Forecasting the 2024 U.S. Presidential Election*

Kamala Harris Projected to Defeat Donald Trump 48.3% to 47.1% in the Popular Vote and 270 to 268 in the Electoral College Based on Poll of Polls and Bayesian Modeling

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The U.S. Presidential election will take place on Tuesday, November 5th with Vice President Kamala Harris and former President Donald Trump in a close race for the White House. In this paper, we used the poll-of-polls method and applied a Bayesian model to estimate the winner of the popular vote and the winner of each of the seven battleground states: Arizona, Georgia, Nevada, North Carolina, Michigan, Wisconsin, and Pennsylvania, and Nebraska's second congressional disctict. Using the results of our poll-of-polls analysis, we predict that Vice President Harris will win the popular vote, 48.3% to 47.1% and the electoral college 270 to 268 by winning three of the seven battleground states, Wisconsin, Michigan, and Pennsylvania. Our analysis shows that the race is extremely tight and former President Trump winning the popular vote, electoral college, or both is well within the margin of error. Our results show a statistical tie when we account for margin of error, bias, weaknesses, and limitations.

1 Introduction

On Tuesday November 5, 2024, Americans will head to the polls to elect their 47th president. Polling data has shown a tight race between VIce President Kamala Harris and former President Donald Trump since President Joe Biden made the historic and unprecedented decision to end his re-election campaign on July 21, 2024. President Biden immediately endorsed Vice President Harris on July 21, making her the presumptive Democratic nominee. Vice President Harris officially became the Democratic nominee on August 2, 2024 following a virtual rollcall. This paper uses presidential polling data from after President Joe Biden ended his re-election campaign and Vice President Harris became the presumptive Democratic nominee

*The code and data used to perform this presidential election forecast can be found at: https://github.com/taliafabs/USPresidentialPollingForecast2024.git.

and Bayesian models to estimate the percentages of voters supporting Vice President Harris and former President Trump.

We are interested in the effects of time since Biden ended his re-election campaign, state, pollster, and pollscore on the percentages of poll respondents supporting Vice President Harris and former President Trump at the national level, in each of the seven battleground states (Arizona, Nevada, Georgia, North Carolina, Wisconsin, Michigan, and Pennsylvania), and in Nebraska's second congressional district. Our estimand, which we can never know for sure, is the true effect of time, state, pollster, and pollscore on the percentages of voters supporting Harris and Trump (Alexander 2024).

Based on the results of applying our Bayesian models, we estimate that Vice President Harris will receive 48.3% of the popular vote and win the swing states of Michigan, Wisconsin, Pennsylvania, and Nebraska CD-2, and former President Trump will receive 47.1% of the popular vote and win the swing states of Arizona, Nevada, North Carolina, and Georgia. We use a baseline of 222 electoral votes for Vice President Harris from safe and likely Democratic states that were won by both Hillary Clinton and President Biden in 2016 and 2020, and 219 electoral votes for former President Trump from safe and likely Republican states that he won in 2016 and 2020 (270 to Win 2024). U.S. elections are decided by the electoral college, not the popular vote; the candidate who wins the popular vote is not guaranteed to win the election (270 to Win 2024). We estimate that Vice President Harris will defeat former President Trump in the electoral college 270 to 268.

Political polarization in the United States is at an all-time high. Vice President Harris and former President Trump have presented staunchly different policies and visions for the future of the United States. Vice President Harris has campaigned on reproductive rights, supporting small businesses, building more affordable housing, expanding medicare coverage, and cutting taxes for the middle class. Former President Trump has campaigned on tariffs, sales taxes ending foreign aid to Ukraine, and securing the Southern border despite instructing his allies in the U.S. Senate to oppose a bipartisan border bill. He is has not yet acknowledged that he lost the 2020 election to President Joe Biden. Women make up 50% of the U.S. population, but all 46 presidents so far have been men. Only one person of color, Barack Obama, has ever been elected president.

The remainder of this paper is structured as follows. Section 2 contains an overview of the polling dataset from FiveThirtyEight (2024) that was used, visualizations of different variables, and summary statistics. Section 3 contains the Bayesian regression models used to predict the percentages of voters that will support Vice President Harris and former President Trump. Section 4 contains tables and visualizations that present the national popular vote and state-level results after applying the Bayesian regression model model. Section 5 contains detailed discussions about the ….. Appendix A contains a thorough discussion about an idealized methodology that we would use if given a $100,000 budget to build a survey to forecast the 2024 U.S. election and our idealized survey questions. Appendix B contains a deep-dive into and evaluation of the methodologies used in the Siena College/New York Times poll. The statistical programming language R (R Core Team 2023) and the `tidyverse`, `janitor`, `ggplot`,

`kableExtra`, `arrow`, `rstanarm`, and `spline` packages were used to perform this election forecast, clean the dataset, build the Bayesian regression models, create data visualizations and tables, and apply the model.

2 Data

2.1 Overview

The data was downloaded on October 29, 2024; polling data released after this date was not considered anywhere in this paper. The presidential polls dataset from FiveThirtyEight contains national polls and state-level polls for each of the 50 states and congressional districts in Maine and Nebraska (FiveThirtyEight 2024). The polls are conducted by various pollsters, including YouGov, Siena/NYT, CES/YouGov, Marquette Law School, The Washington Post, and McCourtney Institute/YouGov. We analyze national data and state-level data for the seven swing states that are expected to determine the results of this election: Michigan, Wisconsin, Pennsylvania, North Carolina, Georgia, Nevada, and Arizona.

We cleaned this dataset to only include high-quality polls at the national and state-level conducted on or after July 21, 2024, where the `population` is likely voters. We determined which polls were high-quality based on the numeric grade, and cleaned the dataset to include only polls with a numeric grade of at least 3.0. Polls with a rating (`numeric_grade`) of 3.0 are conducted by the best pollsters in the United States and score in the 99th percentile or better for accuracy and transparency (Morris 2024b). If a poll in the dataset from FiveThirtyEight (2024) includes multiple populations, the narrowest one is used (likely voters over registered voters and registered voters over all American adults) (Morris 2024a). Additional data cleaning details are available in Appendix C.1.

2.2 Measurement

Our primary measurement task is to capture public opinion and translate it into a 2024 U.S. presidential election prediction. Surveys are a common instrument for measuring public opinion (Alexander 2024). During presidential election cycles, pollsters conduct surveys to measure public opinion and candidate preferences. These surveys aim to represent the U.S. electorate by sampling likely or registered voters and asking them questions about demographics, partisan affiliation, candidate preferences, and stances on issues. Each survey response reflects an individual's voting preference, which pollsters sum up and adjust to represent the population This includes weighting by state, demographic factors (e.g. age, education, race, gender) and accounting for the likelihood of voting (Office of Institutional Reseaerch 2024). These adjustments turn raw opinions into a projected percentage of support for each candidate and make it possible to predict potential election outcomes.

Our dataset from FiveThirtyEight (2024) is a collection of presidential polls from different pollsters that were conducted during the 2024 presidential election cycle. Each entry represents the percentage of respondents to a unique poll supporting Vice President Harris (after July 21, 2024) or President Joe Biden (before July 21, 2024), former President Trump, and third-party candidates. Unique polls are identified by a poll id and each entry contains information about the poll, such as the pollster that conducted it, its population, sample size, and the methodology that was used and information about its quality and accuracy, including its numeric grade, pollscore, and transparency score(FiveThirtyEight 2024).

The transformation from an individual opinion to an entry in our dataset follows three steps: survey, adjustment, and reporting. This process outlines how voter preferences are translated into structured data that allows us to look at trends and predict the outcome of an election

- Survey: selected voters respond to a survey.
- Adjustment: survey responses are aggregated and weighted to estimate support for each candidate.
- Reporting: the results from the adjustment step are recorded as dataset entries, which serve as snapshots of public opinion over time.

2.3 Outcome and predictor variables

We will use `end_date` (the date that a poll was completed), `state`, `pollster`, and `pollscore` to predict support for Vice President Harris and former President Trump at the national level, at the state level for each of the seven battleground states, and in Nebraska's second congressional district in Section 3. The tables and visualizations below present possible relationships between the predictor variables and support for Vice President Harris and former President Trump.

2.3.1 Variation in support for Harris and Trump by state

The percentage of voters that support Vice President Harris and former President Trump varies by state; in some states support for Vice President Harris is higher than the national average and in others, it is lower than the national average. The 2024 presidential election is expected to be decided by seven swing states: Arizona, Georgia, Nevada, North Carolina, Wisconsin, Michigan, and Pennsylvania and Nebraska's second congressional district (270 to Win 2024). Two states, Maine and Nebraska, award one electoral vote to the popular vote winner in each congressional district and an additional two electoral votes to the statewide popular vote winner (270 to Win 2024).

Table 1: Polling averages for Harris and Trump at the national level and at the state level for the states included in the polling dataset show a narrow popular vote lead for Vice President Harris and extremely close races in the 7 battleground states (Arizona, Georgia, Nevada, North Carolina, Michigan, Pennsylvania, Wisconsin as of October 29, 2024.

