A Dead Heat and the Electoral College

Robert S. Erikson
Department of Political Science
Columbia University
rse14@columbia.edu

Karl Sigman
Department of Industrial Engineering and Operations Research
sigman@ieor.columbia.edu

This paper can be downloaded from
http://www.ieor.columbia.edu/~sigman/

Saturday, November 4, 2000

{NEW VERSION : AS THE EVIDENCE FROM STATE POLLS ACCUMULATES, THE CASE FOR A GORE ADVANTAGE IN THE ELECTORAL COLLEGE UNDER A DEAD HEAT POPULAR VOTE SCENARIO HAS SHARPENED.THE MOST INTERESTING QUESTION IS WHAT IS THE CRITICAL VALUE OF THE POPULAR VOTE AT WHICH THE ODDS OF WINNING THE ELECTORAL COLLEGE IS THE SAME FOR BOTH CANDIDATES. THE ANSWER IS 51.4 BUSH/48.6 GORE (OF THE TWO-PARTY VOTE). IN OTHER WORDS THE BREAK EVEN POINT IS A BUSH ADVANTAGE OF ABOUT 2.8 POINTS IN THE POPULAR VOTE. IF THE POPULAR VOTE IS EVEN, THEN GORE WINS WITH VIRTUAL CERTAINTY. IF BUSH LEADS BY 5 POINTS IN THE POPULAR VOTE, THEN BUSH WINS AN ELECTORAL COLLEGE LANDSLIDE.}

With the anticipation of a close presidential election, the possibility arises that the Electoral College might induce an outcome different from the popular vote. What are the chances of a split popular vote-Electoral College verdict? And does the Electoral College favor Gore or Bush in the sense that one is favored more than the other in case of a virtual tie in the popular vote? Finally, what is the probability of a tie in the Electoral College, with each major candidate receiving precisely 269 electoral votes?

We attempt to answer these questions by trying to figure out the most likely combinations of state for Bush and states for Gore given a close national election. To do this, we use the wealth of information from state-level polls during the Fall campaign. Specifically, we use the vote estimates of 272 available state polls in all 51 states (including DC) to estimate the states two-party vote divisions under different scenarios of a national popular vote.[1] From pooling each state s polls and adjusting for the national trend at the time of the poll, we estimate the state vote *relative to the national popular vote*. (This

[1] We have updated the polls via *National Journal* Polltrack, pollingreport.com, and hotlinescoop.com through polls through Nov 3. By two-party vote we mean that we only count the Bush and Gore vote and then renormalize so that the sum equals one.

assumes that the states maintain their relative positions as the national popular vote shifts.). Because these 51 estimates contain sampling error, they are only approximations of the true state preferences. Sampling theory, however, allows us to estimate the distribution of likely positions.

We address three questions:

1. Suppose the popular vote were a virtual dead heat. What would be the probable Electoral Vote Outcome?

2. What is the critical value of the popular vote at which the two major candidates are equally likely to win the decisive Electoral College vote?

3. What is the probability of a tie in the Electoral College?

The answers are:

- Gore is the virtual certain winner if the popular vote is actually tied. Gore is also favored (by lesser and varying amounts) if the popular vote goes to Bush but in the narrow range where the two-party vote is no more favorable to Bush than 51.4 Bush-48.6 Gore. Gore s decisive edge remains quite strong even if it is 51.0 Bush-49.0 Gore.

- The critical value is about 51.4 Bush/ 48.6 Gore. At this popular vote division, each candidate is equally likely to win the Electoral College given what we know about the configuration of the vote across states. If Bush wins at least 51.5 percent of the popular vote, he is favored in the Electoral College.

- With a close popular vote, a tie in the Election College is a slim possibility, even less than 1 chance in a hundred. But it could happen if a handful of states change over from one candidate to another.

