Joe Biden Predicted to Win 55.9% of the Popular Vote in the 2024 U.S. Presidential Election*

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The 2024 U.S. Presidential Election will take place on November 5th and it will be a rematch between President Joe Biden and Former President Donald Trump. In this report, we used a logistic regression model along with multi-level post-stratification (MRP) to predict the winner of the upcoming election. Using the results of our model, we predict that President Biden will win 55.9% of the popular vote and defeat former President Trump 467 to 71 in the electoral college, and win a second term in the White House. However, due to the limited nature of our survey data, the error range of our electoral college prediction is large.

1 Introduction

The 2024 U.S. Presidential Election will take place on Tuesday November 5 2024. Incumbent President Joe Biden will seek a second term in a rematch against his 2020 opponent and, arguably, the most polarizing figure in American politics, former President Donald Trump.

Packages used for data cleaning, model, visualizations, and tables: `tidyverse` Wickham et al. (2019), `janitor` Firke (2023), `rstanarm`, `readr`, `ggplot2`, `knitr`, and `arrow`.

The remainder of this paper is structured as follows. Section 2 discusses the survey and post-stratification data used.

Talk about polarization in a discussion point instead of introduction

Clear gap that needs to be filled … what is the research gap and why is this important? - 2024 US Presidential Election - how consequential this election is - what is on the ballot - women's rights - trump's project 2025 thing

*Code and data are available at: https://github.com/taliafabs/US-Election-Forecast-2024.git

If someone's done it before not on this data set not in this context

Previous groups have looked at …

The survey data for our study was provided by the Polarization Research Lab. The Polarization Research Lab was formed by a group of researchers to increase understanding of where partisan animosity comes from and what can be done to help (Iyengar, Lelkes, and Westwood 2024). The post-stratification data for this study was provided by the Integrated Public Use Microdata Series (IPUMS). IPUMS is an organization which lays out survey and census data with the help of 105 statistical agencies (Steven Ruggles and Schouweiler 2024). We used the data from the 2022 American Community Survey (ACS) for this report (Steven Ruggles and Schouweiler 2024).

Our report has 5 sections.

We are using multi-level regression with post-stratification (MRP) to predict the results of the 2024 U.S. presidential election. MRP uses two different data sets, survey data and post-stratification data. It fits a model using the smaller survey data set and applies it to the larger post-stratification data set.

R Core Team (2023) was used

ESTIMAND: SUPPORT FOR BIDEN

We will build a logistic regression model to estimate support for President Biden in the upcoming election, using sex, age, race, highest level of education, and whether the respondent lives in an urban or rural area as predictors.

We will use logistic regression to estimate support for Biden. Multilevel regression with post-stratification (MRP)

2 Data

Our survey data is from the America's Political Pulse Survey conducted by the Polarization Research Lab. The Polarization Research Lab is a research group founded by top political science research scholars at Dartmouth College, Stanford University, and the University of Pennsylvania, dedicated to applying scientific research methods to the study of democracy and political polarization Iyengar, Lelkes, and Westwood (2024). The America's Political Pulse Survey interviews 1000 American adults each week and asks them questions that aim to track affective polarization, support for violations of democratic norms, and support for the use of political violence in America Iyengar, Lelkes, and Westwood (2024). High-level survey results are available on the Polarization Research Lab website.

Our post-stratification data is a subset of the 2022 American Communities Survey (ACS) provided by the Integrated Public Use Microdata Series (Steven Ruggles and Schouweiler 2024).

2.1 Survey Data

We selected the America's Political Pulse Survey Data Week 3 2024 from the Polarization Research Lab as our survey data. It contains the responses of the 1000 American adults interviewed between January 12-19 2024. Samples were collected via interviews. The population of the survey, the respondents, are paid survey-takers from the YouGov survey platform Iyengar, Lelkes, and Westwood (2024). Demographic information about respondents, including sex, age, race, home state, employment status, marital status, and the size and type of city that they live in is included. Participants were also asked questions about who they voted for in the 2016 and 2020 U.S. presidential elections, stances on political violence, what their party affiliation is, the strength of their party affiliation, and what their political ideology is. While the America's Political Pulse survey aims to learn about affective polarization and respect for democratic norms by asking respondents questions regarding their feelings about the importance of voting, towards the Democratic Party and the Republican Party, faith in democratic institutions, and about the use of political violence, we are focusing on demographics and political preferences. As expected, responses vary by ideology and political affiliation.

We are focusing on demographics and other variables that might indicate who each respondent will vote for in the 2024 presidential election. The variables from the America's Political Pulse Survey that we selected include:

- `pid7`: the respondent's party affiliation and the strength of it.
- `presvote16post`: who the respondent voted for in the 2016 U.S. presidential election.
- `pres20votepost`: who the respondent voted for in the 2020 U.S. presidential election.
- `gender`: the gender of the respondent
- `age`: the respondent's age as of January 2024.
- `race`: respondent's race or ethnicity.
- `educ`: highest level of education completed.
- `inputstate`: state of residence.
- `urbancity2`: whether or not the respondent lives in a city, and if so, the size of that city.

The survey does not contain a question about a preferred 2024 Presidential Candidate. In fact, it was conducted in January 2024, before Super Tuesday took place and Donald Trump had secured almost enough delegates to win the Republican (GOP) nomination. As of March 11, 2024, former President Trump has secured 1078 out of the 1215 delegates needed to win the GOP nomination. Therefore, we were able to conclude that the two major candidates in the upcoming election will be incumbent President Joe Biden and former President Donald Trump. We created a `vote_biden` binary variable that indicates a respondent's preferred presidential candidate in the upcoming 2024 presidential election. It is equal to 1, which indicates that the respondent's preferred presidential candidate is Joe Biden, if their party affiliation is

Table 1: Races of survey respondents

Race	%
asian	1.95
black	10.06
mixed	2.71
native american	0.65
other	15.26
white	69.37

Democratic. `vote_biden` is equal to 0 otherwise, indicating that a respondent's preferred presidential candidate is Donald Trump. Donald Trump is arguably the most polarizing figure in American politics, therefore we are considering independents who voted for Joe Biden in 2020 to prefer Joe Biden over Donald Trump again in 2024. It is important to note that because `vote_biden` is a binary variable, it only considers two possible presidential candidates: Joe Biden and Donald Trump. In the context of this report and the `vote_biden` variable, voting for a third-party candidate, a write-in vote, or not voting are not considered possible voting outcomes.