State	Harris %	Trump %
Popular Vote	50.5	48.0
Arizona	47.0	51.0
Georgia	46.0	51.0
Nevada	51.0	47.0
Pennsylvania	49.0	49.0
Michigan	51.0	46.0
Wisconsin	50.0	47.0
North Carolina	48.0	50.0
Florida	46.0	52.0
Minnesota	53.0	43.0
Missouri	41.0	54.0
Montana	39.5	56.5
Nebraska	39.5	54.0
Nebraska CD-2	53.5	41.5
New Hampshire	52.0	45.0
Ohio	45.0	52.0
Texas	41.0	51.5
Virginia	52.0	44.0

Based on our presidential polling data from FiveThirtyEight (2024) Vice President Harris leads former President Trump in the popular vote 50.5% to 48.0%. The margins in the seven battleground states are tight, with Vice President Harris leading in Nevada, Michigan, Wisconsin, and Nebraska's second congressional district and former President Trump leading in Arizona, Georgia, North Carolina. The two candidates are tied in Pennsylvania. The data set also includes state-level polls from likely Democratic states (Minnesota, New Hampshire, Virginia) and likely Republican states (Florida, Missouri, Montana, Nebraska, Ohio, Texas) that are not expected to determine the winner of the election (270 to Win 2024). Support percentages for Harris and Trump are closer, but still have some variation among the seven battleground states. Harris' support in five of the seven battleground states is lower than her national support, while Trump's support in four of the seven battleground states is higher than his national support.

Since President Biden ended his re-election campaign and Vice President Harris became the Democratic Presidential nominee, the polls have shown a close race between Vice President

Harris and former President Trump. Polling averages for the six months leading up to election day, including from before President Biden withdrew on July 21, 2024 can be found in Appendix C.2. Figure 1 shows national polling averages for Harris and Trump since July 21 and Figure 2 shows state-level polling averages fo Harris and Trump in the seven battleground states and Nebraska's second congressional district.

Vice President Harris surpassed former President Trump in popular vote polls shortly after becoming the presumptive Democratic nominee in late July, but her lead narrowed in mid-August and the polls have been neck-and-neck since late August.

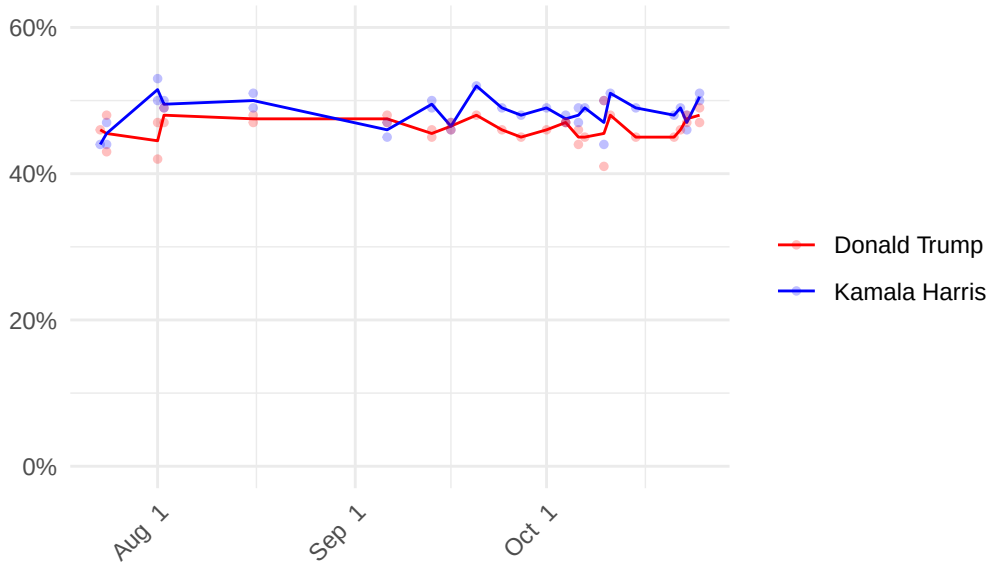


Figure 1: Harris leads Trump in national popular vote polling. The lines are moving poll averages and the points are individual high-quality polls. Color shading of points indicates which candidate won the poll.

The changes in Harris and Trump's polling averages over time at the state level has varied among the seven battleground states and Nebraska's second congressional district. Trump has had a narrow lead over Harris in Arizona since early September. He has been leading over Harris in Georgia since she entered the race. Harris and Trump were tied in Michigan until early October, when Harris took the lead. There is not a lot of polling data for Nebraska's second congressional district, but Harris has had a wider lead there than either candidate has ever had in any of the seven battleground states since late September. Harris and Trump were virtually tied in North Carolina until Trump took a very narrow lead in October, and they are now virtually tied in Pennsylvania. Harris has had a narrow lead in Wisconsin since August.

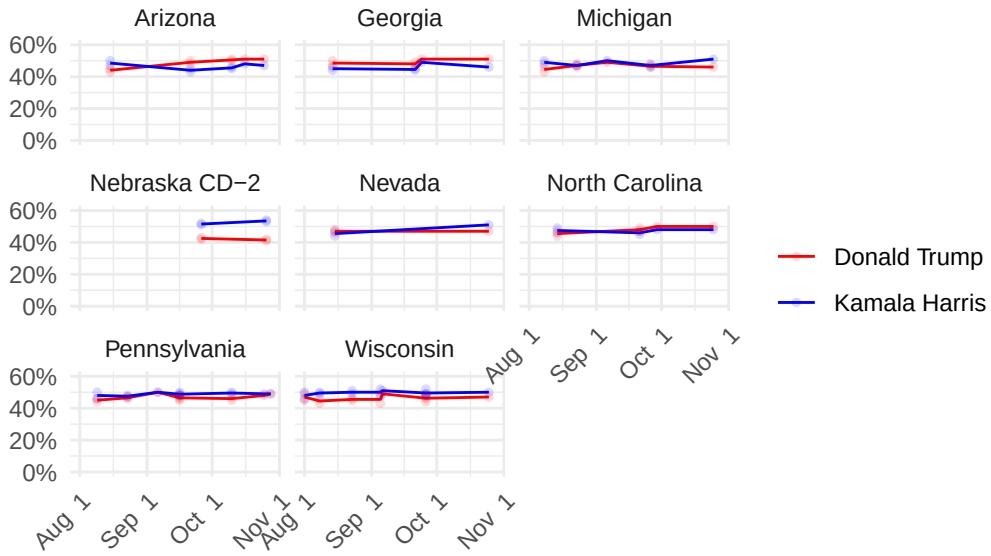


Figure 2: Harris and Trump have been in a dead heat in swing state polls since July 2024. The lines are moving poll averages for each candidate in the seven battleground states. The points are individual state-level polls. The color of each point indicates which candidate lead in the poll.

2.3.2 Variation in support for Harris and Trump by pollster and pollscore

Individual pollsters can produce results that are skewed in favor of either candidate. This can be caused by differences in methodology, respondent recruitment, sample size, or how non-responses are handled [The New York Times (2024b)]. Overall, the different pollsters within our dataset have shown very close polling averages for Harris and Trump, but there is some variation. Figure 3 shows that Harris and Trump national polling averages within our dataset vary by pollster. Siena/NYT polls showed Harris and Trump virtually tied until mid-September when Harris took a narrow lead, but have been virtually tied again since mid-October. YouGov polls have shown a narrow lead for Harris since mid-August and Marquette Law School polls have shown a shrinking lead for Harris since she became the Democratic nominee. Support for Harris and Trump within a poll can be affected by the pollster that conducted it. We "pool the polls", or average the results from different polls to balance out pollster biases [PASEK (2015)]. There are fewer CES/YouGov and McCourtney Institute/YouGov polls in our dataset, but they have both shown a narrow lead for Harris.

Pollscore indicates whether a pollscore is more accurate than a theoretical replacement-level pollscore that polled the exact same election and a negative pollscore is better (Morris 2024b). Our dataset only includes high-quality polls with a numeric grade of 3, which means they have negative pollscores, excellent transparency, and high accuracy (Morris 2024b). The pollster in our dataset with the best pollscore is Siena/NYT and its polling averages for Harris and Trump

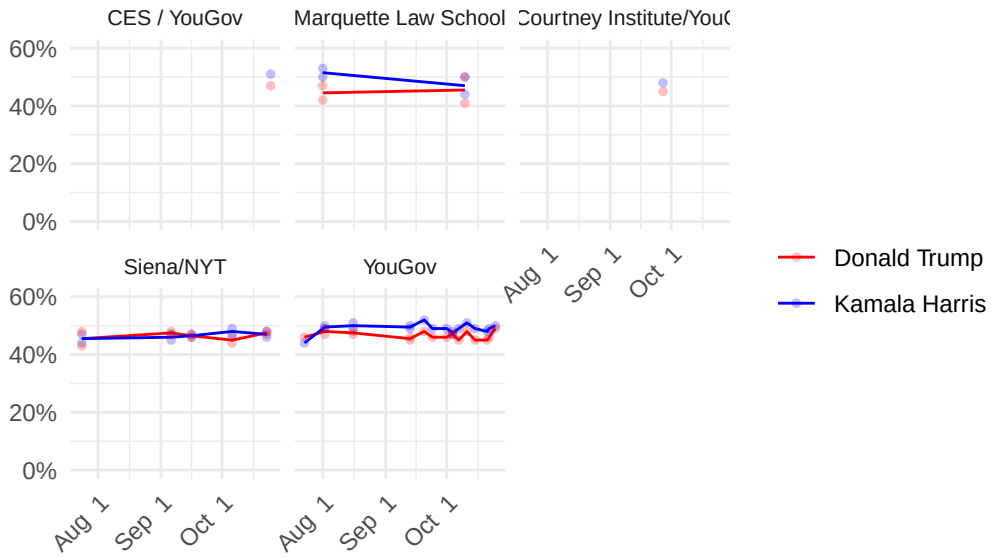


Figure 3: Harris and Trump polling averages vary by pollster. The lines are moving poll averages for each candidate in the seven battleground states. The points are individual polls. The color of each point indicates which candidate lead in the poll.

have varied from other pollsters. We will consider the effects of pollscore on the percentage of respondents to a poll that support Harris and Trump.