The Electoral Vote if there is a dead heat

Here we ask: given what we know about the states vote outcomes *relative to each other*, what would happen if the popular vote is a virtual tie? We pool each state s state polls, adjusting for the national trend observed in state and national polls.[2] Then we adjust

[2] We control for the national trend by regressing the polls reported two-party vote on state and date dummies (the methodology of least-squares dummy variable analysis or LSDV). (To use all available evidence to adjust for the national trend, we include the national polls as the equivalent of a 52nd state.). In previous iterations we adjusted for the trend by regressing poll outcomes on Donald Green and Alan Gerber s index of the national trend (http://pantheon.yale.edu/~gogreen) in addition to state dummy variables The Green-Gerber index is a smoothed measure of the Gallup tracking poll using Kalman filter technology. We subtract the Green index times its coefficient from the state polls and adjust the uniform swing to the point where the population-weighted state polls show a .50-.50 dead heat. The choice of methodology appears to make little difference in the results. The state polls agree with the national polls in the sense that the sum of state polls (weighted by population) show a .50-.50 national outcome as when the smoothed Gallup reading is .50-.50. Similarly LSDV analysis shows that when the collective state

these 51 popular vote estimates so that the mean is .50 Bush and .50 Gore when the states are weighted by their populations.[3] Then, we solve this problem: given the means and plurality to Gore. From this information, we want to know each state s probabilities of the three outcomes: Gore, Bush and tie. The challenge is that this question is difficult to solve analytically because of the many permutations and combinations. We solve by computer simulation. We simulate one million sets of state vote outcomes, each representing a draw from the distribution of probabilities shown in Table 1. We count the proportion of the three outcomes: Bush wins most Electoral College votes, Gore wins, and a 269-269 tie.

The key assumptions are:

- With proper adjustment for the partisan trend, the state polls accurately reflect the voting of states relative to each on election day, within the bounds of sampling error and sampling theory. As states change their vote, their change is uniform; all states move in lock-step with every movement of the national vote.
- Support for minor candidates does not change in a way to affect the two-party verdict. For instance, if Nader scores high in the early Fall polls, he scores high at the end.
- State turnout is proportional to state population (which also tracks the number of voters in1996)
- The national popular vote is a tie.

From the simulations, the relative probabilities, given a popular vote tie are:

Bush wins Electoral College	.000917 [0 percent]
Gore wins Electoral College	.999069 [100 percent]
Tie	. 000014 [0.00 percent]

There are two important points. First, Gore has a decisive edge in the Electoral College in the case of a truly close vote. Second, the possibility of a tie appears to be very small under the dead heat scenario. To see the reasons for these results, consult Table 1 and Graph 1. Table 1 presents our estimates for the distribution of the state vote if the popular vote is a dead heat. Graph 1 shows the probability distribution of the Electoral College given a popular vote tie.

---

polls are weighted by population or past number of voters, they match the national polls almost exactly. In other words, state and national polls share any bias they may have.

[3] We actually weight by the number of House seats, which is proportional to population size. We have also weighted by the state s number of actual voters in the 1996 presidential election and get virtually no difference. The state polls agree with the national polls in the sense that the sum of state polls (weighted by population) show a .50-.50 national outcome as when the smoothed Gallup reading is .50-.50. Similarly LSDV analysis shows that when the collective state polls are weighted by population or past number of voters, they match the national polls almost exactly. In other words, state and national polls share any bias they may have

What accounts for Gore s decisive Electoral College edge if the popular vote is truly close? With a tied vote nationally, the state vote divisions would be configured so that Gore would be the heavy favorite (probability of .9 or better) in 21 states with 284 electoral votes, more than enough to win (See Table 1.)

The critical value of the popular vote

According to polls of the moment, Bush holds a slight lead in the popular vote. An important question is, how large does Bush s popular vote margin need to be to become favored in the electoral college. We compute this critical value--the balance point in the popular vote where the two candidates are equally likely to win the Electoral College. We have rerun our simulations with different outcomes, incrementally increasing the Bush vote until we find a popular vote outcome that erases Gore s Electoral College edge. Graph 2 summarizes these simulations, showing Bush s expected number of electoral votes (the means from the various simulations) as a function of the size of Bush s percentage point lead, with Graph 3 summarizing the associated probabilities of a Bush Electoral College win. It turns out that the critical value for the popular vote is about 51.5 Bush /48.5 Gore. Once Bush s popular vote reaches 51.5%, he finally wins a higher proportion of simulated runs than does Gore and Bush's expected Electoral College vote finally reaches 270.˚ Note that if Bush receives 52.5% of the popular vote, his expected Electoral College vote reaches 314 and the probability of his winning the Electoral College is certain .

