result. The first time this happened was in 1876 when the two-seat bonus benefited the Republican candidate,[30] then again in 1916 when it benefited the Democratic candidate, and finally again in 2000 when it benefited the Republican candidate. However, we observe that the over the last seven elections, the two-seat bonus has consistently favored the Republican candidate, even when it has not had an impact on election outcome. On the other hand, glancing through Table 2's first two columns reveals several instances where a *reversal almost* happened. In most of these instances, the Democratic candidate came out on top, for example, in 1960.[31]

Second, while proportionality variants of EC allocations clearly can dramatically change the magnitude of seat outcomes relative to vote outcomes, it is only in the period from 1880 to 1900 that we see repeated evidence of changes in the presidential winner based on choice of a proportional as opposed to a winner-take-all rule, though, of course, we also see this in 2000 and 2016.

Third, we note that the "reform" that would have the most dramatic effect on recent elections is a winner-take-all rule based on district outcomes. In recent elections where a Democratic Party candidate won the election, such a rule would reverse the EC. That such inversions provide net benefits to the Republican Party can be explained by the degree to which Democratic voting strength is inefficiently concentrated in urban districts (Chen and Rodden, 2013), and the degree to which there is greater Republican unified control of state legislatures and governorship than is true for Democrats, giving Republicans a much greater opportunity to engage in successful partisan gerrymandering of congressional district lines.[32] In 1960, 1976, and 2012, for example, the outcomes would have been reversed (all three times benefiting the Republican candidate) if we allocated based on the results *within* congressional districts plus the plurality state winner getting two bonus seats.[33] In 1976, however, not giving the two-seat bonus to the state plurality winner reverses yet again back to the actual winner, Jimmy Carter (i.e., benefits the Democratic candidate).

Fourth, if we want to understand inversions we must look to when popular vote elections are close. As mathematician Sam Merrill has argued, inversions are essentially a coin-flip as the popular vote approaches 50 percent (Merrill, 1978).

[30] As noted previously, this was an election that was decided not by the votes of the people but instead by a deal between the Democratic and Republican candidates that involved the federal government ending Reconstruction in the South.

[31] In such situations, very small permutations in vote shares at the state level can, because of the unit-rule, take a popular vote and EC convergence and reverse them. In 1960, inconsistencies in popular vote totals and controversial methods for counting the popular vote, especially in Alabama, have led some to argue that Nixon in fact won the popular vote. Nobody, including Nixon himself, believed that the questioned votes would have changed the EC outcome. However, a few votes in specific states would have made Nixon president, and depending on how votes in other places were counted, perhaps made him a reversal president.

[32] Blatant partisan gerrymandering was made more likely by the Supreme Court's consistent refusal to rein in this practice (McGann et al., 2016).

[33] There is an especially large difference when allocating by congressional district in 2012, due in no small part to the aggressive House gerrymandering that took place in the census before the election, mostly to the benefit of Republicans (McGann et al., 2016). Since benefit from incumbency advantage reduces the vote shares of challengers, ceteris paribus, once incumbents are in place whose election is in part or largely due to gerrymandering, apparent partisan bias in subsequent elections may appear lower (Theodore Arrington, personal communication, February, 2017).

An EC Based on an Expanded U.S. House

Now we turn to the last structural variation on the present EC rules that we consider. Ladewig and Jasinski (2008), drawing on ideas in Taagepera (1972), have proposed that the House size should be decennially adjusted to equal the cube root of U.S. population.[34] The cube root of the U.S. population in 2010 was $\sqrt[3]{309,785,186} = 676$. Using this House size, a congressional seat's average size would be just 458,262 people.[35] As it turns out, this would have ensured that, had congressional size been increased in 2010 according to this formula, even the smallest state would have received at least one congressional seat based solely on the state population. How would EC malapportionment and outcome effects change if we increased the size of the House to make the allocation rule in that body more nearly proportional to the population of the state using the cube root of population to determine House size?

One way in which House size could become determinative is when a reversal actually happens, so the popular vote winner has lost the election. Under this circumstance, as the House size grows to approximate the population size, eventually the popular vote winner will also win the EC. Recalculating the 2016 election for a House size of 676 (but now excluding the two bonus seats for each senator) yields Donald Trump 380 of the 676 electors (56.2 percent). Again, as with the current EC and the version that simply omitted the bonus Senate-based electors, Trump would still have won the White House even if the House size were 676. In this EC rule, he wins by 84 electors. Although this is a larger number of seats, the EC is also larger. Since Trump won 306 of 538 (56.8 percent) electors in 2016, his percentage would, as expected, slightly decrease under the cube root rule.

