

Predicting Political Support in the United States*

The Effects of Culture and Key Political Choices

Janssen Myer Rambaud Timothius Prajogi

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Using data gathered from the 2022 Cooperative Election Study (CES), we navigate through the various possible factors that influence a US citizen’s voting decision. By examining a representative sample of 60 000 Americans, we can discern patterns in beliefs and personal backgrounds—ranging from gun control and student loan stances to race, religion, and educational background. This paper discusses the impact these individual factors may have towards predicting a voter’s alignment, as well as how multiple factors can coalign to portray a more substantial impact. We aim to highlight these correlations and their potential implications with future elections.

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*Code and data are available at: https://github.com/prajogt/predicting_political_support_us.git .

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1 Introduction

Voting for the leader of your country is one of the biggest decisions an American citizen can make. It decides many of the decisions that will be made throughout that four year term as well as how their life will change in that period of time. There may be changes that this elected government makes that they believe to be a great decision, but it may also be seen as terrible one in the eyes of others. This is why it is important to understand there are many factors that influence a voter's decision. They vote for the candidate who they believe will make the best decisions for them and their country. In this paper, we hope to show the impact of various factors on a voter's decision, and how these factors can be used to predict a voter's alignment. From personal stances and religious beliefs to political stances, or to biological factors, we hope to show how these factors can be used to predict a voter's alignment.

The topic of concern is the 2020 United States presidential election held on November 3rd, 2020, where we saw Democratic Party leader Joe Biden win against incumbent president Donald Trump (Gambino 2020). Using the 2022 Cooperative Election Study (CES) survey data, we aim to predict who a voter supported in the 2020 election based on their cultural background, political stances, and other factors. We will be using a representative sample of 60000 Americans to discern patterns in these voters' responses and how their personal backgrounds may have influenced their voting decision. We will be examining the impact of various factors such as: gender, race, educational background, religion, and personal stances on key political issues such as gun control and student loans. Our main focus is to compare the correlations in the 2022 CES survey data to the 2020 CES survey data, and to see if our estimand, the effect of a voter's cultural background and political stances on their voting decision, has influenced their voting decision in the 2020 election. Using these understandings, we hope to highlight the potential implications these correlations may have for this upcoming 2024 election.

With this context and information in mind, we developed this paper to be structured as follows. We will first present the data and the models we used to analyze the data. We will then present the results of our analysis, and discuss the implications of these results. Finally, we will conclude with a summary of our findings and the potential implications of these findings for the upcoming 2024 election. To go in more detail, after downloading and cleaning the 2022 CES survey data, we used the `rstanarm` (Goodrich et al. 2024) package to create a generalized linear model to predict who a voter supported in the 2020 election based on their cultural background, political stances, and other factors, as listed above. We then used the `modelsummary` (Arel-Bundock 2022) package to summarize the results of our model.

We found that there were strong correlations, with a strong example of this being the voter’s personal stances on student loan forgiveness and gun ownership. With the two main parties, Democrats and Republicans, having opposing stances on these issues, we found that there was a strong correlation between these stances and who a voter supported. As Biden was in favour of student loan forgiveness, but opposed to gun ownership, while Trump was opposed to student loan forgiveness, but in favour of gun ownership, we discovered a correlation between a voter’s ties to these stances because they directly oppose each other. This is just one example of the many correlations we found, and we will discuss these in more detail in the results section. These findings are important because it shows how a leading presidential party’s stance on a certain topic has the potential to sway a voter’s decision in the event that they align with that stance. This is important because it shows how a leading presidential party’s stance on a certain topic has the chance to adjust and adapt to certain factors to possibly sway some more votes in their favour. We will also discuss the implications of these findings, and how they may be used to predict a voter’s alignment in the upcoming 2024 election.

2 Data

The data was retrieved from Harvard’s CCES Dataverse database, using the `dataverse` (Kuriwaki, Beasley, and Leeper 2023) package. In this report we consider data collected from the 2022 CES (Cooperative Election Study) survey, a questionnaire administered by YouGov collecting information about respondent’s demographic, background, beliefs, opinions, past ballots cast, and future vote intentions. This data is accessible through Dataverse as *Cooperative Election Study Common Content* (Schaffner, Ansolabehere, and Shih 2023). There was an option to use the 2020 CES dataset, but we opted to use the newer, 60000 observation, 2022 CES dataset for a more updated and accurate representation of the current political climate in the United States after two years of Joe Biden being in office. When the 2024 elections are held, we can see how the original previous aligning of the respondents have changed, if they have changed.