Table 2: Only high-quality datasets with a numeric grade of at least 3.0 were included, so the polls included all have good pollscores. Negative/lower pollscores are better.

Pollscore	Number of Polls
-1.5	112
-1.2	8
-1.1	114

Table 3: All the pollsters included in our analysis dataset have a numeric grade of 3, but Siena/NYT has the best pollscore at -1.5.

Pollster	Pollscore	Numeric Grade
CES / YouGov	-1.1	3
Marquette Law School	-1.1	3
McCourtney Institute/YouGov	-1.1	3
YouGov	-1.1	3
The Washington Post	-1.2	3
Siena/NYT	-1.5	3

Table 3: All the pollsters included in our analysis dataset have a numeric grade of 3, but Siena/NYT has the best pollscore at -1.5.

Pollster	Pollscore	Numeric Grade

3 Model

The goal of our modeling strategy is to use a Bayesian model to investigate the relationship between the percentage of voters in a poll who support Vice President Harris or Former President Trump and the date the poll was conducted, the state (or if it was a national poll), the pollster who conducted the poll, and the pollscore it received. Model details, validation, checking, and diagonstics are presented in Appendix D. We use two Bayesian regression models, one each to model the percentage of voters supporting Vice President Harris, *pct_harris* and the percentage of voters supporting former President Trump, *pct_trump*.

The models to predict *pct_harris* and *pct_trump* both use the following predictors:

- `end_date_num`: the number of days since July 21, 2024, when President Biden ended his re-election campaign and endorsed Vice President Harris. This is the spline term; it uses an spline with 5 degrees of freedom to model changes in *pct_harris* (in the Harris model) and *pct_trump* (in the Trump model) over time.
- `state`: accounts for the change in *pct_harris* and *pct_trump* at the state-level for a particular state or at the national level.
- `pollster`: accounts for the differences in *pct_harris* and *pct_trump* among different pollsters.
- `pollscore`:adjusts for the pollscore rating, which is the Predictive Optimization of Latent skill Level in Surveys, Considering Overall Record, Empirically, calculated by averaging the predictive error and predictive bias of a poll (Morris 2024a).

3.1 Model set-up

Define pct_harris_i as the percentage of voters supporting Vice President Harris and pct_trump_i as the percentage of voters supporting former President Trump in the poll with unique `poll_id`=i.

Harris model:

$$pct\_harris_i = \beta_0 + \beta_1 \cdot ns(end\_date\_num_i, df = 5) + \beta_2 \cdot state_i + \beta_3 \cdot pollster_i + \beta_4 pollscore_i$$
$$\beta_0 \sim \text{Normal}(50, 10)$$
$$\beta_1 \sim \text{Normal}(0, 5)$$
$$\beta_2 \sim \text{Normal}(0, 5)$$
$$\beta_3 \sim \text{Normal}(0, 5)$$
$$\beta_4 \sim \text{Normal}(0, 5)$$

Trump model:

$$pct\_trump_i = \beta_0 + \beta_1 \cdot ns(end\_date\_num_i, df = 5) + \beta_2 \cdot state_i + \beta_3 \cdot pollster_i + \beta_4 pollscore_i$$
$$\beta_0 \sim \text{Normal}(50, 10)$$
$$\beta_1 \sim \text{Normal}(0, 5)$$
$$\beta_2 \sim \text{Normal}(0, 5)$$
$$\beta_3 \sim \text{Normal}(0, 5)$$
$$\beta_4 \sim \text{Normal}(0, 5)$$

The models are run in R (R Core Team 2023) using the `rstanarm` package of Goodrich et al. (2022). The default priors from `rstanarm` are used for both GLM Bayesian models. The intercept normal prior with $\mu = 50$ and $\sigma = 10$ reflects the central tendencies of Harris and Trump's polling percentages, influenced by prior knowledge and the predictors use a normal prior with $\mu = 0$ and $\sigma = 5$ (Goodrich et al. 2022).

3.1.1 Model justification

We use separate Bayesian regression models with the same predictors to estimate *pct_harris* and *pct_trump*. This allows us to predict the percentage of voters supporting Vice President Harris and former President Trump, using the same high quality polls from FiveThirtyEight (2024) and the same predictors. We use `end_date_num` (number of days since President Biden ended his campaign on July 21, 2024) as the spline term because we want our Harris model to account for changes *pct_harris*, in and our Trump model to account for changes in *pct_trump* over time. We use state, pollster, and pollscore as predictors to account for changes in . and . at the national or state-level, across different pollsters, and different pollscores. The Harris model is trained on Vice President Harris' polling data and the Trump model is trained on former President Trump's polling data from FiveThirtyEight (2024).

We used the default priors from `rstanarm` in both our models because using a normal prior with $\mu = 50$ and $\sigma = 10$ for the intercept of each model allows us to reflect the central

tendencies of *pct_harris* and *pct_trump* and the prior knowledge from the FiveThirtyEight (2024) presidential polls that show a close race between Vice President Harris at the national popular vote level and in each of the seven battleground states (Goodrich et al. 2022).

Initially, we considered using a single Bayesian regression model to predict *pct_harris*, using `end_days_num` (spline term), `state`, `pollster`, and `pollscore` as predictors. If we used this single Bayesian regression model, we would have calculated *pct_trump* as 100% - *pct_harris*. Calculating the percentage of voters supporting Trump as 100% minus the percentage of voters for Harris would have been insufficient because there are third-party candidates who will receive a small percentage of the vote nationally and in each of the seven battleground states. This may have produced inaccurate or misleading results because either Harris or Trump could win the popular vote or a swing state with less than 50% of the vote (FiveThirtyEight 2024). We would have assumed that if Harris received less than 50% of the vote, she would have lost, even though this is not always the case. President Biden won the swing states of Arizona, Georgia, and Wisconsin in 2020 with less than 50% of the vote (CNN 2016a). Former President Trump won Wisconsin, Michigan, Pennsylvania, and Arizona in 2016 with less than 50% of the vote (CNN 2016b). With many presidential polls this election cycle showing a statistical tie between Harris and Trump in the popular vote and electoral college, calculating Trump's support this way could overestimate it by a few percentage points and produce an inaccurate or misleading result (Silver 2024).

3.1.2 Model weaknesses and limitations

The use of two separate models to predict the percentage of voters supporting Vice President Harris and the percentage of voters supporting former President Trump has weaknesses and limitations. We do not use support for Harris as a predictor in the Trump model or support for Trump as a predictor in the Harris model. However, we know that as support for Harris at the national level or in one of the seven battleground states increases, support for Trump decreases (and vice versa). We could improve our model by adding support for Harris as a spline term in our Trump model and support for Trump as a spline term in our Harris model. This would allow us to use changes in support for Harris over time to predict support for Trump and changes in support for Trump over time to predict support for Harris. Our models do not give higher quality polls or polls with a larger sample size more weight. Our dataset only includes polls with a numeric grade of 3, so this is likely not an issue when we apply our models to it. We did not consider sample size when cleaning our data or building our models because we only included high-quality polls in the 99th percentile for accuracy and transparency. If our models were applied to a larger dataset that includes polls with different numeric grades, these could be weaknesses.

4 Results

Model results and model summary are presented in Appendix D.

4.1 National Popular Vote Results

We applied the Harris model and the Trump model defined in Section 3.1 to predict each candidate's share of the national popular vote.