Trump won a plurality in the majority of states, so the same Trump victory still occurs if we add in the two-seat "federal bonus." In 2016, for House size to matter required a House size so huge as to be unrealistic: the effects of increasing House size do not affect the outcome in 2016 for any House size under at least 800 (data omitted for space reasons). In Appendix B, we also include a table that compares the *popular vote* and EC under present apportionment with those using the cube root rule of assembly size for the entire time period of our study.[36] In the year 1912, the cube root EC size is actually larger than the actual EC size. In 2000, an increase in the size of the House could have mattered in that, in most House sizes starting above 493, including all of them above 655 (the cube root law value), the popular vote winner, Gore, would also have won the EC, a result previously pointed out by Neubauer and Zeitlin (2003). The years in which a cube root allocation would have changed the outcomes are limited to just 1876 and 2000, which were already reversed, thus reducing inversions by two.[37]

[34]Taagepera (1972) argued that, for optimal communication purposes between representatives and those they represent, an assembly size should be the cube root of the polity's population. He also demonstrated that this model did a rather good job in explaining actual assembly size in the world's democracies, with the United States in the last 100 or so years being one of the most notable exceptions.

[35]In addition to the work of Ladewig and Jasinski (2008), the effects on presidential outcomes under the EC of increasing/varying the size of the House have been studied by other authors (e.g., Neubauer and Zeitlin, 2003; Barthélémy et al., 2014; Miller, 2014).

[36]In Appendix B, we also provide comparisons to cube root results for the EC without the two-seat bonus, and the whole-number and fractional proportionality rules, both with and without two-seat bonus. The district-based measures cannot be calculated since we cannot know the partisan composition of a House delegation that has never existed, and the *popular vote* rules would be the same regardless of the House size.

[37]The effect in 1876 is hard to assess given the log-rolling involved. Mathematically, based solely on the criteria of popular votes counted on a state-by-state basis, a cube-root-based apportionment would have resulted in the election of the runner-up, Samuel J. Tilden.

Discussion

A reporter once asked legendary singer/actor Maurice Chevalier: "Mr. Chevalier, how does it feel to have reached the ripe old age of 70?" Without hesitation, Chevalier responded to the reporter: "Old age isn't so bad when you consider the alternative!" Using election results from the period 1868 to 2016, we have constructed a total of 13 counterfactual variants on the EC for the purpose of comparing the actual EC results and popular votes with those from various proposed reforms. Presidential elections have seen four occasions in the modern political party era of American history in which outcomes of the popular vote and the EC vote diverge, with two of these coming within the past two decades. While some may argue that even once is too much, others view the relatively small number of inversions as vindication for the founders (Hardaway, 1994). If we look at modifications to the EC such as eliminating the two-state bonus, allowing for a more proportional distribution of electors, or switching to House-district-based outcomes, we discover that at best they reduce the number of inversions by one, from four to three and, at worst, with the House-district-based outcomes, they actually increase the number of inversions. Moreover, with the partial exception of 2016, the years in which inversions occur under alternative EC arrangements are different from those in which they occurred under present EC rules. Thus, changing the rules in the ways identified above seems to serve no useful purpose. It does not eliminate or even substantially reduce the prevalence of inversions; all it does is change the years in which they occur. We also considered the implications of a proposal by Ladewig and Jasinski (2008) to increase the size of the House (and thus of the EC) by picking a House size that was proportional to the cube root of population. Here we found that the election results in 2016 would have been unchanged, though the net effects of this rule over the entire time period do reduce the number of inversions by two.

While certainly far from perfect, the EC has proved a robust institution that usually produces clear victories that match the plurality winner. Moreover, the alternatives to it identified above, with the partial exception of a rather large increase in the size of the House of Representatives, have virtually the same flaw in terms of likelihood of creating a reversal between popular vote winner and EC winner, with some even worse. And the two-seat bonus afforded on the basis of statehood has been shown in this essay to be generally nondeterminative of election outcomes.

Reformers should also acknowledge that the EC "wrong winner" is no less legitimate than any legislation passed by senators representing a minority of the population, or Supreme Court decisions that largely are immune from public opinion, and somewhat less affected by electoral tides due to the long length of service on the Court and the absence of a mandatory age-linked retirement.[38] As if that were not enough reason to be skeptical about the insistence on majoritarianism in the EC, in the process by which the EC would change through constitutional amendment, senators from the 34 states with the smallest population could vote for a change without the input of a popular majority.[39] A bill would still need to pass the House regardless of action in the Senate, but extreme gerrymandering also means that a minority of the population can, in effect, carry out a constitutional change. Additionally, when it comes to state ratification, state legislatures

[38] Reformers who demand majoritarian winners as normative doctrine of democracy should look no further than the multiparty coalition governments common in proportional representation (PR) systems. Leaders emerge through postelection negotiation, and their party may not even receive a plurality of the votes, though the largest party normally gets first chance to put together a winning majority coalition.