A tie in the Electoral College

Given a tied popular vote, a tied electoral college appears unlikely. From our computations, the maximal probability occurs when the popular vote is 51.7 Bush/48.3 Gore, yielding a probability of a little over one out of two hundred. It is of interest to consider just how a tie might happen. We offer an example: If we give Gore the favored 284, but take IA, ME, and NH away from him giving them and all the rest to Bush, then both have 269, a tie.

Summary

The purpose of this study is not to predict the popular support for Bush and Gore. Rather, it is to project the likely Electoral College verdict given the national popular vote division between the two candidates. To do this, we exploit state polls to project the likely distribution of states voting relative to each other and the error in these projections due to sampling error) This provides estimates of each state s probabilities of giving its plurality to Bush and to Gore, conditional on the national popular vote. From these probabilities, we estimate the probable national Electoral Vote verdict as a function of the national popular vote scenario. Our conclusion is that Gore holds moderate but

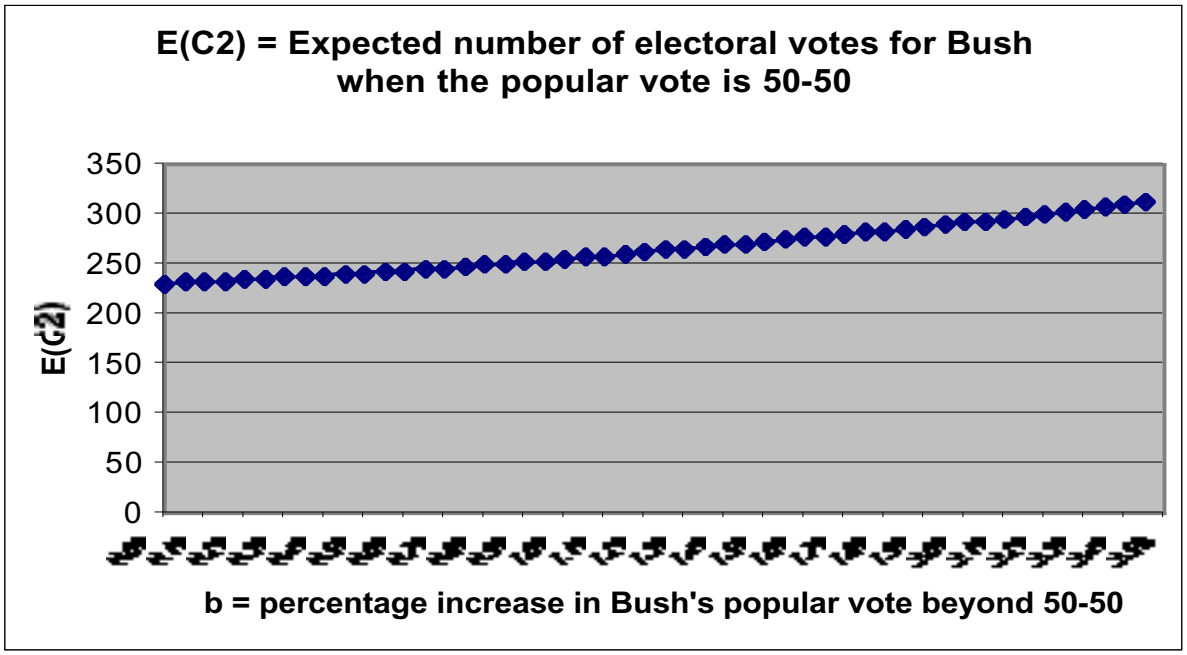
possibly crucial Electoral College advantage, in the sense that a dead heat in the popular vote certainly yields the Electoral College victory to Gore.