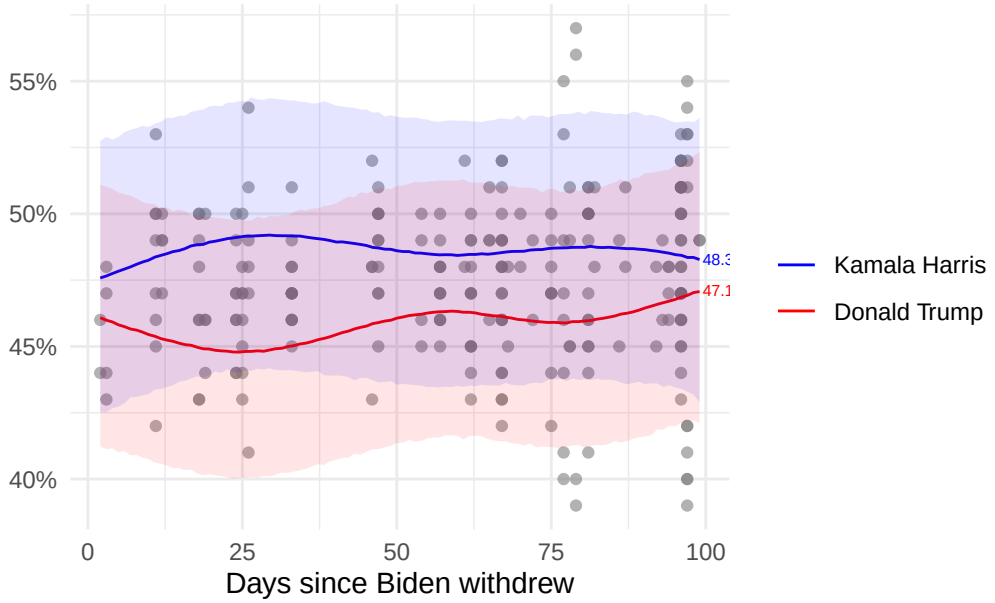


Figure 4: Results of applying Bayesian regression models with spline to predict support for Harris and Trump show that Harris is leading the popular vote 48.3% to 47.1% as of October 29. Lines are moving averages from applying the model, points are individual polls, and the shaded areas show the range of values within the margin of error.

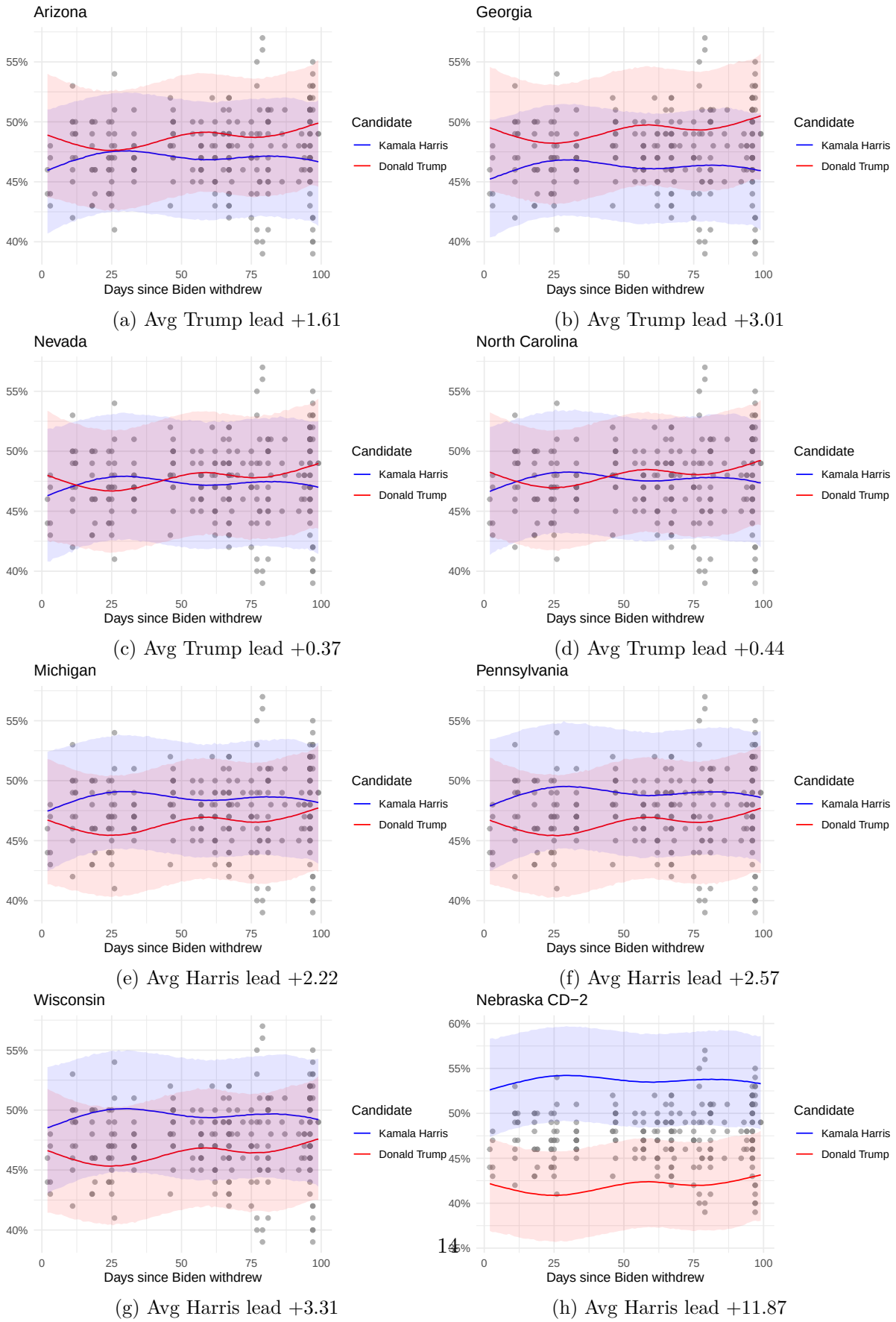
4.2 State-Level Results for the Seven Battleground States and Nebraska's Second Congressional District

Vice President Harris starts out with 225 electoral college votes from states that went to both Hillary Clinton in 2016 and Joe Biden in 2020 (270 to Win 2024). These states are considered safe or likely Democrat and available poling from FiveThirtyEight (2024) shows Vice President Harris with a lead outside the five percent margin of error and in most cases, a double-digit lead. Former President Trump starts out with 219 electoral college votes from states that he won in both 2016 and 2020 (270 to Win 2024). These states are considered safe or likely Republican

and available polling data from FiveThirtyEight (2024) shows former President Trump with a lead outside the five percent margin of error, and in most cases, a double-digit lead. For this reason, the results of the Bayesian models presented in Section 3 focus on estimating support for Vice President Harris and former President Trump in Arizona, Nevada, Georgia, North Carolina, Wisconsin, Michigan, Pennsylvania, and Nebraska's second congressional district, which are worth a total of 94 electoral votes (270 to Win 2024).

We applied the Harris model and the Trump model defined in Section 3.1 at the state-level to predict the percentage of the vote that each candidate will receive in each of the seven battleground states. This will allow us to predict the winner of the electoral college and who will become the 47th President. Figure 5 shows the results of applying the Harris and Trump Bayesian models with spline at the state-level over time.

Figure 5 shows former President Trump leading in Arizona, Nevada, Georgia, and North Carolina and Vice President Harris leading in Michigan, Wisconsin, Pennsylvania, and Nebraska's second congressional district as of October 29, 2024. The margins of error for Trump and Harris have little overlap for Nebraska CD-2, so we can predict that Harris will likely win its single electoral vote. Nebraska CD-2 will not be considered safe or likely Democratic because there is still overlap in the margins of error for Harris and Trump and it was not won by Clinton in 2016. The shaded margins of error for the seven battleground states have a lot of overlap; this means that it is within the margin of error for either candidate to win any of the seven battleground states.



(a) Avg Trump lead +1.61

(b) Avg Trump lead +3.01

(c) Avg Trump lead +0.37

(d) Avg Trump lead +0.44

(e) Avg Harris lead +2.22

(f) Avg Harris lead +2.57

(g) Avg Harris lead +3.31

(h) Avg Harris lead +11.87

Figure 5: The lines are the weighted moving averages resulting from applying the Bayesian model with spline, dots are individual state-level polls, and shaded areas show range of values within the margin of error.

4.3 Electoral College Results

Before the seven key battleground states are decided, Vice President Harris has 225 electoral votes from safe and likely Democratic states and former President Trump has 219 from safe and likely Republican states (270 to Win 2024). We use this starting point and the results from Section 4.2 to predict the electoral college.

Table 4: Electoral votes for the seven battleground states and Nebraska CD-2

State	Electoral Votes
Arizona	11
Georgia	16
Michigan	15
Nebraska-2	1
Nevada	6
North Carolina	16
Pennsylvania	19
Wisconsin	10

If the results presented in Figure 5 hold on election night, and Harris and Trump win their safe and likely states, Harris would defeat Trump in the electoral college, 270 to 268. This is the mean estimate for the number of electoral college votes for Harris and Trump. If Vice President Harris wins all seven battleground states and Nebraska CD-2, she would defeat former President Trump in the electoral college 319 to 219. If former President Trump wins all seven battleground states, he would defeat Vice President Harris in the electoral college 313 to 225.

Table 5: The electoral college outcomes that fall within the margin of error for the seven battleground states.