In Figure 1, we can see that support for Biden within our survey data varies by race and sex. Black women showed overwhelming support for President Biden's upcoming re-election campaign, while white men appear to be split between Biden and Trump. As shown in Table 1 69% of respondents were white. Among white survey respondents, women were more likely to support President Biden and men were more likely to support Trump. We used some of the code from Chapter 13 of Telling Stories with Data and modified it to produce the bar graphs in this section (Alexander 2023).

We see differences in vote preference among survey respondents with different levels of education. Male voters with up to a high school education or some college education were more likely to prefer Trump than their 4-year college or post-graduate educated counterparts. Only male voters whose highest level of education is a 4-year college degree favored Biden over Trump, while males with a post-graduate education were split. Females with a post-graduate education heavily favored Biden, further highlighting the gender-gap in support for Biden and Trump. This makes sense, as Trump is strongly opposed to abortion rights and since the Supreme Court of the United States overturned Roe v. Wade in June 2022, there is nothing to stop him from signing an outright ban on abortion, contraceptives, or fertility treatments if elected. Females with a 4-year college or post-grad education were more likely to prefer Biden than those with only a high school education.

Since the 1990s, America has developed an urban-rural ideological divide and it has kept growing (Staff 2022). The America's Political Pulse data set does not have a variable that explicitly indicates whether each respondent lives in an urban or rural area, but it does have a variable `urbancity2`, which indicates whether each respondent lives in a city and the size of the city that they live in. We created a new binary variable, `urban`, which is equal to

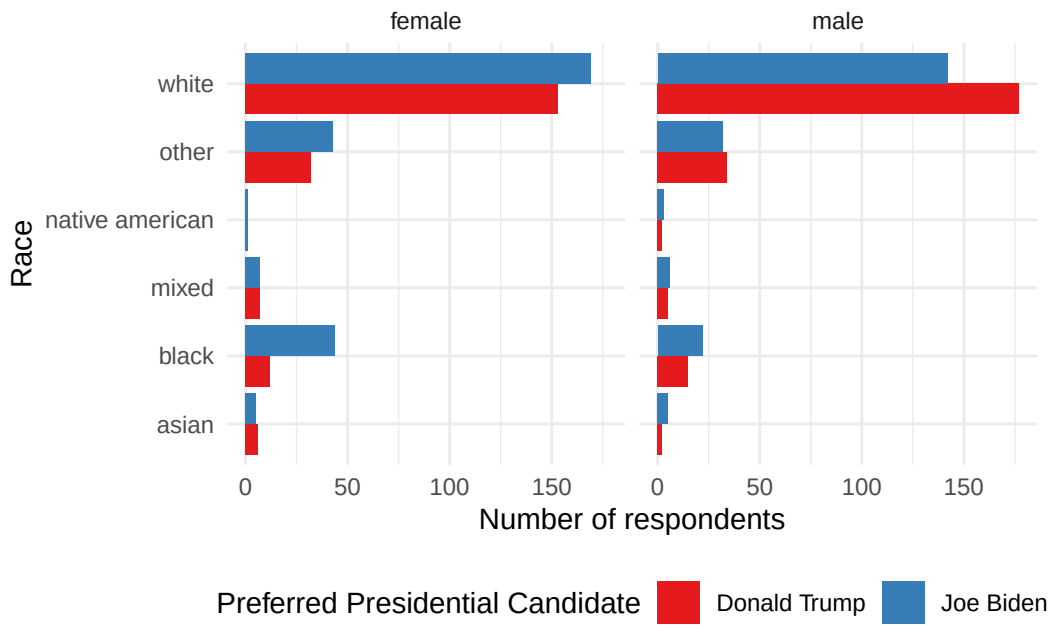

Figure 1: Preferred presidential candidates of survey respondents, by gender and race

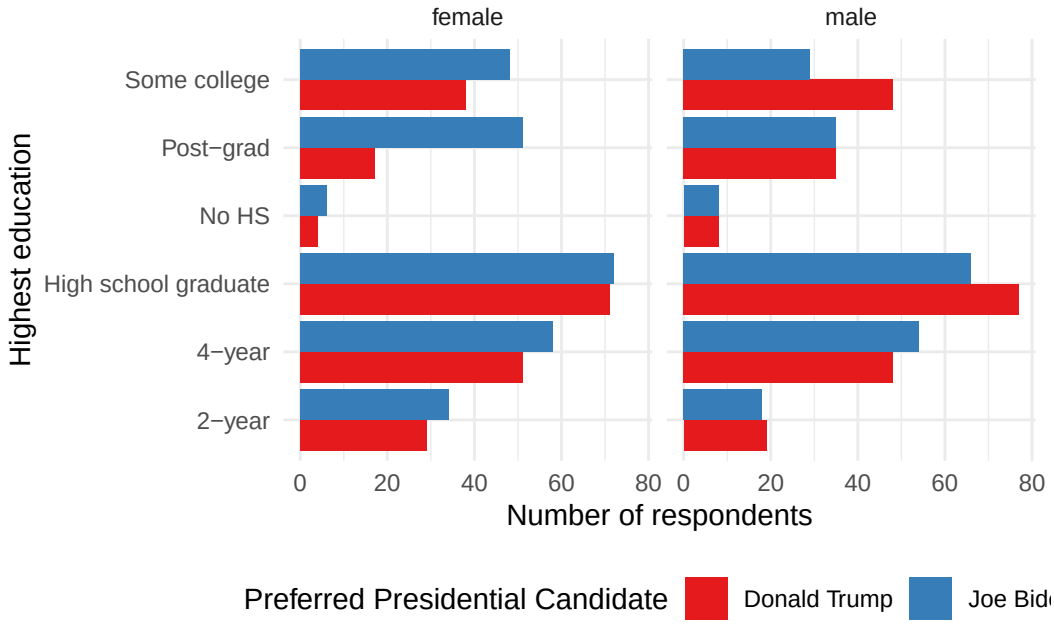

Figure 2: The Distribution of Presidential Preferences, by gender and highest level of education

"urban" if the respondent lives in a big city, a smaller city, or a suburb, and "rural" if the respondent lives in a small town or rural area. This effectively distinguishes city and suburban voters from small town and rural voters, making our analysis simpler. We found that female survey respondents living in urban areas heavily favored Biden, while male survey respondents living in rural areas heavily favored Trump. In Figure 3, we can see that while female survey respondents living in rural areas favored Trump and male survey respondents living in urban areas favored Biden by a small margin, females in urban areas heavily favored Biden and males in rural areas heavily favored Trump.