[39] As of the 2010 census, the lowest population two-thirds states represented just 30 percent of the total population. Conversely, 34 senators from the 17 smallest states with a total population of 21,031,314 (6.8 percent) could block any amendment.

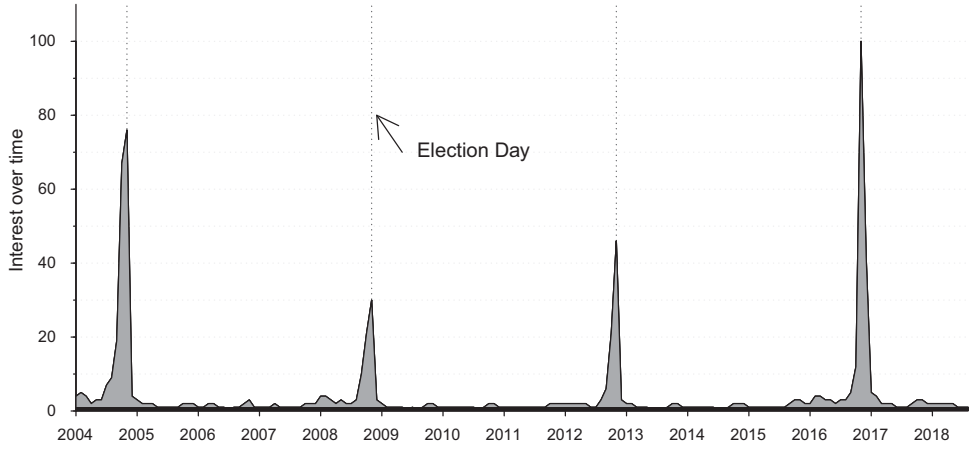
are often so severely gerrymandered that a majority of voters fail to elect a majority of legislators, and often seats are so noncompetitive they regularly fail to garner competition at all. Ratification by 38 states is required, and those smallest 38 states amount to just 38.4 percent of the total population.[40] While it is clear that reformers who believe *only* in strict majoritarianism are right to criticize the EC, they should first look to reform the other more disproportionate aspects of the U.S. Constitution.

Without informed examination, one might assume the EC to be an archaic institution that does more harm than good. The EC is not perfect, a fact that the framers were perfectly aware of. All plausible alternatives, except for the popular vote or something that is its equivalent, do not cure the main problem of inversions. Moreover, many have new and severe problems of their own. For example, changes that would eliminate the state-level winner-take-all and move to district unit-rule would almost definitely lead to political maneuvering and even more extreme gerrymandering (as would increasing the size of the House). And, in an age of hyperpolarization, with the potential for a close national outcome, the direct popular vote creates problems with respect to a proliferation of election challenges. At best the adaptations result in similar outcomes, and at worse could lead to severe constitutional crises. All in all, it is in our opinion that making changes to the system of electing the president should be looked at with a high degree of skepticism.

Appendix A: Electoral College Google Trends

FIGURE A1

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 its peak search in the days following the 2016 election (an inversion).

[40]Again conversely, 13 state legislatures from the smallest population states could prevent ratification with a total population of 12,562,969 (4.1 percent).

Appendix B: Cube Root Adjusted Electoral College

This appendix provides the simulations for an Electoral College (EC) and a number of alternatives by adjusting the total number of electors such that the U.S. House portion is equal to the cube root of the population. As the size of the House increases, disproportionality is reduced. We provide data for the five alternatives that lend themselves to such analyses. Just like the alternatives in the main text of this article, the cube-root-based apportionment adjusted reforms produce a similar number of inversions, with only the most proportional alternatives minimizing the occurrences. Still, every alternative in this set produces at least one reversal, with several years being near misfires. In only one year, 1900, is the popular vote margin greater than 2 percent and produces and inversion. We see this as rather redeeming to the EC as currently constructed because *only* in very close elections is there a legitimate probability of reversal. We also note that 1900 is the last year where apportionment uses 1890 census populations, and that position makes for maximal disproportionality within a given census period.[41]

[41] Population growth and differences in migration patterns throughout a decade lead to suboptimal appropriation, which is most significant in the election preceding a new census.

