Supplementary Appendix:

Understanding Biden's Exit and the 2024 Election: The State Presidential Approval/State Economy Model

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Contents

Appendix 1 Multilevel Regression With Poststratification (MRP) Details

We use Multilevel Regression with Poststratification (MRP) to estimate state-level presidential approval from the national surveys listed in Appendix 5. The model includes age (18-29, 30-44, 45-64, 65+), education (no high school degree, high school degree, some college, college graduate (or more)), race (white, black, other), Hispanic, and sex (male, female).[1] Race and gender are included as an interaction (i.e., white male, white female, black male, black female, other male, and other female). Age and education are included independently and as an interaction. We select these specific variable combinations based on what has the most predictive accuracy in our one-step-ahead forecasts. In addition to alternate variable combinations we also estimated MRP models that included state partisanship as a contextual variable. The addition of state partisanship did not improve forecast accuracy. While we use the MRP model that generates the most accurate one-step-ahead forecasts, variability across MRP models was minimal. Across all MRP model combinations we tested, forecast accuracy never decreased by more than two additional states incorrectly forecasted. While the robustness of results across alternate MRP models is reassuring, it is important to recognize that our MRP model assumes that groups of respondents behave broadly in the same way no matter their locale. Election-specific factors could violate this assumption. For example, in 2020 Georgia had two Senate races and a black incumbent Democratic Senator seeking re-election. This specific context may help account for why our 2020 Georgia forecast was incorrect.

State-Level Poststratification Data

Poststratification based on the MRP estimates requires that we have population-level information about the proportion of each demographic combination (e.g., percent of white men aged 45 to 65 with a high school degree, or percent of black women aged 18-29 with a college degree or more) within each state. To create these poststratification proportions, we used the 5% sample of census data for presidential elections from 1980 to 2000. We use linear interpolation between the 1980 and 1990 and 1990 and 2000 censuses to estimate proportions for 1984, 1988, 1992, and 1996. After 2000, we rely on the American Community Survey (ACS) because neither the 2010 nor 2020 census asked education level. The ACS is a household survey developed by the Census Bureau to replace the long form of the decennial census program. Both data sources come from IPUMS USA (`https://www.ipums.org/`). For the election years 2004-2020, when we used ACS data, we combined ACS data from the election year with data from the previous year. Combining two years of ACS data balances the goal of obtaining as large a sample size as possible with the desire to keep data from as close to the election of interest as possible. Since the data for 2024 are not currently available, we used ACS data from 2021 and 2022, the latest available data, to estimate 2024 state-level population proportions.

Tabel A-1 reports the sample size of the various data sources. While the 5 percent census samples were larger, we need to linearly interpolate between census years. With the exception of the 2003 and 2004 ACS, which has a sample size of 1.8 million, the ACS sample sizes are close to 5 million. While change in data source from Census to ACS is necessary because the Census stopped asking education level, the consistently large sample sizes across both data sources suggest that this shift

[1] Hispanic is only consistently available in the survey data from 1996 on.

Table A-1: Years, Sample Size, and Source of Poststratification Data

Data Years	Sample Size	Source
1980	8,121,791	5% Census
1990	9,233,211	5% Census
2000	10,427,994	5% Census
2003-04	1,803,940	ACS
2007-08	4,598,978	ACS
2011-12	4,878,246	ACS
2015-16	4,994,366	ACS
2019-20	4,735,975	ACS
2021-22	5,351,878	ACS

in data source should have minimal effect on our MRP Estimates. Further, since our forecasts are more accurate since 2000, if anything, the shift may have increased accuracy of our estimates.