	Harris	Trump
Harris Upper/Trump Lower Estimate	319	219
Mean Estimate	270	268
Harris Lower/Trump lower Estimate	225	313

5 Discussion

5.1 Why Harris or Trump could win

Vice President Harris and former President Trump have been deadlocked in national and state-level polls in Arizona, Nevada, Georgia, North Carolina, Wisconsin, Michigan, and Pennsylvania since the summer. Our results presented in Section 4 show Harris leading Trump 48.3% to 47.1% in the popular vote and 270 to 268 in the electoral college. Our electoral college prediction is based on narrow leads for Harris in Wisconsin, Michigan, and Pennsylvania and narrow leads for Trump in Arizona, Nevada, Georgia, and North Carolina. Harris' popular vote lead and all of Harris' and Trump's leads in the seven battleground states fall well within the margin of error.

A normal polling error could swing the popular vote and the seven battleground states in either candidate's favor. Silver (2024) found that the average polling miss is 3 to 4 percentage points. If either Harris or Trump outperforms their swing state and national polling averages by 3 to 4 percentage points, they would win the popular vote and sweep the seven battleground states. This would result in Harris winning the electoral college 319 to 219 or Trump winning the electoral college 313 to 226 and it is within the margin of error shown in Section 4.

5.2 Polling misses in 2016, 2020, and 2022

Discuss polling flaws in 2016 and 2020, how support for Trump was underestimated. Discuss how this was overcorrected in 2022, and how support for GOP house and senate candidates was overestimated. Discuss Trump's unique appeal to a certain segment of the electorate. Refer to Nate Silver articles.

In the 2016 and 2020 presidential elections, polls underestimated support for former President Trump. In 2020, 93% of national polls overestimated President Biden's support and underestimated former President Trump's support among voters

5.3 Weaknesses, limitations, and next steps

Harris and Trump have been deadlocked in national and battleground state-level polls this election cycle. In Section 4, we predicted that Vice President Harris will win the popular vote to and the electoral college 270 to 268. These are razor-thin margins, indicative of a statistical tie.

Pollsters have made extensive efforts to correct their polling misses from 2016 and 2020, which led them to predict that Democratic nominee Hillary Clinton would win the 2016 election and President Biden would win the 2020 popular vote and swing states by larger margins than he actually did.

Biden's withdrawal, use of two models, no third-party candidates, only national popular vote and swing states were analyzed, we did not consider how the pollsters in our dataset handled nonresponse when modeling. Weaknesses and next steps should also be included.

Once the results of the 2024 U.S. presidential elections are in, our next step will be to compare the actual results to the polls and our own forecast and investigate why the polls were accurate or inaccurate. If the results are within the margin of error, we will know that the polls accurately predicted a close race. If Harris or Trump wins in a landslide (i.e. wins all the battleground states, some by a margin outside the margin of error, or flips any of the losing candidate's safe/likely states, wins the popular vote by a margin outside the MOE), we will take a deeper dive into 2024 polling methodologies, what was done to correct past polling misses, and why it failed.

Appendix

A Idealized methodology

A.1 Survey objectives

A.2 Sampling approach

The target population for our idealized survey is likely voters in the United States. We will use the L2 voter database from L2 (2024) to build a representative sampling frame. The L2 voter database is one of the most trusted sources for enhanced voter data and it includes detailed demographics and voting history data (L2 2024). Using this data set is the first step towards ensuring that our sample aligns with the general electorate and is representative of likely voters so that we can sample precisely.

We will use a stratified sampling approach to closely examine voter demographics. Stratified sampling allows us to look at every stratum and carry out simple random sampling with those strata (Alexander 2024). Its main goal is to ensure that every strata of the population is represented (Neyman 1934). We selected stratified sampling because it will allow us to have representation within the subgroups that we are interested in and it has a reduced sampling error and improved accuracy rate (Alexander 2024). We considered simple random sampling, but ultimately chose stratified sampling instead because it tends to produce more precise accurates when used to forecast U.S. elections (Pew Research Centre 2024). The U.S. election is decided by the electoral college, not the popular vote so we will oversample from the seven battleground states that are expected to decide the 2024 election: Arizona, Nevada, Georgia, North Carolina, Wisconsin, Michigan, and Pennsylvania (FiveThirtyEight 2024). Oversampling from the swing states will allow us to put an emphasis on forecasting their results and increase the accuracy of our electoral college estimate. Our target sample size of 100,000 respondents will provide a margin of error of 2% at a 95% confidence level; this will allow us to be precise while still accounting for budgetary constraints (Pew Research Centre 2024).

A.3 Respondent recruitment

We will use multi-channel respondent recruitment, including both phone and digital outreach. Phone outreach will allow us to capture older demographics and individuals who use the internet and social media less. Digital outreach, such as targeted social media ads, email lists, and news websites will enable us to recruit a broad sample. Digital outreach channels are cost effective and can reach younger demographics. We will allocate $28,000 of our budget for rewarding survey respondents to improve our response rates, particularly within harder-to-reach groups such as young people and low-information voters (Alexander 2024). As shown

by Smith et al. (2019), incentives increase survey participation, particularly amongst lower-response demographics.

A.4 Survey Design

Our survey is conducted using GoogleForms, which allows for an easy, user-friendly experience and increases respondent likelihood. The survey length is kept within the five to ten minute range, with thirteen questions to balance the need for data collection with the need for respondent engagement (Stantcheva 2023).

The survey includes the following sections:

- Demographics: In this section, we collect essential demographic data that we will use for post-survey weighting. This includes gender and ethnicity.
- Candidate evaluation: This section includes direct questions about candidate support, vote choice, and support level.
- Key issues and concerns: This section includes questions that aim to identify the top issues driving voter decisions, such as abortion rights and the economy.

A.5 Data Validation

Common issues with surveys include incomplete or inconsistent responses, duplicate responses, and fake responses by bots. We will use automate validation checks to detect and filter out incomplete or inconsistent responses, IP tracking to prevent duplicate responses, and CAPTCHA technology to minimize bot interference (Zhang et al. 2019).

A.6 Poll Aggregation

We will use the seven-day average method to aggregate polls because it decreases fluctuations in daily responses by smoothing out temporary spikes. This will make trends clearer.

A.7 Weighting and Data Adjustments

We will use post-stratification weighting to correct demographic imbalances in our final sample (The New York Times 2024a).

A.8 Budget

A.9 Idealized survey questions

2024 U.S. Presidential Election Poll This survey collects information about voters' political views and who they support in the 2024 U.S. Presidential Election. The data collected will not be shared with any external parties and will strictly be used for analytical purposes. This survey is completely anonymous and your data will be protected. Any published material regarding the results drawn from this survey cannot be traced back to you. The goal of this survey is to draw conclusions about the 2024 presidential elections held in the United States. Please answer as accurately as possible. If you have any questions or concerns, please reach out to aliza.mithwani@mail.utoronto.ca (correspondence will not be shared with any external parties).

1. Are you a registered voter in the United States ? Yes No
2. Do you plan to vote in the upcoming presidential election? Yes No Undecided

Demographics Questions

3. Would you consider yourself: White Black or African American Hispanic or Latino Asian American Indian or Alaskan Native Middle Eastern or North African Native Hawaiian or Pacific Islander Prefer not to say Other (specify)
4. What is your age? 18-29 20-44 45-64 65+ Prefer not to say
5. What sex were you assigned at birth, on your original birth certificate? "Female" "Male" Prefer not to say
6. How do you currently describe yourself (select all that apply)? "Female" "Male" "Transgender" Prefer not to say Other (Specify)
7. What is your household income? Less than $20,000 $20,000-59,999 $60,000-79,999 $80,000-99,999 $100,000 or more Prefer not to say
8. In which state do you currently reside? Dropdown list of states

Candidate Evaluation

9. If the 2024 presidential election were held today, who would you vote for?

Donald Trump, Republican Kamala Harris, Democrat Jill Stein, Green Party Write-in Don't know Prefer not to say Other (please specify)

(Optional) If you selected "Write-in" for the last question, please specify below:

10. Do you consider yourself a Democrat, a Republican, an Independent, or a member of another party? Democrat Republican Independent Another Party Don't know Prefer not to say

Key Issues and Concerns

11. Rate these issues in order of importance to you (1 being most important and 7 being the least important): (use multiple choice grid with 7 rows and 7 columns) Abortion Immigration The state of democracy/corruption Foreign policy The economy Character Climate change?
12. If you had to assign a value from 1 to 5 to your level of optimism about the future of the United States, where 1 means highly pessimistic and 5 means highly optimistic, where would you place yourself? 1 (Highly pessimistic) 2 3 4 5 (Highly optimistic)
13. What would you say to someone who is undecided about voting in this election?

Confirmation Message

Thank you for your response! Your answers have successfully been recorded.