TABLE B1

Cube Root Adjusted Electoral College

Year	EC No.	Popular Vote (%)	Electoral College (%)	Electoral College Cube Root (%)	Cube Root Whole-Number Proportionality with Two Seats (%)	Cube Root Whole-Number Proportionality Without Two Seats (%)	Cube Root Fractional Proportionality with Two Seats (%)	Cube Root Fractional Proportionality Without Two Seats (%)
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

Continued

TABLE B1

Continued

Year	EC No.	Popular Vote (%)	Electoral College (%)	Electoral College Cube Root (%)	Cube Root Whole-Number Proportionality with Two Seats (%)	Cube Root Whole-Number Proportionality Without Two Seats (%)	Cube Root Fractional Proportionality with Two Seats (%)	Cube Root Fractional Proportionality Without Two Seats (%)
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 No.) 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. Shaded cells are those in which the new rule disagrees with the popular vote.

Appendix C: Formal Definition of the 10 Electoral College Variants Being Compared

We begin with some notation to elucidate how we will measure these EC alternatives. We are interested in all elections since 1868, $Y\{1868, 1869, \ldots y, 2016\}$. In each year, there is a set of states, $S\{Alabama_y, Alaska_y, \ldots, s_y\}$, which all receive a proportion of the EC, $Electors_{ys}$, as determined by the U.S. Constitution.

The equation for the *Popular vote* (C1) is simply,

$$Popular\ vote = \frac{\sum DemVotes_{ys}}{\sum \left(DemVotes_y + RepVotes_y\right)}, \tag{C1}$$

which translates into the national summed percentage of votes for the Democratic candidate, with the two-party vote total in the denominator and third-party votes excluded. This is, of course, the most proportional to the voters, but not necessarily to the population since turnout rates might vary by state (Grofman, Brunell, and Campagna, 1997). It also happens to be the reform that has generated the most demand since it is the only system that can guarantee a plurality winner takes the office.

The actual EC (C2), assuming unit-rule for all states, is determined by the following equation,

$$EC = \frac{\sum Electors_{ys} \times [(1 \times DemVotes_{ys} > RepVotes_{ys}) + (0 \times RepVotes_{ys} > DemVotes_{ys})]}{\sum Electors_y}. \tag{C2}$$

The first of the alternatives we consider sets an EC vote share equal to the size of the state's delegation in the U.S. House divided by the total number of seats in the House, that is, an EC with the two-seat Senate bonus removed. We refer to it as an EC without two-seat bonus.[42] The equation is the same as the EC (C2), except every $Electors_{ys}$ is first subtracted by 2.

The second sets the EC vote share as identical to the state's share of the national population, with fractional allocations to allow for (nearly) perfect proportionality, that is, an EC that corrects for both House malapportionment and malapportionment due to the two-seat Senate bonus. We refer to the second as a *State-unit population proportionality* (C3). Here, instead of the total electors equaling 538, it is set to 1, or 100 percent, and each state gets exactly the percentage of this EC as their census year population, and the winning candidate is the one who wins enough states such that his share of the states' allocations surpasses 50 percent of the population.

$$State\text{-}unit\ population\ proportionality = \frac{\frac{Population_{ys}}{\sum Population_{ys}} \times \begin{pmatrix} 1 \times (DemVotes_{ys} > RepVotes_{ys}) \\ +0 \times (RepVotes_{ys} > DemVotes_{ys}) \end{pmatrix}}{\sum Population_y}. \tag{C3}$$

[42] For the purposes of this calculation, Washington, DC will still be counted for one House vote in periods after 1960 despite not having a voting member of the House of Representatives. As per the 23rd Amendment, adopted in 1961, District of Columbia is allocated three EC votes regardless of its population.

In the same way that one might expect campaigns to employ a different strategy than with the EC, a proportionality rule such as a state population allocation might encourage regional candidates or smaller parties to run because it would not be necessary to win a majority of states or votes, since the winner would be the candidate who can attract enough support in a subset of states that is greater than any other candidate. Essentially, even though seats are awarded nearly proportionately, this rule would change the nature of campaigns for the highest office. Any increase in the number of viable candidates who go on to win EC seats would result in the winner of an election winning smaller pluralities. With the winner-take-all feature maintained, which results in an unbalanced distribution of votes in some states, we would expect more frequently split popular and electoral votes. For the purposes of this essay, we treat the actual results as if they happened under the alternative rules.