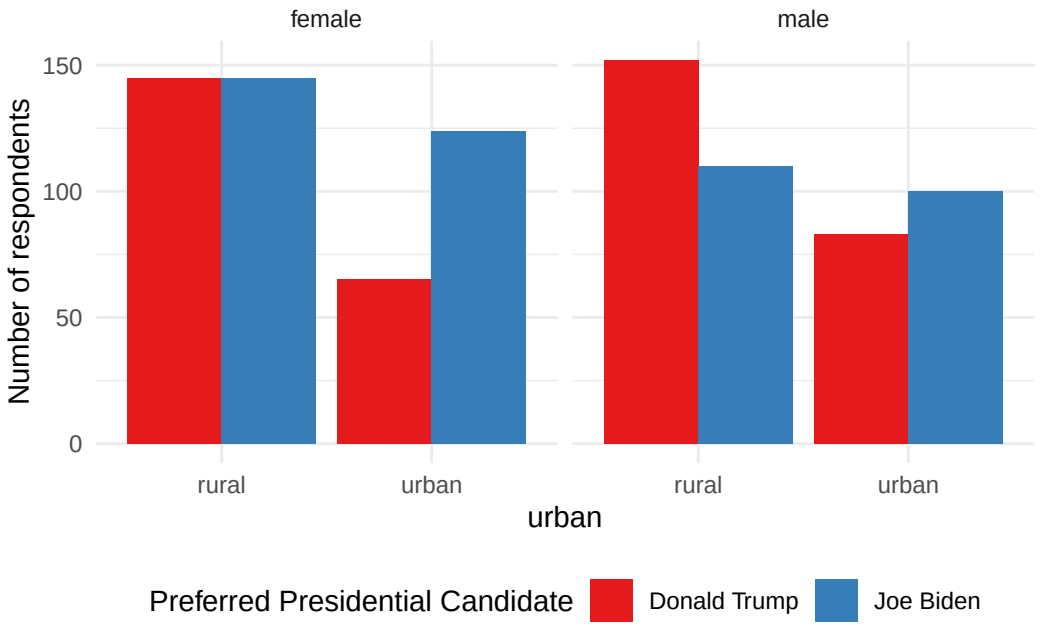

Figure 3: Preferred presidential candidate of respondents living in urban vs rural areas

Overall, Biden outperformed Trump in urban areas, with the support of 60.22% of survey respondents living in urban areas. This is unsurprising, and it is a continuation of the pattern observed in recent presidential elections. Scala and Johnson (2016) found that both former President Barack Obama and 2016 Democratic nominee Hillary Clinton performed well in densely populated urban areas, but faced increasingly challenging political climates and diminished voter support in rural areas. Hillary Clinton saw a particularly pronounced decline in support in rural areas in the 2016 election, where she was defeated by Donald Trump (Scala, 2016). Our survey data is somewhat consistent with this, as Biden trails Trump among survey respondents living in rural areas, with 46.20% support.

Using only the survey data, we can calculate the overall support for Biden and the support for Biden in each state to make a popular vote and electoral college prediction. Based on our earlier findings, we believe that being non-white, female, college or post-grad educated, and living in an urban area makes an individual more likely to support Biden. To calculate a popular vote prediction for President Biden based on the survey data, we simply calculated

Table 2: Presidential preferences of respondents living in urban and rural areas

Urban or Rural:	Biden %	Trump %
Urban	60.22	39.78
Rural	46.20	53.80

the mean of the `vote_biden` binary indicator variable, and to calculate an electoral college prediction, we added up the electoral college votes of the states where Biden received more than 50% support from survey respondents. We used the steps and code provided by Alen Mitrovski (2020) and the `statebins` package (Rudis 2020) to produce Figure 4 .