Link to survey: https://forms.gle/h7MTA8k21ZbYxahT6

B Pollster methodology overview and evaluation

B.1 Overview

The Siena College/New York Times (Times/Siena) poll is a collaboration between the New York Times and the Siena College Research Institute that aims to capture voter sentiment in the battleground states and the nation overall (The New York Times 2024b). Its accuracy has made it a highly regarded poll for predicting U.S. presidential election results. The NYT/Siena poll uses live poll interviews to reach a representative sample of voters and measure their political preferences, views, and issue priorities (The New York Times 2024b). Its methodology focuses on

B.2 Population and Sampling Frame

The target population, defined by Alexander (2024) is the population that the Times/Siena poll aims to speak about, is registered voters and likely voters in the United States. Some polls conducted by Times/Siena have a target population of registered voters, while others use likely voters (The New York Times 2024a). The sampling frame, defined by Alexander (2024) as the individuals from the target population that Times/Siena can get data about is drawn from various voter registration databases, including the L2 voter database (The New York Times 2024b). In polls for the 2024 presidential election, Times/Siena has put an emphasis on gathering nationally-representative and state-specific samples for the seven battleground states that decided the 2020 presidential election and are expected to decide the 2024 presidential election: Arizona, Nevada, Georgia, North Carolina, Michigan, Wisconsin, and Pennsylvania (The New York Times 2024b). A sampling frame that includes various voter registration

databases helps ensure precise targeting and that the sample reflects the demographics of registered or likely voters in the upcoming U.S. election (The New York Times 2024b).

B.3 Respondent Recruitment Strategy

Times/Siena recruits respondents for its poll at random, from a national list of registered voters gathered from various high-quality voter registration databases (The New York Times 2024b).

B.4 Sampling Approch and Trade-offs

B.5 Strengths and limitations of The Siena College/New York Times methodology

C Additional data details

C.1 Data Cleaning

C.2 Polling averages from before President Joe Biden ended his re-election campaign

It is impossible to quantify or model the effects of Biden's unprecedented decision to end his re-election campaign in July 2024. There is no established methodology for analyzing this, so we made the decision to focus on Harris versus Trump polling from after July 21, 2024 because they are the two major presidential nominees. National and swing-state polling averages in the six months leading up to election day are shown in Figure 6 and Figure 7.

D Model details

The model summaries are shown in Table 6

D.1 Posterior predictive check

D.1.1 Harris Model

In Figure 8a we implement a posterior predictive check. This shows the comparison of the actual outcome variable, *pct_harris*, with simulations from the posterior distribution (Alexander 2024). Figure 8b shows a comparison of the posterior with the prior.

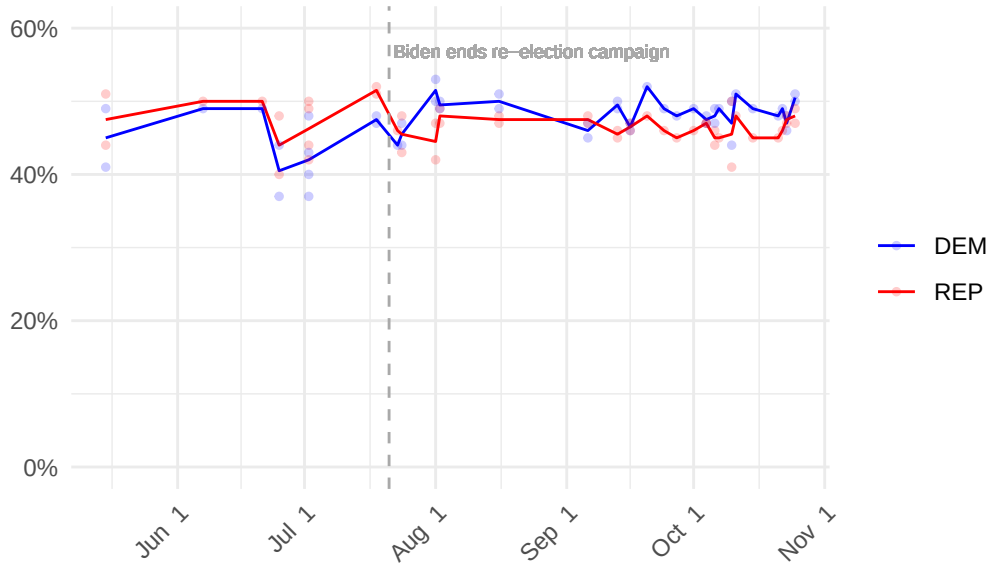


Figure 6: National popular vote averages for the Democratic and Republican presidential nominees since May 5, 2024 (six months before election day) show former President Trump leading before Biden ended his campaign, the gap narrowing after Harris became the Democratic nominee, Harris taking the lead in August, and a dead heat in September and October.

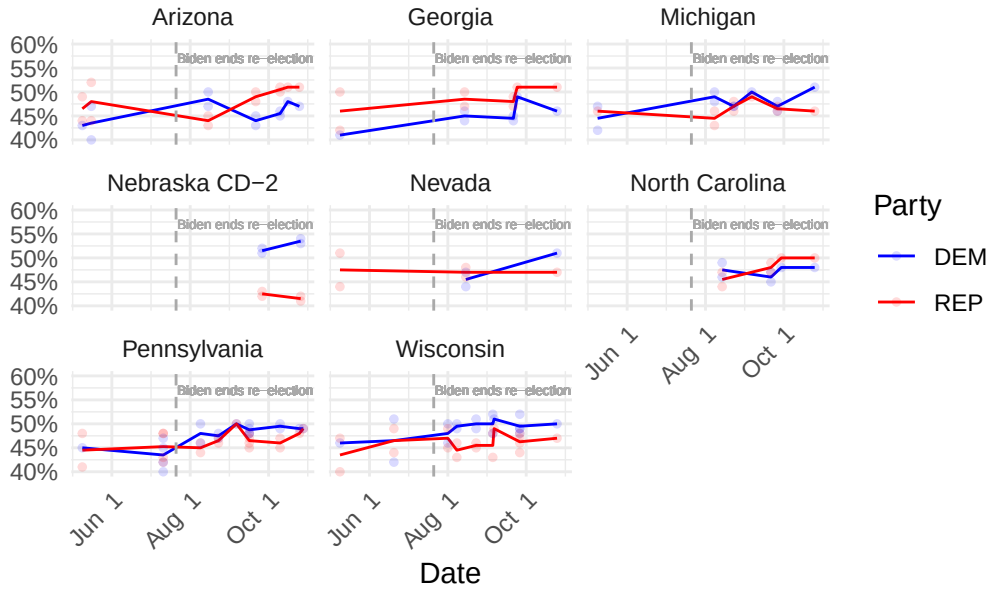
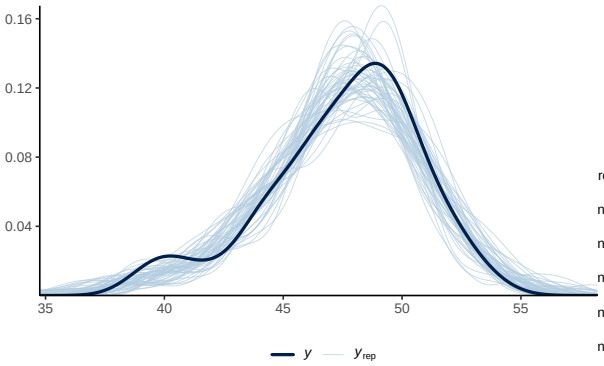


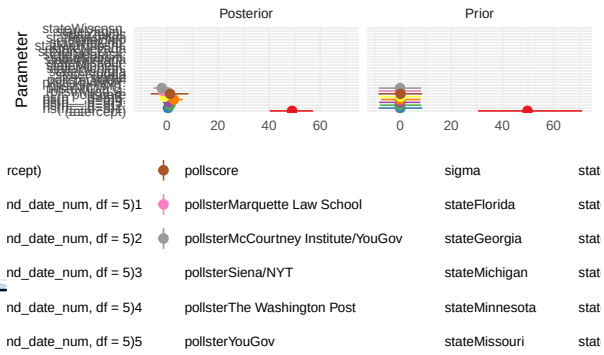
Figure 7: Democratic vs Republican presidential polling averages from May 5 to October 29, 2024, including both Biden and Harris as the Democratic nominee and Trump as the Republican nominee.

Table 6: Explanatory models of support for Harris and Trump based on end date (number of days since Biden ended re-election campaign on July 21, 2024), state, pollster, and pollscore