Appendix 2 Measurement of State Economic Conditions

We have monthly economic data for each state through June of election year (the first 14 quarters of the current presidency). The data come from the Federal Reserve Bank of Philadelphia's State Coincident Indexes, which combine four state-level indicators to summarize current economic conditions in each state. (`www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident`). Our approach follows Erikson and Wlezien (2008, 2016). We first calculate the monthly percent change in economic conditions. Each month then gets assigned a weight for the corresponding quarter, $\delta^{(15-q)}$, where δ equals the weight parameter and q equals the quarter. This calculation means the weight of these economic changes increase exponentially by quarter. We then calculate weighted cumulative average economic conditions by summing each month's weighted value and dividing by the sum of the weights. The State Coincident Indexes data begin in January 1979. Since we use a cumulative weighted average, having only 6 quarters of data for 1980 does not pose a problem (the cumulative average for 1980 is based on 6 quarters instead of 14). Kansas, Oklahoma, Texas, Virginia, Washington, and Wisconsin have missing values for January, February, and March of 1979. We estimated these values by taking the difference between each state and the overall US measure in April of 1979 and then subtracting this difference from the US overall for the three prior months. The Philadelphia Fed does not produce a Coincident Index for Washington DC, so we base DC's economic conditions on the average of neighboring Maryland and Virginia.

Table A-3 illustrates the above process for California in 2024 using a weight of $\delta = 0.55$. The final column is the weighted percent change and the Cumulative Weighted Average value in the bottom right of the table (0.224461996) is the value assigned to California for 2024.

Table A-2: Illustration of Cumulative Weighted Average Economic Conditions, Based on Coincident Index for California (2024 values)

Year	Month	Quarter	Coincident Index	Percent Change	δ=0.55 $\delta^{(15-q)}$	Weighted Percent Change
2020	Dec	16	139.31			
2021	Jan	1	140.16	0.6088438	0.0002318	0.0001411
2021	Feb	1	141.24	0.7741554	0.0002318	0.0001794
2021	Mar	1	142.27	0.7298524	0.0002318	0.0001692
2021	Apr	2	143.14	0.6113738	0.0004214	0.0002576
2021	May	2	144.58	1.006926	0.0004214	0.0004243
2021	Jun	2	145.25	0.4640481	0.0004214	0.0001956
2021	Jul	3	146.91	1.136418	0.0007662	0.0008707
2021	Aug	3	148.39	1.011912	0.0007662	0.0007753
2021	Sep	3	149.97	1.065446	0.0007662	0.0008164
2021	Oct	4	151.9	1.28341	0.0013931	0.0017879
2021	Nov	4	153.37	0.9723357	0.0013931	0.0013546
2021	Dec	4	154.37	0.647194	0.0013931	0.0009016
2022	Jan	5	155.56	0.7736032	0.002533	0.0019595
2022	Feb	5	157.25	1.084579	0.002533	0.0027472
2022	Mar	5	158.8	0.9856387	0.002533	0.0024966
2022	Apr	6	159.86	0.6656235	0.0046054	0.0030654
2022	May	6	160.54	0.4290273	0.0046054	0.0019758
2022	Jun	6	161.23	0.4305474	0.0046054	0.0019828
2022	Jul	7	162	0.4780139	0.0083734	0.0040026
2022	Aug	7	162.71	0.4342535	0.0083734	0.0036362
2022	Sep	7	162.61	-0.0603675	0.0083734	-0.0005055
2022	Oct	8	162.38	-0.1402553	0.0152244	-0.0021353
2022	Nov	8	162.46	0.0496763	0.0152244	0.0007563
2022	Dec	8	162.54	0.0517204	0.0152244	0.0007874
2023	Jan	9	162.62	0.0431614	0.0276806	0.0011947
2023	Feb	9	163.02	0.2510538	0.0276806	0.0069493
2023	Mar	9	163.37	0.2144121	0.0276806	0.0059351
2023	Apr	10	163.79	0.255234	0.0503284	0.0128455
2023	May	10	164.28	0.2965386	0.0503284	0.0149243
2023	Jun	10	164.4	0.0738853	0.0503284	0.0037185
2023	Jul	11	164.4	0.002285	0.0915063	0.0002091
2023	Aug	11	164.54	0.0867061	0.0915063	0.0079342
2023	Sep	11	164.44	-0.0649421	0.0915063	-0.0059426
2023	Oct	12	164.6	0.1022094	0.166375	0.0170051
2023	Nov	12	165.01	0.2469098	0.166375	0.0410796
2023	Dec	12	165.47	0.2807385	0.166375	0.0467079
2024	Jan	13	165.62	0.0873344	0.3025	0.0264187
2024	Feb	13	165.67	0.0283249	0.3025	0.0085683
2024	Mar	13	166.05	0.2336621	0.3025	0.0706828
2024	Apr	14	166.45	0.2409424	0.55	0.1325183
2024	May	14	167.21	0.4560591	0.55	0.2508325
2024	Jun	14	167.68	0.2774775	0.55	0.1526126
Total:					3.665817	0.8228366
Cumulative Weighted Average:						0.224461996