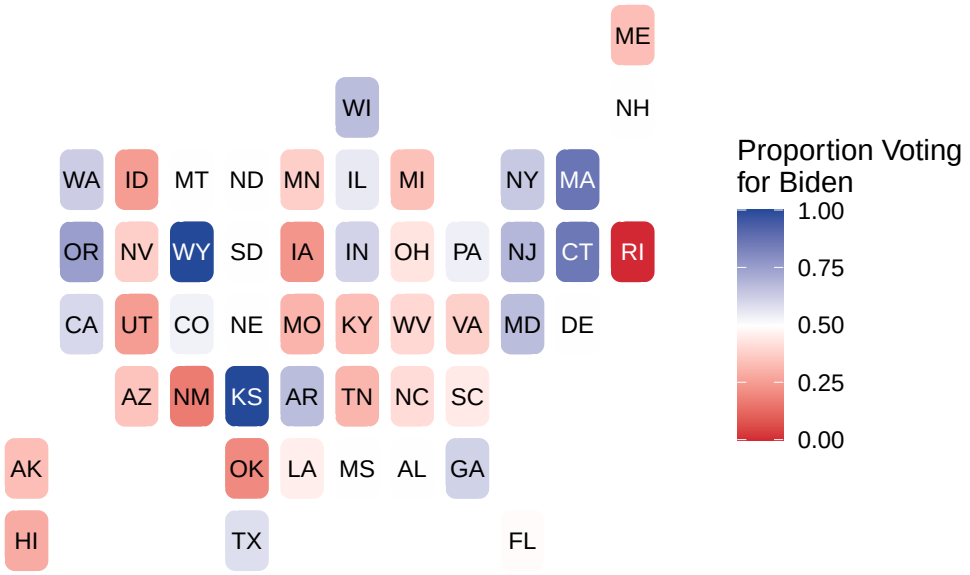

Figure 4: Electoral college map based on the survey data

Figure 4 illustrates the proportion of voters in each state who plan to support President Biden in the 2024 election. We can see that there is very strong support for President Biden in "deep blue" states such as Massachusetts, Connecticut, New Jersey, and Oregon. A majority of respondents in New York, New Jersey, Maryland, and California also support President Biden. On the contrary, Oklahoma, Idaho, Utah, and Alaska appear to be "deep red" states, which indicates that a high proportion of survey respondents from those states support former President Trump. Notably, Wyoming appears to be dark blue, indicating that 100% of survey respondents from that state support President Biden. However, Wyoming is a Republican stronghold, and the only Democratic presidential candidate who has won it since 1948 is Lyndon B. Johnson in 1964 (Politics 2020). Wyoming was the most pro-Trump state in both the 2016 and 2020 presidential elections. Trump outperformed 2016 Democratic nominee Hillary Clinton and President Joe Biden in Wyoming by 46 and 43.3 percentage points, respectively (Politics 2020). The America's Political Pulse Survey contains one respondent from Wyoming,

Table 3: Popular vote and electoral college based on survey data

Survey Estimate:	Biden	Trump
Num Votes	479.00	445.00
% Votes	51.84	48.16
Electoral College	324.00	211.00

who leans Democrat and voted for Hillary Clinton in 2016 and Joe Biden in 2020. There are over half a million people in Wyoming, and Figure 4 reflects the political preferences of exactly one of them. Similarly, Hawaii appears to be a "red" state, indicating that the majority of survey respondents from that state prefer former President Trump. However, Hawaii is a Democratic stronghold and it has only been carried by a Republican presidential candidate twice since it became a state in 1959 (Politics 2020). President Biden and Hillary Clinton won 63.7% and 62.2% of the vote in Hawaii in 2020 and 2016, respectively.

It is important to note America's Political Pulse survey data set only contains 1000 observations, so it has very few respondents from states with small populations, such as Wyoming, Kansas, Hawaii, and Rhode Island. It contains zero respondents from Vermont. It is not possible to invent missing data, so the proportion of voters supporting Biden in Vermont is not shown in Figure 4. The number of electoral college votes in Table 3 adds up to 535 instead of 538 because Vermont's 3 electoral votes were not included. This is a significant weakness, and we will discuss it in more depth, as well as how it contributes to the weaknesses and limitations of our model in Section 5.4.

2.2 Post Stratification Data

Our post-stratification data is a subset of the American Community Survey (ACS) 2022 provided by IPUMS (Steven Ruggles and Schouweiler 2024).

We selected variables that mirror the ones in our survey data set.

```
# A tibble: 6 x 5
  races            Count   pct type   group
  <fct>            <int> <dbl> <chr>  <chr>
1 asian            23855  6.31 survey races
2 black            31195  8.25 survey races
3 mixed            36430  9.63 survey races
4 native american   4440  1.17 survey races
5 other            19366  5.12 survey races
6 white           262962 69.5  survey races


# A tibble: 6 x 5
```

Table 4: Races of post stratification data

races	n	pct	type	group
asian	23855	6.31	survey	races
black	31195	8.25	survey	races
mixed	36430	9.63	survey	races
native american	4440	1.17	survey	races
other	19366	5.12	survey	races
white	262962	69.52	survey	races

```
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3 mixed           36430  9.63 survey races
4 native american  4440  1.17 survey races
5 other           19366  5.12 survey races
6 white          262962 69.5  survey races
```

Our raw post-stratification data set has 500,000 records. We selected variables that mirror the ones that we have in our survey data set, including:

- `age`: the age of the census respondent
- `sex`: only male and female are considered, for simplicity and to align with our survey data
- `race`: the race of the census respondent.
- `educ`: highest level of education completed.
- `stateicp`: state of residence.
- `metro`: whether the respondent lives in a metropolitan area or not.

The sex, race, educ, and metro variables were cleaned and re-factored to mirror our survey data and to allow us to apply our model to our post-stratification data. Figure 5 shows the demographic statistics of our survey and post-stratification data. The steps and code for producing Figure 5 were obtained from Alen Mitrovski (2020).

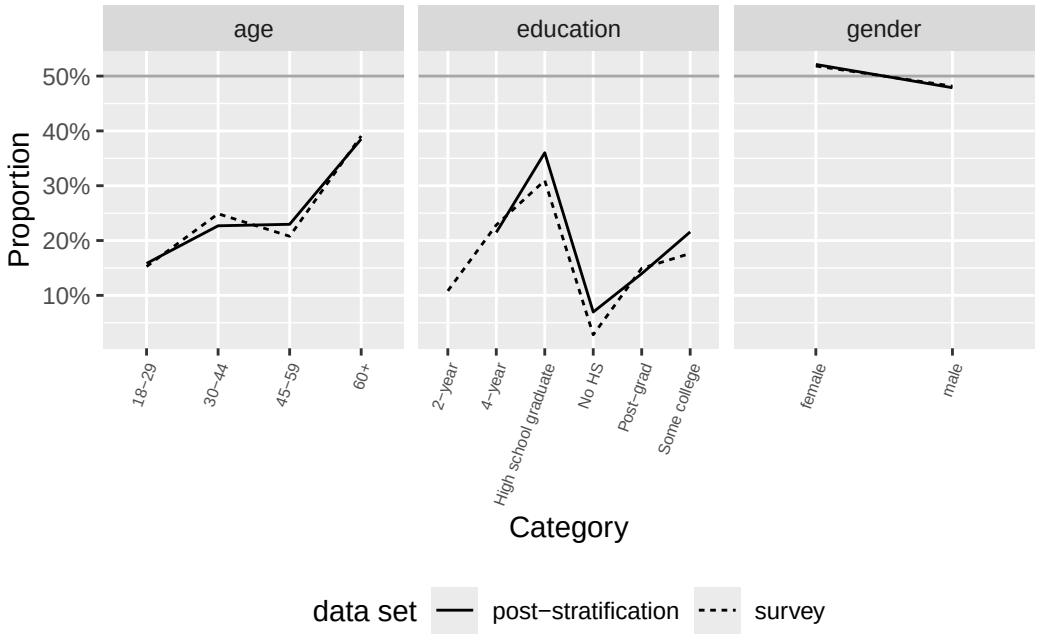

Figure 5: Survey vs post-stratification voter demographics

Figure 7 illustrates the distribution of voters across the 50 states, including Washington D.C. in both our survey and post-stratification data sets. The steps and code for producing Figure 7 were obtained from Alen Mitrovski (2020).