	Harris	Trump
(Intercept)	48.99	48.59
	(5.02)	(5.21)
ns(end_date_num, df = 5)1	0.49	0.96
	(1.10)	(1.04)
ns(end_date_num, df = 5)2	1.25	−0.58
	(1.41)	(1.44)
ns(end_date_num, df = 5)3	0.83	0.59
	(1.47)	(1.45)
ns(end_date_num, df = 5)4	2.74	−0.98
	(2.22)	(2.11)
ns(end_date_num, df = 5)5	−0.87	2.45
	(1.10)	(1.05)
stateFlorida	−4.13	4.45
	(1.19)	(1.21)
stateGeorgia	−0.81	0.61
	(0.93)	(0.96)
stateMichigan	1.57	−2.18
	(0.86)	(0.88)
stateMinnesota	4.10	−5.70
	(1.82)	(1.79)
stateMissouri	−5.98	4.82
	(1.82)	(1.79)
stateMontana	−5.88	7.63
	(1.41)	(1.37)
stateNational	1.66	−2.81
	(0.71)	(0.72)
stateNebraska	−5.55	4.29
	(1.46)	(1.55)
stateNebraska CD-2	6.75	−6.76
	(1.09)	(1.12)
stateNevada	0.42	−0.91
	(1.20)	(1.16)
stateNew Hampshire	3.28	−3.88
	(1.75)	(1.87)
stateNorth Carolina	0.74	−0.64
	(0.96)	(0.93)
stateOhio	−2.29	1.41
	(1.10)	(1.09)
statePennsylvania	2.06	−2.19
	(0.80)	(0.80)
stateTexas	−2.80	1.53
	(0.95)	(0.97)
stateVirginia	3.22	−4.82
	(1.82)	(1.91)
stateWisconsin	2.59	−2.29
	(0.85)	(0.85)
pollsterMarquette Law School	−1.34	−0.08
	(1.02)	(1.01)
pollsterMcCourtney Institute/YouGov	−1.93	−0.70
	(1.95)	(1.84)
pollsterSiena/NYT	−2.43	−0.12
	(1.98)	(1.95)
pollsterThe Washington Post	−1.71	1.22
	(1.28)	(1.26)
pollsterYouGov	−1.34	1.31
	(0.88)	(0.85)
pollscore	1.29	−0.01
	(4.44)	(4.54)
Num.Obs.	117	117
R2	0.715	0.697
R2 Adj.	0.629	0.603
Log.Lik.	−224.988	−224.011
ELPD	−249.5	−248.2
ELPD s.e.	8.2	7.6
LOOIC	499.0	496.3
LOOIC s.e.	16.3	15.2
WAIC	495.1	492.1
RMSE	1.57	1.56



(a) Posterior prediction check

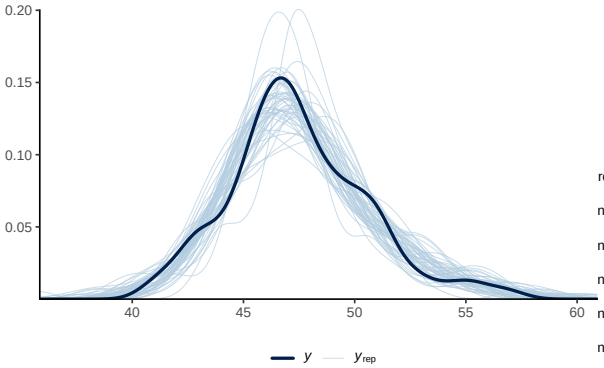


(b) Comparing the posterior with the prior

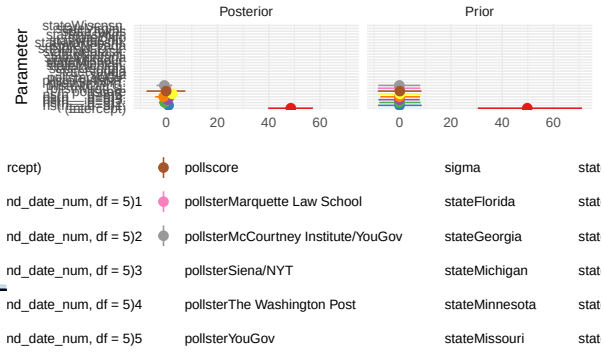
Figure 8: Examining how the model for support for Harris fits, and is affected by, the data

D.1.2 Trump Model

In Figure 9a we implement a posterior predictive check. It shows the comparison of the actual outcome variable, *pct_trump*, with simulations from the posterior distribution (Alexander 2024). Figure 9b shows a comparison of the posterior with the prior.



(a) Posterior prediction check



(b) Comparing the posterior with the prior

Figure 9: Examining how the model for support for Trump fits, and is affected by, the data

D.2 Distribution

Credibility intervals are the equivalent of confidence intervals when using a Bayesian model (Alexander 2024). We use Bayesian estimation to get a distribution for each coefficient. Figure 10 shows the 95% credibility intervals for the coefficients in the Harris model. Figure 11 shows the 95% credibility intervals for the coefficients in the Trump model. There is a 95% probability mass between the two ends of the 95% credibility interval (Alexander 2024).