The third proposal is to create an EC that allocates its votes in a proportional or more proportional way to the state's share of the present EC, rather than in terms of winner take all. Here there are two main variants, each of which have two minor distinctions. The first major variant uses the current allocation of EC seats, the second allocates electors based on representation in the House of Representatives, that is, with the two-seat bonus eliminated. For the minor variations, *Whole-number proportionality* (C4) for both EC and House delegation sizes are given by the following series of equations:

$$n = \sum U.S.\ House\ seats$$

$$seat = \{1, 2, \ldots, seat_n\}$$

$$Quota_{ys} = \frac{1}{\sqrt{seat_n \times (seat_n - 1)}}$$

$$Priority\ number = \left\{ \begin{matrix} Quota_1 \times DemVotes_{ys}; Quota_2 \times DemVotes_{ys}; \ldots; Quota_n \times DemVotes_{ys} \\ Quota_1 \times RepVotes_{ys}; Quota_2 \times RepVotes_{ys}; \ldots; Quota_n \times RepVotes_{ys} \end{matrix} \right\},$$

where the *Priority numbers* are ordered and the *n*-top priority numbers are allocated to each party.

$$Electors_{1-n} \supseteq Priority\ number_y$$

$$Whole\text{-}number\ proportionality = \frac{\sum Electors_{yDEM}}{\sum Electors_y}. \tag{C4}$$

The second minor variation is the *Fractional proportionality* (C5), in which electors are abolished, and candidates receive their share of the state-wide vote rounded to the third decimal. This variant has been proposed numerous times and was actually passed by the U.S. Senate in 1950 under what was known as the Lodge-Gossett Amendment (S.J. Res. 2 of the 81st Congress). The *Fractional proportionality* (C5) alternative results is an increase in proportionality from *Whole-number proportionality* but yet is less proportional than *Popular vote* because it sets the number of *Electors* each state gets but relaxes the unit-rule nature of

the election. It failed ratification in the House of Representatives (Koza et al., 2013). The equation is as follows:

$$Fractional\ proportionality = \frac{\sum \left(\frac{DemVotes_{ys}}{DemVotes_{ys}+RepVotes_{ys}} \right)}{\sum Electors_{y}}. \tag{C5}$$

The other frequently proposed variant is one in which EC votes are allocated by giving one seat for each House district won, and a two-seat bonus for the candidate who wins the popular vote in the state. This variation emulates the rules presently practiced in the states of Maine and Nebraska.[43] We refer to this as the *District rule* (C6). It has two minor variations, with and without two-seat bonus.[44] It is akin to a plan advocated by Senator Karl E. Mundt (R-SD), which was opposed by then Senator John F. Kennedy (D-MA).[45]

District rule

$$= \frac{\begin{array}{c}\sum [(1 \times DemVotes_{ys}\ RepVotes_{ys}) + (0 \times RepVotes_{ys}\ DemVotes_{ys}] \\ + \sum [(\omega \times DemVotes_{ys}\ RepVotes_{ys}) + (0 \times RepVotes_{ys}\ DemVotes_{ys}])\end{array}}{\sum Electors}. \tag{C6}$$

District rule with two-seat bonus sets ω to 2, while the *District rule* without two-seat bonus instead sets it to 0.

In addition, in the subsequent section, we briefly consider an additional type of change, one based on the suggestion in Ladewig and Jasinski (2008) that the House size be decennially adjusted to reflect the cube root of U.S. population. The idea is that increasing the size of the House should increase the proportionality of EC outcomes, and hence make the EC vote look more like the popular vote.[46]

$$Cube\ root\ House\ size = \sqrt[3]{\sum Population_{ys}}. \tag{C7}$$

Instead of locking the size of the U.S. House at 435, this rule would apportion seats using method of equal proportions (as described in Equation (C4)), and we replace *n* with the *Cube root House size* rounded down to the nearest integer. We can then use the new apportionment to apply to all the alternative EC rules.

[43]Maine adopted this rule in advance of the 1972 presidential election, while Nebraska enacted it starting with the 1992 election. A split has occurred once in each of these states. In 2008, Barack Obama won Nebraska's second congressional district, picking up a Democratic electoral vote in that state for the first time since 1964. In 2016, Donald Trump won Maine's second congressional district.

[44]Although this plan is more proportional than the state unit-rule plans, including the current EC, it is not a proportional plan since it still awards electors on a winner-take-all basis, except now at the congressional-district level. Given the potential for partisan gerrymanders, this plan may end up being less proportional than a winner-take-all state rule.

[45]S.J. Res. 12, 90th Congress, first session.

[46]This proposal can be seen as an attempt to avoid change in the present EC that would be impossible to achieve without a constitutional amendment while still assuring concordance with popular vote outcomes by creating a compact of all the states such that they would report EC results as if the national popular vote winner was the winner in the state. This proposal would only take an act of a Congress, since it sets the size of the U.S. House and thus the percentage of electors who are allocated via population.

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