However, we can see that there are some slight discrepancies in the proportions of respondents in the survey and post-stratification data from Alabama, California, Florida, Kansas, Maryland, Massachussets, Michigan, New York, Nebraska, and Virginia.

None of the voters in our survey data are from Vermont, but 0.198% of the voters in our post-stratification data are. Therefore, the results from applying our model to our post-stratification data will include a prediction for Vermont.

Figure 7 shows that there is a comparable distribution of voters across U.S. states in the survey and post-stratification data. However, the survey data over represents Florida, Michigan, New York, and Virginia.

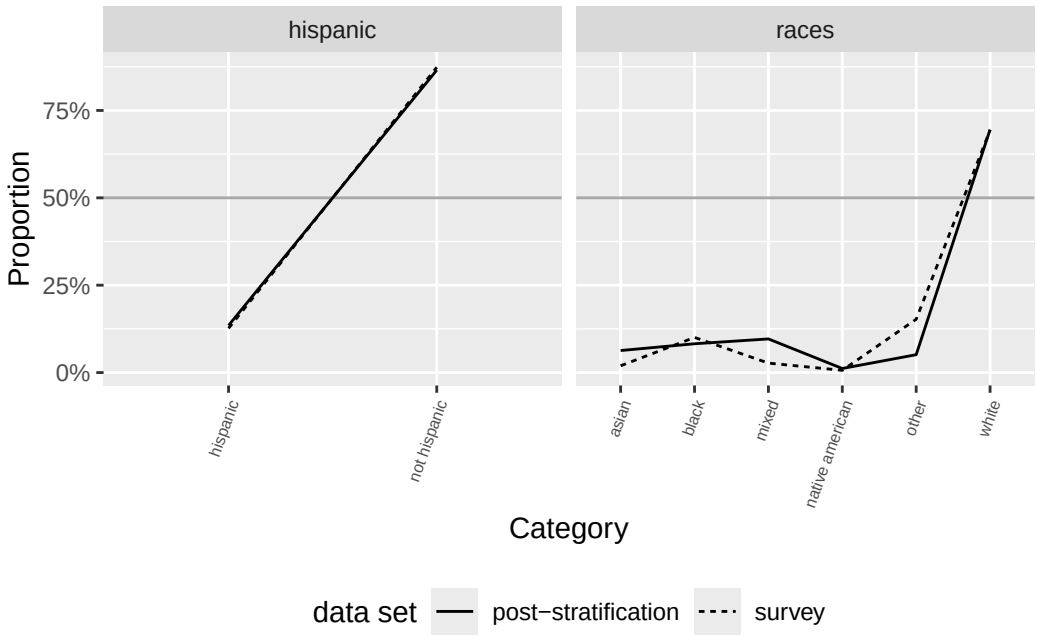

Figure 6: Survey vs post-stratification voter race demographics

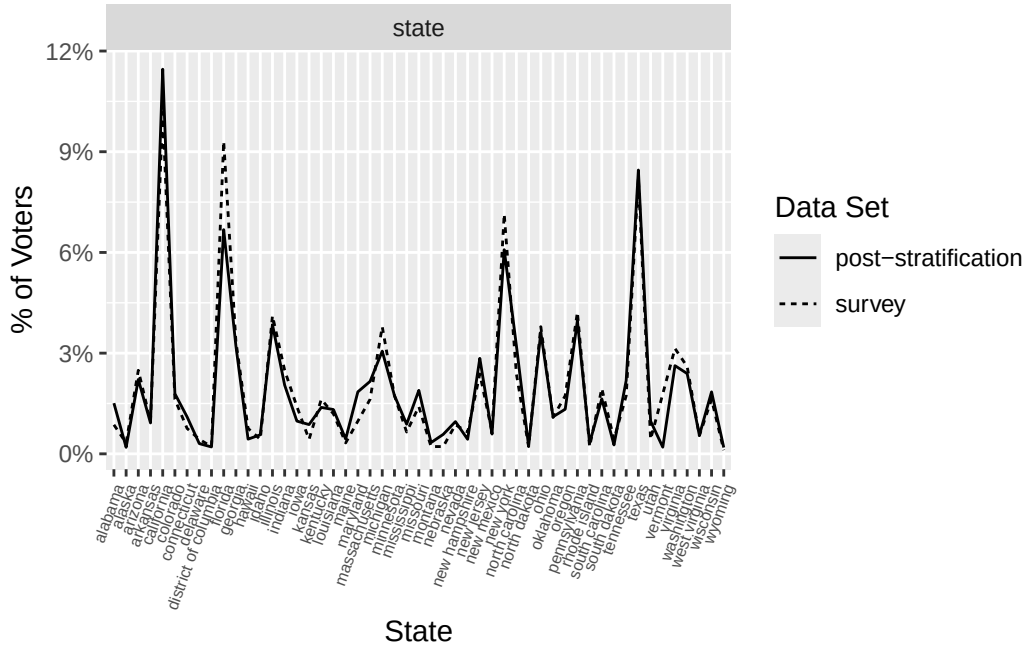

Figure 7: **?(caption)**

3 Model

We will use multilevel regression with post-stratification (MRP) for our analysis.