Appendix 2.1 Accounting for the COVID-19 Pandemic's Effect on 2020 Economic Conditions

Due to the COVID-19 Pandemic, economic conditions varied much more than usual across states in 2020. In fact, the standard deviation of our economic variable was almost ten times greater than the historical average. We use these actual values for our 2020 forecast. However, if we include these economic values in the model used to forecast 2024 vote, the extreme variance of 2020 economic conditions would have a disproportionate influence on the overall estimated relationship between economic conditions and presidential vote by reducing the size of the economic conditions coefficient in our forecast model, leading us to underestimate the influence of economic conditions on presidential vote. To ensure that extreme outlier economic conditions in 2020 do not have an undue influence on our forecast, we rescale the 2020 economic variable to have the median standard deviation of economic conditions in the prior three elections. Because we only adjust the standard deviation, the estimated relationship between 2020 state economic conditions and state presidential vote is preserved.

The weight parameter would have also been heavily influenced by the pandemic. Again, because we want to forecast based on average historical conditions (as opposed to outlier conditions caused by the COVID-19 pandemic), we use the median weight parameter from 2008 through 2016 for our 2024 forecast.

Appendix 3 The Shifting Influence of Southern States

As noted in the text, due to population changes in Southern states, the Republican lean of these states, *after* conditioning on each state's past presidential vote, in unlikely to persist in recent elections (McKee, Hood, Lupton, Shino & Smith 2024). Figure A-1 shows this is indeed the case. Each subfigure plots the estimated coefficient for the Southern dummy variable and corresponding 95 percent confidence intervals based on a series of rolling regressions based on a window of a single election year (top left), two elections (top right), three elections (bottom left), and four elections (bottom right). Regardless of the number of elections in each window, we see that in the 1980s, Southern states were indeed more likely to vote Republican, even conditioning on each state's prior vote history. In the 1990s and early 2000s, there is some evidence of a continued slight pro-Republican vote in Southern states. Looking at the far right of each panel, however, regardless of how many elections in the rolling regression (1, 2, 3, or 4), there is no evidence that after conditioning on states' prior vote, that Southern states are systematically more likely to vote Republican. Based on these findings, in contrast to our prior work (Enns & Lagodny 2021), our 2024 forecast does not include a dummy for the Southern states.