Table 1. Estimate of the State Vote given a Tied National Popular Vote

	State	Electors	Gore proportion of two-party vote given a national tie	Sample size (Bush/Gore only) of pooled state polls	Variance	Probability Gore wins the state given a national tie
1	"AL"	9	0.418	1486.74	0.000164	7.15E-11
2	"AK"	3	0.328	319.74	0.00069	3.01E-11
3	"AZ"	8	0.462	1340.8	0.000185	0.002423
4	"AR"	6	0.489	2403.66	0.000104	0.138612
5	"CA"	54	0.553	7842.173	3.15E-05	1
6	"CO"	8	0.453	2493.9	9.94E-05	1.16E-06
7	"CT"	8	0.593	1521.59	0.000159	1
8	"DE"	3	0.548	1281.9	0.000193	0.999733
9	"DC"	3	0.829	454.14	0.000312	1
10	"FL"	25	0.512	7642.557	3.27E-05	0.98101
11	"GA"	13	0.443	1979.5	0.000125	1.68E-07
12	"HA"	4	0.619	812.7	0.00029	1
13	"ID"	4	0.362	1023.36	0.000226	0
14	"IL"	22	0.549	9947.727	2.49E-05	1
15	"IN"	12	0.419	3095.9	7.86E-05	0
16	"IA"	7	0.540	1274.2	0.000195	0.998082
17	"KS"	6	0.356	454.14	0.000505	6.83E-11
18	"KY"	8	0.479	982.72	0.000254	0.089045
19	"LA"	9	0.453	1900.66	0.00013	1.99E-05
20	"ME"	4	0.538	2179.21	0.000114	0.999833
21	"MD"	10	0.570	1594.41	0.000154	1
22	"MA"	12	0.662	413.34	0.000541	1
23	"MI"	18	0.525	9962.33	2.5E-05	1
24	"MN"	10	0.521	2682.66	9.3E-05	0.983649
25	"MS"	7	0.418	691.5	0.000352	5.8E-06
26	"MO"	11	0.505	2495.34	0.0001	0.686469
27	"MT"	3	0.403	2125.46	0.000113	0
28	"NE"	5	0.438	1033.5	0.000238	2.9E-05
29	"NV"	4	0.470	1507.26	0.000165	0.010513
30	"NH"	4	0.520	4710.48	5.3E-05	0.996314
31	"NJ"	15	0.570	5013.02	4.89E-05	1
32	"NM"	5	0.502	1306.46	0.000191	0.564783
33	"NY"	33	0.624	9534.56	2.46E-05	1
34	"NC"	14	0.469	2637	9.44E-05	0.000613
35	"ND"	3	0.399	945.16	0.000254	1.1E-10
36	"OH"	21	0.482	7979.42	3.13E-05	0.000538
37	"OK"	8	0.407	958.92	0.000252	2.42E-09
38	"OR"	7	0.496	1999.27	0.000125	0.357392
39	"PA"	23	0.528	8599.98	2.9E-05	1
40	"RI"	4	0.623	1147.66	0.000205	1
41	"SC"	8	0.427	1044.01	0.000234	8.91E-07
42	"SD"	3	0.358	475.26	0.000484	5.8E-11
43	"TN"	11	0.508	2561.34	9.76E-05	0.803934
44	"TX"	32	0.292	464.64	0.000445	0
45	"UT"	5	0.322	1229.8	0.000177	0
46	"VT"	3	0.539	3688.3	6.74E-05	0.999999
47	"VA"	13	0.436	2482.05	9.91E-05	5.75E-11
48	"WA"	11	0.527	3024.64	8.24E-05	0.998553
49	"WV"	5	0.481	1843.38	0.000135	0.047865
50	"WI"	11	0.526	3123.92	7.98E-05	0.998291
51	"WY"	3	0.317	831.04	0.00026	0