3.1 Model set-up

To predict whether a person will vote for Joe Biden or Donald Trump, we fitted a logistic regression model using data from the America's Political Pulse Survey (Iyengar, Lelkes, and Westwood 2024) and post-stratified it using ACS census data (Steven Ruggles and Schouweiler 2024). Logistic regression only works for binary classification, therefore we created a `vote_biden` variable during our data cleaning process, which is equal to 1 if a person's preferred candidate is Joe Biden, and 0 if it is Donald Trump.

The logistic regression model used to predict support for Biden using sex, age, race, highest level of education, state, and whether the individual lives in an urban or rural area is as follows:

$$Pr(vote\_biden = 1) = \text{logit}^{-1}(\beta_0 + \beta_1 \text{sex}_i + \beta_2 \text{age\_bracket}_i + \beta_3 \text{race}_i + \beta_4 race_h ispanic_i + \beta_5 \text{education\_level}_i + \beta_6 \text{u}$$

We run our model in R (R Core Team 2023) using the `stan_glm()` function of the `rstanarm` package (Goodrich et al. 2022). We use the default priors from `rstanarm`.

We use the `predict()` function in R (R Core Team 2023) to apply our logistic regression model to the ACS Census data (Steven Ruggles and Schouweiler 2024).

Model weaknesses: logistic regression output is binary so it does not include the options of not voting or voting for a third-party candidate.

Concerns about our model are discussed in more detail in this section:

3.2 Model justification

We expect to see a positive relationship between support for President Biden and non-white race, college or post-graduate education, and living in an urban area. This expectation is based on the fact that Trump has spent much of his political career spewing anti-immigrant rhetoric and America's urban/rural ideological divide. In 2016, Trump campaigned on the promise of building a wall at the U.S.-Mexico border, and during his presidency, Trump labeled Mexicans as rapists and drug smugglers, referred to the coronavirus as the "Kung-flu" and the "China virus." Ghitza and Robinson (2020) found that 39% of Biden's supporters in the 2020 election were voters of color, compared to only 15% for Trump. Black and Asian-American voters turned out at an increased rate, heavily in favor of President Biden in 2020 (Ghitza

and Robinson 2020). Scala (2016) found that even after social, demographic, and economic factors including education, age, and race were controlled for, the urban-rural divide was still statistically significant in estimating vote patterns in U.S. presidential elections. The 2020 election was no exception, as Trump had strong support in rural areas and Biden dominated in major cities (Ghitza and Robinson 2020).

Table 5: Coefficient estimates

	(1)
(Intercept)	0.955
sexmale	−0.387
age_bracket30-44	−0.412
age_bracket45-59	−0.362
age_bracket60+	−0.404
racesblack	0.713
racesmixed	0.070
racesnative american	0.653
racesother	−0.539
raceswhite	−0.193
race_hispanicnot hispanic	−0.555
education_level4-year	0.162
education_levelHigh school graduate	−0.100
education_levelNo HS	0.190
education_levelPost-grad	0.635
education_levelSome college	−0.102
urbanurban	0.483
Num.Obs.	924
R2	0.073
Log.Lik.	−611.964
ELPD	−630.2
ELPD s.e.	7.8
LOOIC	1260.3
LOOIC s.e.	15.5
WAIC	1260.1
RMSE	0.48

4 Results

state	mean	lower	upper
connecticut	0.5822598	0.5324812	0.6297652
maine	0.4862644	0.4486057	0.5233904
massachusetts	0.5904030	0.5381231	0.6400940
new hampshire	0.4942822	0.4574654	0.5312882
rhode island	0.5907266	0.5365488	0.6434610
vermont	0.4699648	0.4299677	0.5097889
delaware	0.5514999	0.5135519	0.5890835
new jersey	0.6063769	0.5500059	0.6609217
new york	0.5803021	0.5328835	0.6255917
pennsylvania	0.5355160	0.4939531	0.5769003
illinois	0.5543272	0.5128826	0.5950306
indiana	0.5247223	0.4834543	0.5648062
michigan	0.5302852	0.4904636	0.5701989
ohio	0.5413067	0.4985774	0.5835599
wisconsin	0.4910630	0.4535390	0.5282535
iowa	0.4753272	0.4371360	0.5129832
kansas	0.5192152	0.4808726	0.5570861
minnesota	0.4994205	0.4624964	0.5358343
missouri	0.5211729	0.4824041	0.5593941
nebraska	0.4921274	0.4539914	0.5291001
north dakota	0.4694321	0.4284290	0.5115443
south dakota	0.4617904	0.4140735	0.5088786
virginia	0.5737628	0.5328035	0.6135887
alabama	0.5540723	0.5133184	0.5936242
arkansas	0.5087055	0.4695293	0.5469880
florida	0.6006477	0.5389830	0.6573654
georgia	0.5767979	0.5374718	0.6157410
louisiana	0.5637066	0.5236571	0.6031802
mississippi	0.5357404	0.4937504	0.5766874
north carolina	0.5638151	0.5249439	0.6022520
south carolina	0.5708598	0.5287332	0.6114582
texas	0.5952108	0.5267373	0.6531175
kentucky	0.4981111	0.4595491	0.5356272
maryland	0.6133124	0.5666520	0.6587997
oklahoma	0.5207693	0.4657390	0.5739918
tennessee	0.5438939	0.5030138	0.5833524
west virginia	0.4768880	0.4360533	0.5180567
arizona	0.5901729	0.5282763	0.6466360
colorado	0.5712244	0.5230645	0.6182097
idaho	0.5047902	0.4644995	0.5448758
montana	0.4790785	0.4351910	0.5227375
nevada	0.5785615	0.5217471	0.6330995
new mexico	0.5913407	0.5002132	0.6703405
utah	0.5506729	0.5033088	0.5962022
wyoming	0.4743637	0.4317542	0.5177755
california	0.6137013	0.5388634	0.6793101
oregon	0.5472464	0.5017566	0.5921280
washington	0.5647234	0.5123755	0.6146274
alaska	0.5320225	0.4136148	0.6356532

Table 6: Popular Vote Estimates for Joe Biden

Estimate:	Biden %	Trump %
Lower Estimate	51.43	48.57
Mean Estimate	56.59	43.41
Upper Estimate	61.42	38.58