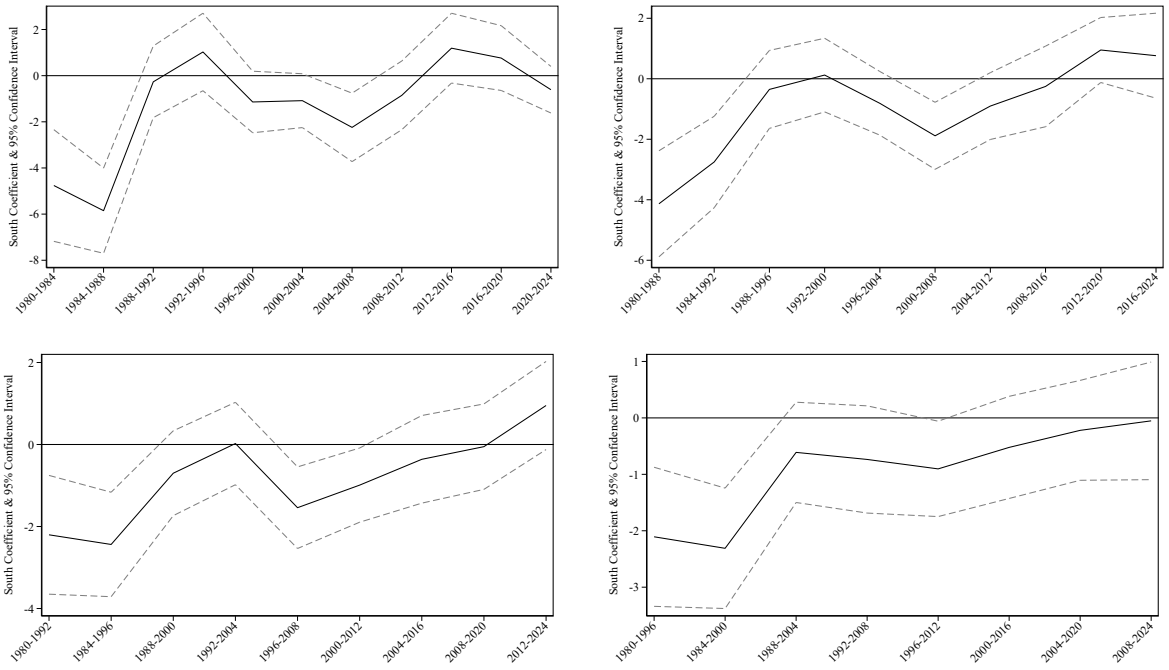

Figure A-1: Southern States No Longer Reflect an Independent Influence on Presidential Vote after Conditioning on Prior State Vote.

Note: Each subfigure presents coefficient and 95 percent confidence intervals from separate rolling regressions based on varying windows of one election (top left), two elections (top right), three elections (bottom left) and four elections (bottom right).

Appendix 4 State-by-State Forecast and Associated Uncertainty

Figure A-2 presents our forecast for each state and associated uncertainty. Dark-blue distributions are forecasted to go Democratic and light-red distributions are forecasted to go Republican. The height of the distribution indicates Electoral College importance.