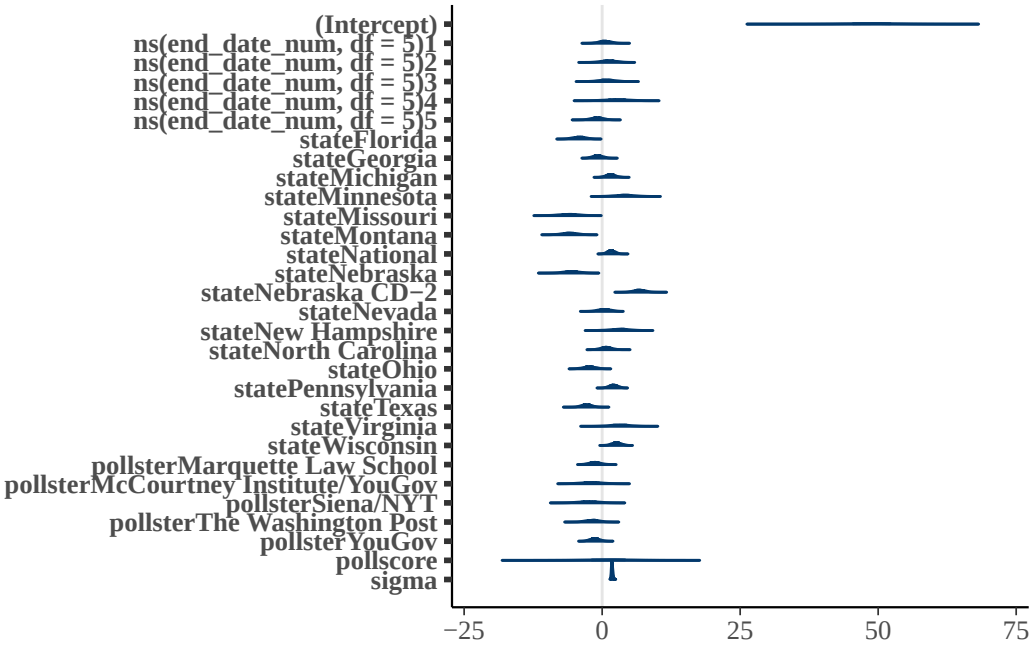


Figure 10: 95% credibility intervals for the Harris model

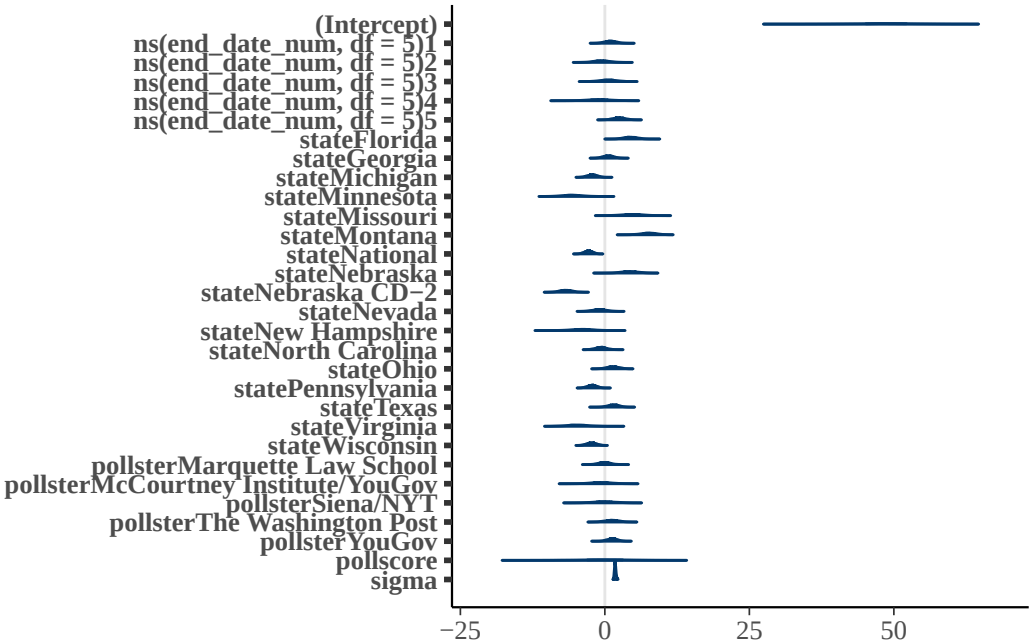


Figure 11: 95% credibility intervals for the Trump model

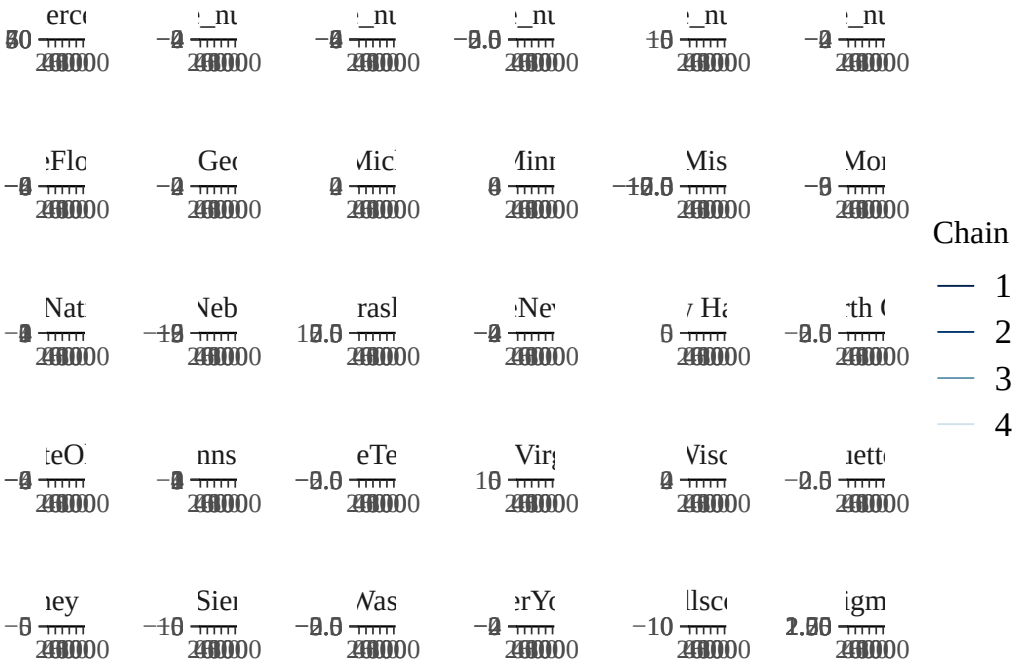
D.3 Model Diagnostics

D.3.1 Harris Model

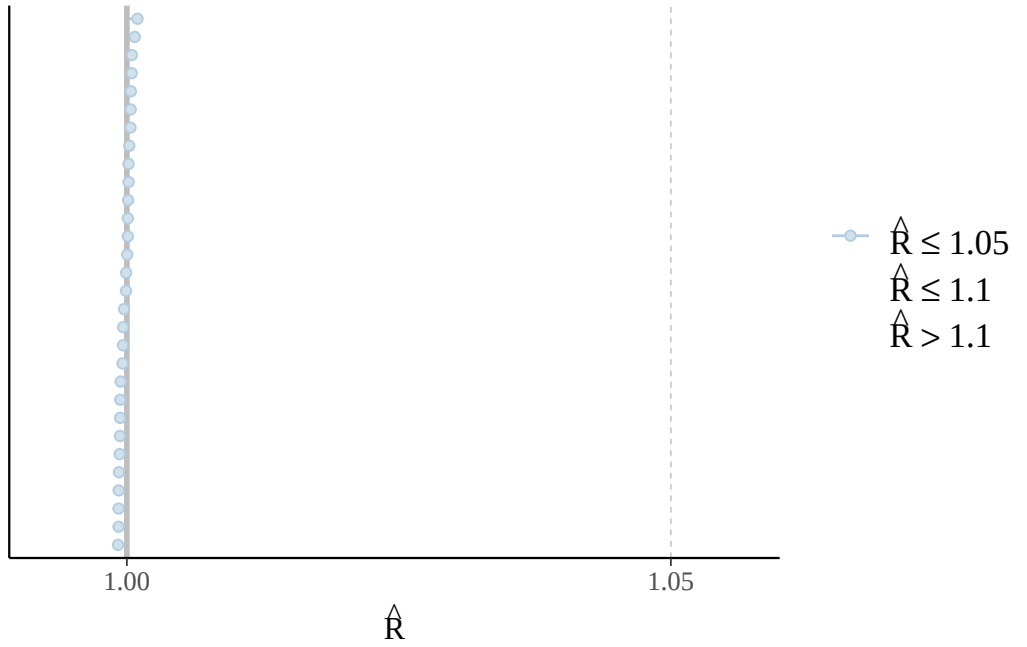
Figure 12a is a trace plot. It shows lines that bounce, are horizontal, and have some overlap between the chains. This suggests that there is nothing out of the ordinary with the Harris model (Alexander 2024). Figure 12b is a Rhat plot. It shows that everything is very close to 1. This suggests that there are no problems with our Harris model and we do not need to simplify it, remove predictors, modify predictors, use different priors, or re-run (Alexander 2024).

D.3.2 Trump Model

Figure 13a is a trace plot. It shows lines that bounce, are horizontal, and have some overlap between the chains. This suggests that there is nothing out of the ordinary with our Trump model (Alexander 2024). Figure 13b is a Rhat plot. It shows that everything is very close to 1. This suggests that there are no problems with our Trump model and we do not need to simplify it, remove predictors, modify predictors, use different priors, or re-run it (Alexander 2024).

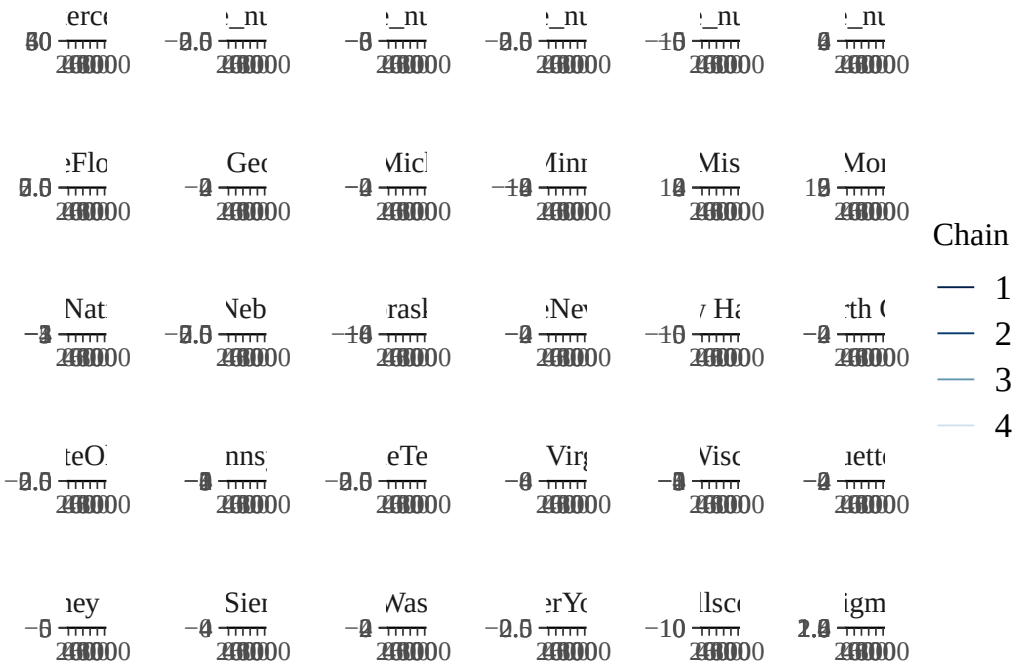


(a) Trace plot

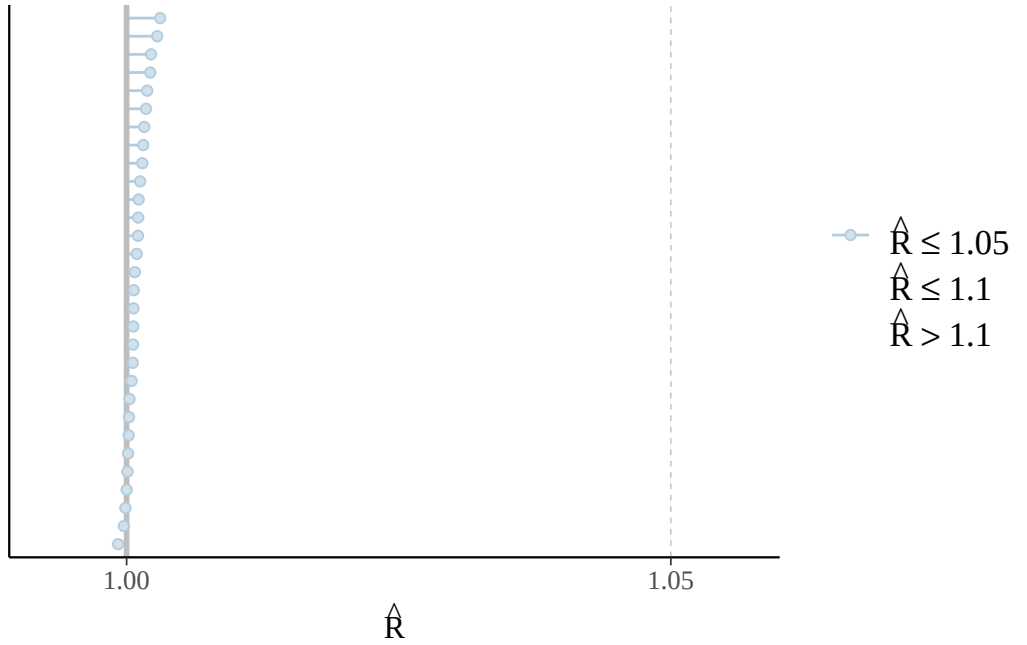


(b) Rhat plot

Figure 12: Checking the convergence of the MCMC algorithm for the Harris model



(a) Trace plot



(b) Rhat plot

Figure 13: Checking the convergence of the MCMC algorithm for the Harris model

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