Electoral College Estimate:	Biden	Trump
Lower	363	175
Mean	471	67
Upper	538	0

popular vote

electoral college

The estimates for the support for Biden in each state are shown in **?@tbl-supporttbl**

We followed and modified the code provided in Chapter 16 of "Telling Stories with Data" (Alexander 2023) to produce Figure 8

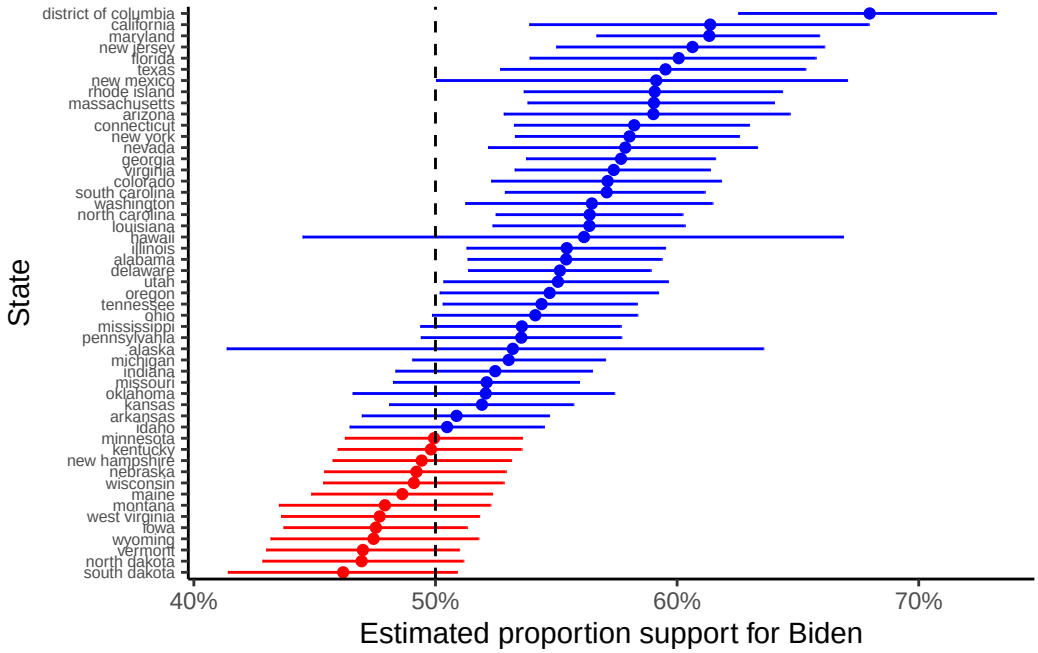

Figure 8: Estimated proportion of each state voting for Biden in 2024 (Post-Stratification)

Figure 9 illustrates the same information as Figure 8, except it includes gray dots that represent the proportion of voters in each state that support Biden from the survey data.

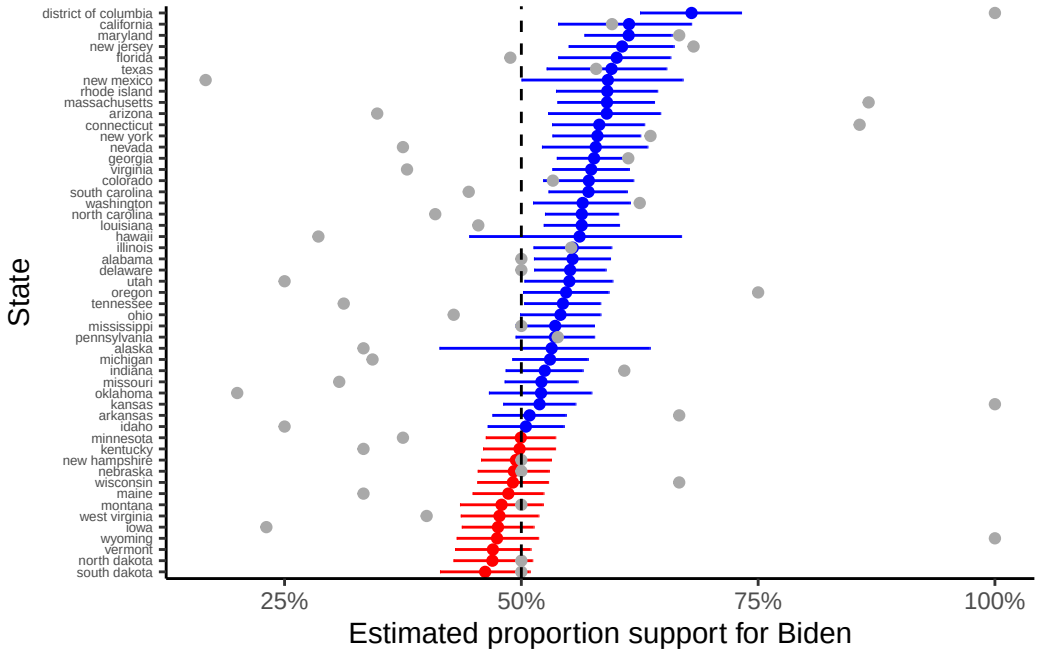

Figure 9: Estimated proportion of each state voting for Biden in 2024 Post-Stratification vs Survey Data

There is a lot of variation between the post-stratification and survey estimates for the proportion of voters in each state that will vote for President Biden in the upcoming election.

We used the steps and code provided by Alen Mitrovski (2020) and the statebins package (Rudis 2020) to produce Figure 10 .