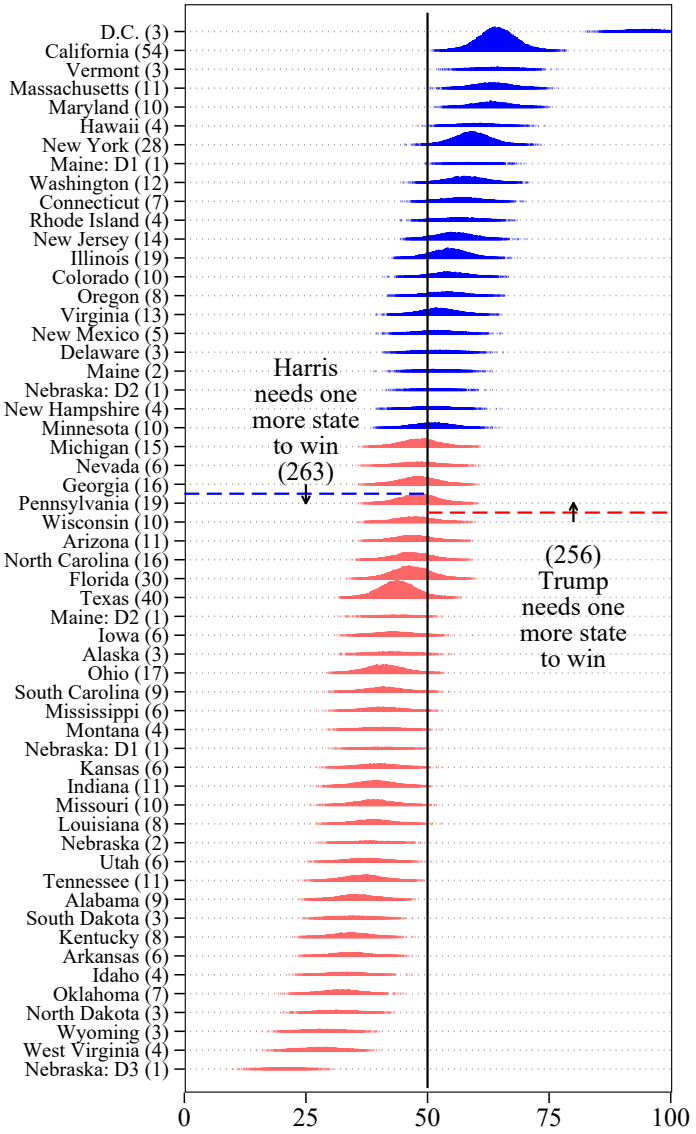

Figure A-2: 2024 Forecast by State and Associated Uncertainty

Appendix 5 Surveys Used for Presidential Approval Data

We utilized the standard presidential approval question, which asks, "Do you approve or disapprove of the way [president's name] is handling his job as President?" Survey data were obtained from the Roper Center for Public Opinion Research at Cornell University (https://ropercenter.cornell.edu/), Gallup Analytics, accessed through the Cornell Center for Social Sciences, and the Inter-university Consortium for Political and Social Research (`https://www.icpsr.umich.edu/web/pages/`), also accessed through the Cornell Center for Social Sciences. Surveys were conducted in June and July of election years. If survey interviews started in late July and continued into August, only responses from the July interviews were used.

All surveys prior to 2024 relied on probability-based sampling methods. In 2024, the Gallup data are based on cell (80%) and landline (20%) random digit dialing.[2] The AP-NORC surveys utilize the AmeriSpeak Omnibus, a bi-monthly multi-client survey using NORC's probability-based panel designed to be representative of the U.S. household population. The Verasight surveys and the Bright Line Watch survey, which was conducted by YouGov, incorporate nonprobability samples. Given our use of MRP models and the accuracy of nonprobability and mixed sample election surveys (Enns & Rothschild 2021), we do not expect the shift in sampling methods to affect our forecast. Specific surveys are listed below.

The presidential approval question in the Bright Line Watch survey was asked immediately following an attention check question. We only analyzed respondents who passed this attention check (i.e., strongly disagree with the statement, "World War I came after World War II,"). The Bright Line Watch survey documentation indicates, "Given the importance of precisely measuring GOP perceptions of topics such as the 2020 election and prosecutions of Trump, the public survey included an oversample of Republicans."[3] The unweighted data do not, however, show evidence of a Republican oversample. An Economist/YouGov August 25-27, 2024 Poll Methodological Report lists the partisan population benchmark as 31% Republican.[4] The unweighted percent Republican in the Bright Line Watch survey we use is 32%, well within the reported margin of error (+/-3.2%).

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Appendix 6 Adjusting for Candidates Who Were Vice President in Previous Administration

As noted in the text, 1988 and 2000, when Vice President George Bush and Vice President Al Gore were the incumbent party candidates, were our model's second and third least accurate forecasts, suggesting that incumbent presidential approval may not fully capture electoral support (or lack of) for vice presidents running for president.[5] Adjusting our presidential approval estimates to incorporate the difference between net approval of the president and vice president during June and July in these election years (i.e., (% approve of the president - % disapprove) – (% approve of the vice president - % disapprove)) substantially improved our one-step-ahead forecasts for these years. As a result, we apply the same adjustment in 2024. Below, we list the survey sources used for this adjustment. We utilize surveys of registered voters in 1988 and 2000 because registered voters were more likely to have impressions of both the president and vice presidential candidates. In 2024, there were no notable differences in net approval across surveys of all adults versus registered voters, so we included data from all surveys we found that were conducted in July at least 100 days prior to the election, were conducted by an established polling firm that did not rely on a survey marketplace (Enns & Rothschild 2022), and the results were published in a major news outlet. The 1988 survey asked about "favorability" (no surveys asked directly about vice presidential approval in 1988). For 2000 and 2024 all questions asked directly about approval.

[5] 1992, when Ross Perot obtained 19 percent of the vote as a third-party candidate, is our least successful forecast.

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Appendix 7 Descriptive Statistics

Table A-3: Descriptive Statistics for Variables in the Forecast Model

Variable	Mean	Std. dev.	Min	Max
Percent Democrat (two-party vote)	48.40	10.87	22.03	95.70
State deviation from the national vote$_{t-1}$	-1.51	10.20	-26.82	45.31
State Presidential Approval	0.71	11.53	-21.85	34.68
State Economic Conditions	0.11	0.57	-1.72	2.08
Presidential candidate home state	0.00	0.19	-1.00	1.00
Vice presidential candidate home state	0.00	0.20	-1.00	1.00
Anderson Vote Share (1984)	0.53	2.08	0.00	15.15
Perot (2000)	0.69	2.48	0.00	14.19

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