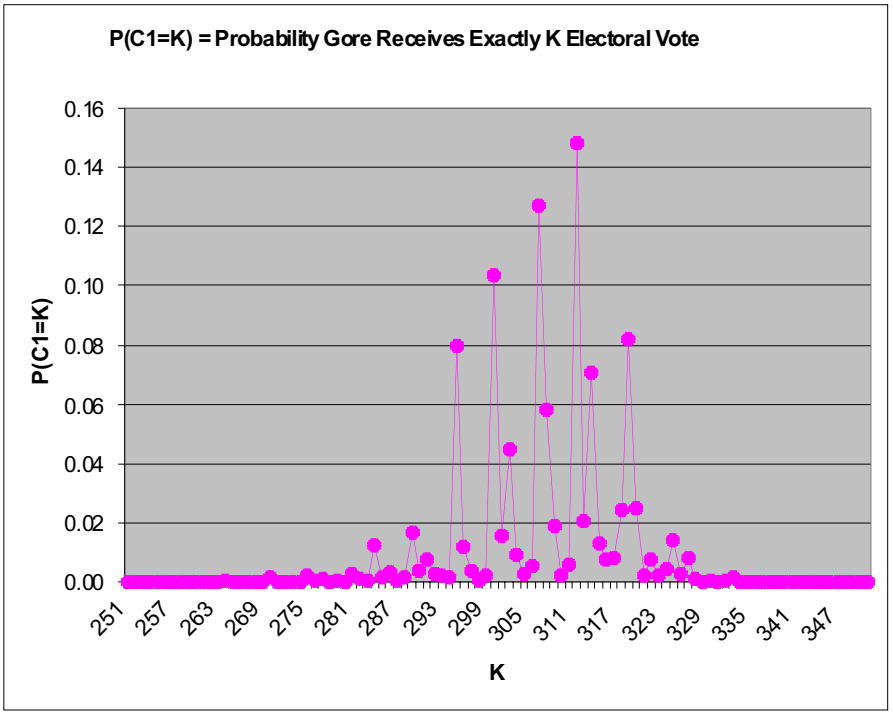
Graph 2

(see Appendix for detail numbers of the graph)

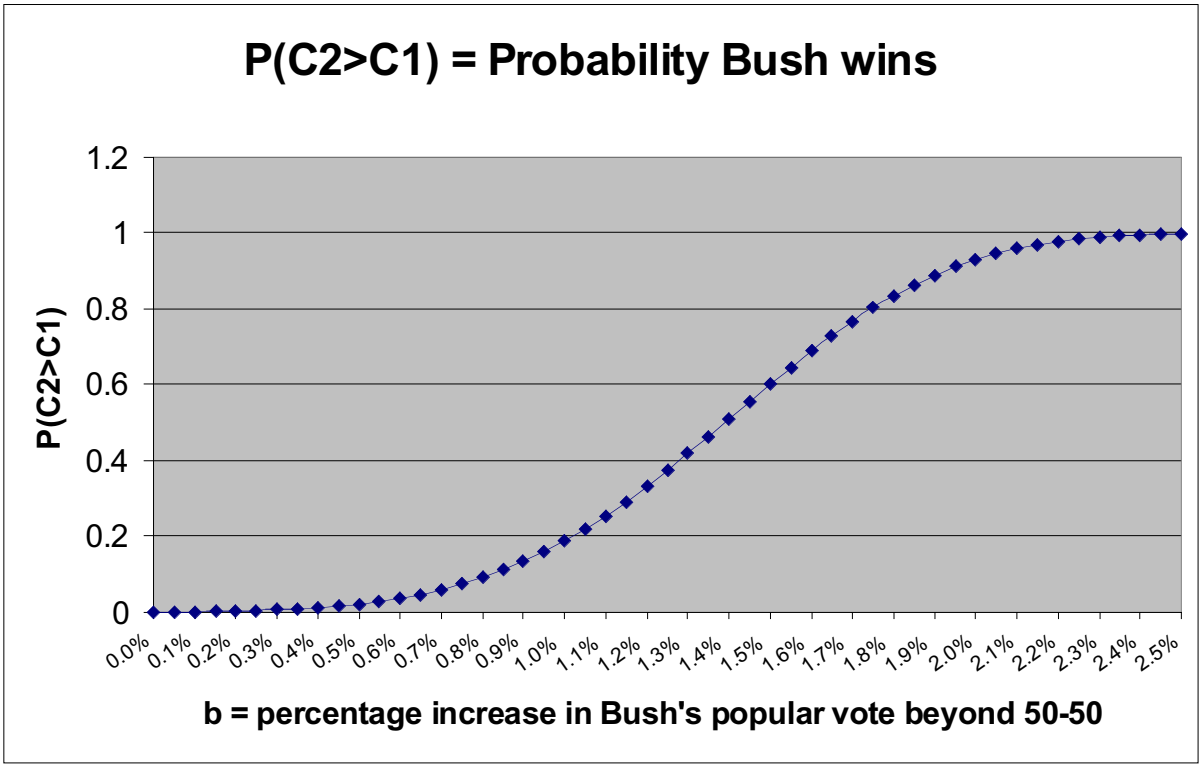


Graph 1

(see Appendix for detail numbers of the graph)



Graph 3
(see Appendix for detail numbers of the graph)