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5 Discussion

5.1 Popular Vote Projection

If my paper were 10 pages, then should be be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

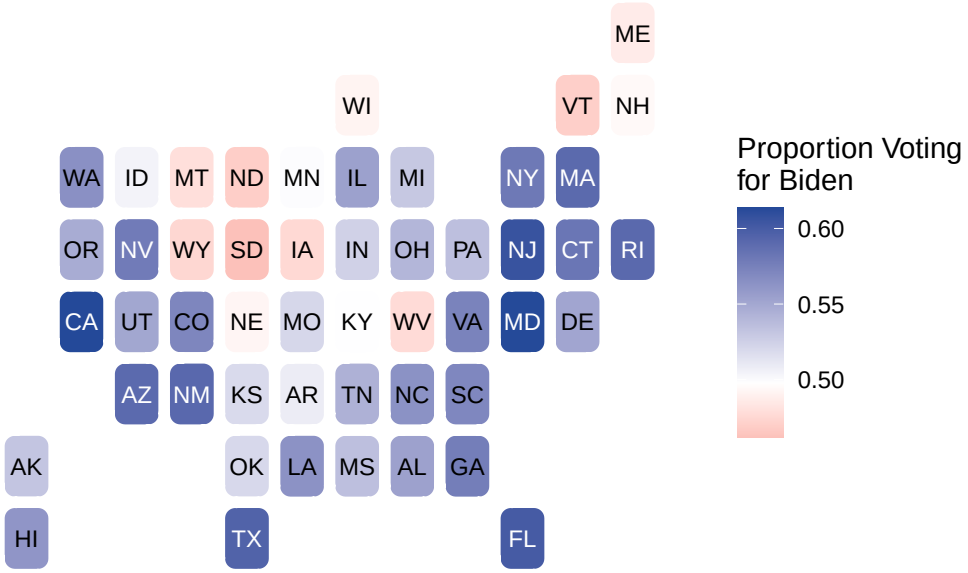


Figure 10: Electoral map based on post-stratification data

5.2 Electoral College Projection

5.3 Large Variation

5.4 Weaknesses and Limitations

Weaknesses and next steps should also be included.

Appendix

.1 Additional data details

.2 Data Cleaning

A Model details

type something here

A.1 Correlation Map

In **?@fig-ppcheckandposteriorvsprior-1** we implement a posterior predictive check. This shows...

In **?@fig-ppcheckandposteriorvsprior-2** we compare the posterior with the prior. This shows...

Examining how the model fits, and is affected
by, the data

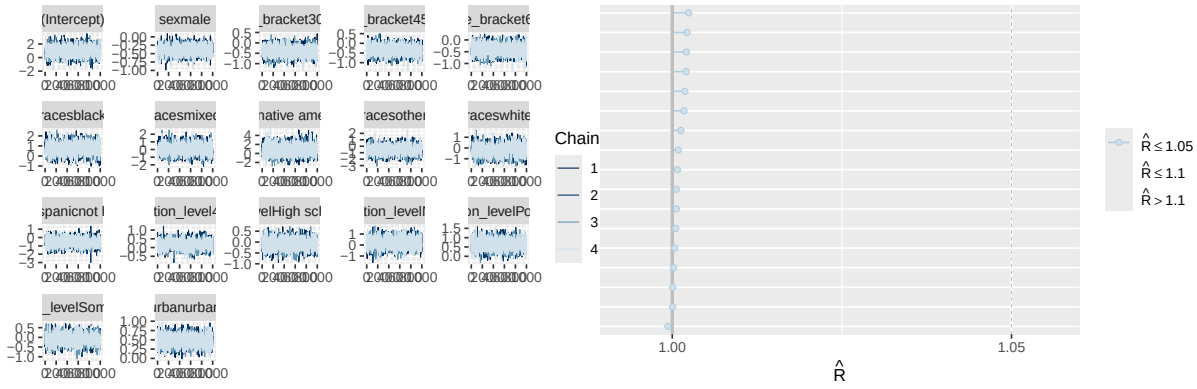
Figure 11: **?(caption)**

Model plot (still need to fix this)

A.2 Diagnostics

Figure 12a is a trace plot. It shows... This suggests...

Figure 12b is a Rhat plot. It shows... This suggests...



(a) Trace plot

(b) Rhat plot

Figure 12: Checking the convergence of the MCMC algorithm

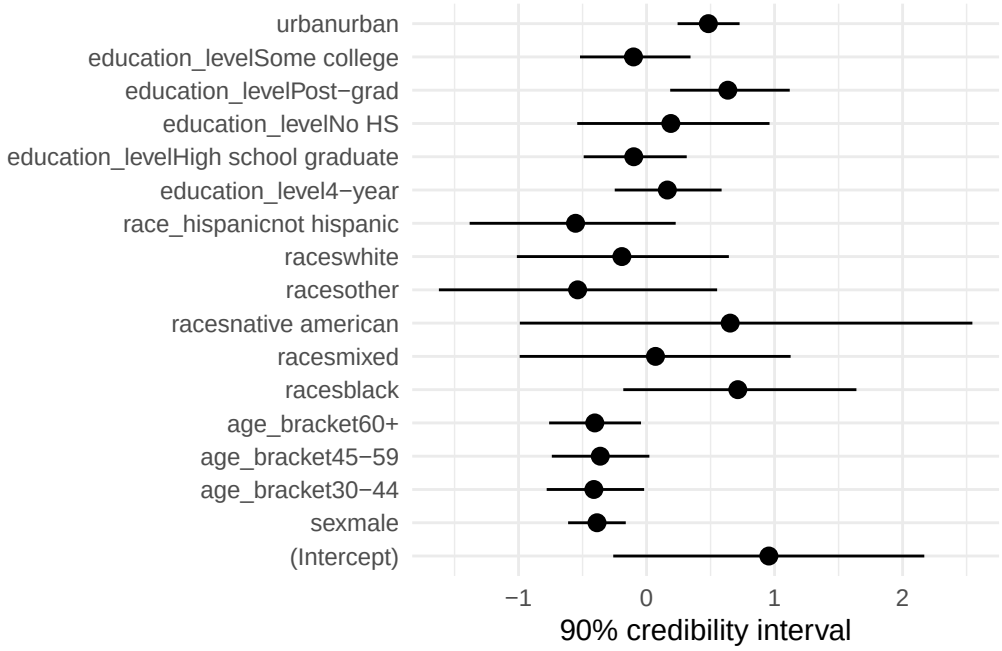


Figure 13: Credibility intervals for predictors of vote_biden

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