Appendix

Details for Graph 2

b	E(C2)	b	E(C2)
0	231.1113	0.013	265.6986
0.0005	231.9381	0.0135	267.475
0.001	232.7698	0.014	269.2341
0.0015	233.6478	0.0145	271.0374
0.002	234.5772	0.015	272.8086
0.0025	235.5079	0.0155	274.624
0.003	236.4912	0.016	276.4019
0.0035	237.5083	0.0165	278.2295
0.004	238.5982	0.017	280.0485
0.0045	239.7063	0.0175	281.86
0.005	240.8799	0.018	283.7222
0.0055	242.0878	0.0185	285.5868
0.006	243.3479	0.019	287.4842
0.0065	244.6959	0.0195	289.3976
0.007	246.0477	0.02	291.3671
0.0075	247.4613	0.0205	293.3824
0.008	248.9287	0.021	295.4356
0.0085	250.4623	0.0215	297.5612
0.009	252.0217	0.022	299.7106
0.0095	253.6259	0.0225	301.9568
0.01	255.2858	0.023	304.2162
0.0105	256.9187	0.0235	306.5502
0.011	258.6359	0.024	308.8995
0.0115	260.375	0.0245	311.3315
0.012	262.1323	0.025	313.7597
0.0125	263.8811		

Details for Graph 3

b	P(C2>C1)	b	P(C2>C1)
0	0.000917	0.013	0.419305
0.0005	0.001232	0.0135	0.464247
0.001	0.001893	0.014	0.509529
0.0015	0.00267	0.0145	0.555816
0.002	0.003715	0.015	0.601293
0.0025	0.005203	0.0155	0.645877
0.003	0.007074	0.016	0.688519
0.0035	0.009711	0.0165	0.729713
0.004	0.01312	0.017	0.7683
0.0045	0.017292	0.0175	0.803086
0.005	0.022585	0.018	0.835473
0.0055	0.029398	0.0185	0.864388
0.006	0.03758	0.019	0.890191
0.0065	0.048195	0.0195	0.911672
0.007	0.060083	0.02	0.930624
0.0075	0.074367	0.0205	0.946231
0.008	0.091497	0.021	0.959139
0.0085	0.11171	0.0215	0.969411
0.009	0.134197	0.022	0.977698
0.0095	0.159992	0.0225	0.983837
0.01	0.188903	0.023	0.988663
0.0105	0.219449	0.0235	0.992203
0.011	0.254517	0.024	0.9947
0.0115	0.292158	0.0245	0.996525
0.012	0.332943	0.025	0.997752
0.0125	0.374693		

Details for Graph 1

K	P(C1=K)	K	P(C1=K)
251	0.000000	301	0.015750
252	0.000000	302	0.044697
253	0.000002	303	0.009399
254	0.000005	304	0.002620
255	0.000002	305	0.005452
256	0.000003	306	0.126969
257	0.000003	307	0.058001
258	0.000001	308	0.018739
259	0.000250	309	0.002084
260	0.000032	310	0.005875
261	0.000007	311	0.148241
262	0.000002	312	0.020521
263	0.000008	313	0.070422
264	0.000296	314	0.013107
265	0.000096	315	0.007746
266	0.000154	316	0.008297
267	0.000037	317	0.024227
268	0.000012	318	0.082134
269	0.000014	319	0.024603
270	0.001526	320	0.002224
271	0.000238	321	0.007408
272	0.000065	322	0.002097
273	0.000057	323	0.004298
274	0.000250	324	0.013993
275	0.001958	325	0.002493
276	0.000282	326	0.008250
277	0.000893	327	0.001085
278	0.000231	328	0.000197
279	0.000332	329	0.000694
280	0.000213	330	0.000192
281	0.002498	331	0.000461
282	0.001128	332	0.001468
283	0.000376	333	0.000042
284	0.012454	334	0.000064
285	0.001578	335	0.000016
286	0.003183	336	0.000021
287	0.000460	337	0.000063
288	0.001590	338	0.000021
289	0.016895	339	0.000047
290	0.003858	340	0.000021
291	0.007535	341	0.000002
292	0.002540	342	0.000006
293	0.002081	343	0.000002
294	0.001358	344	0.000003
295	0.079495	345	0.000010
296	0.011979	346	0.000005
297	0.003823	347	0.000004
298	0.000748	348	0.000001
299	0.002083	349	0.000000
300	0.103289	350	0.000000