This data was downloaded, cleaned, parsed, analyzed, and visualized using R (R Core Team 2023), a statistical programming language, with package support from `tidyverse` (Wickham et al. 2019), a collection of libraries which included the following packages that were utilized:

- `ggplot2` (Wickham 2016)
- `dplyr` (Wickham et al. 2023)
- `readr` (Wickham, Hester, and Bryan 2023)
- `tibble` (Müller and Wickham 2023)

For additional assistance with data storage, the `arrow` (Richardson et al. 2024) was used and for report generation, the `knitr` (Xie 2023) package was used.

Table 1: 2022 CES (Cooperative Election Study) Data (Cultural)

Voted For (2020)	Age Group	Gender	Education	Race	Religion
Biden	30-44	Male	Post-grad	White	None
Biden	65+	Male	Some college	White	Protestant
Biden	30-44	Female	4-year	White	None
Biden	30-44	Other	Post-grad	White	Agnostic
Trump	65+	Male	4-year	Multiracial	None
Biden	45-64	Female	High school graduate	Black	None

Table 2: 2022 CES (Cooperative Election Study) Data (Cultural) Standings

Voted For (2020)	Household Gun Ownership	Student Loan Status
Biden	No	No
Biden	No	No
Biden	No	No
Biden	No	Yes
Trump	No	No
Biden	No	No

2.1 Variables

The variables we used in our analysis were: - **presvote20post**, renamed to **voted_for** - This data was represented in the form of a numerical variable corresponding to the presidential candidate that voted for in the 2020 election. This was cleaned to limit the options to either “Biden” or “Trump”, the two leading candidates in the 2020 and 2024 election.

Personal Background:

- **birthyr**, which was used to calculate the age of the voter, and later grouped into age buckets and renamed to **age**.
 - This data was represented in the form of a numerical variable corresponding to the year the voter was born. This was cleaned to calculate the age of the voter, and then grouped into the age buckets: “18-29”, “30-44”, “45-64”, “65+”.
- **gender4**, renamed to **gender**,
 - This data was represented in the form of a numerical variable corresponding to the gender of the voter. This was cleaned to limit the options to “Man”, “Woman”, and “Other”. Other includes both respondents who specifically selected “Other” as well

as respondents who responded as “Non-binary”. Non-binary responses only totaled 354 participants out of 60,000.

- `educ`, renamed to `education`,
 - This data was represented in the form of a numerical variable corresponding to the highest level of education the voter has completed. This was cleaned to limit the options to “No HS” “High School graduate”, “Some College”, “2-year”, “4-year”, “Post-grad”.
- `race`,
 - This data was represented in the form of a numerical variable corresponding to the ethnicity of the voter. This was cleaned to limit the options to “White”, “Black”, “Hispanic”, “Asian”, “Middle Eastern”, “Native American”, “Multiracial” and “Other”.
- `religpew`, renamed to `religion`,
 - This data was represented in the form of a numerical variable corresponding to the religion of the voter. This was cleaned to limit the options to “Protestant”, “Roman Catholic”, “Jewish”, “Atheist”, “Agnostic”, “Non-Religious”, and “Other”. There were various other religions that were included in the dataset, but represented a small portion of the sample, and were thus grouped into “Other”.

A small sample of these variables can be seen in the Table 1, which shows rows of respondent data, including their `voted_for`, `age_group`, `gender`, `education`, `race`, and `religion`.

Personal Stances:

- `gun_own`, renamed to `household_gun_ownership`,
 - This data was represented in the form of a numerical variable corresponding to whether the voter or anyone in their household owned a gun. This was cleaned to limit the options to “Yes”, “No”, and “Unsure”.
- `edloan`, renamed to `student_loan`,
 - This data was represented in the form of a numerical variable corresponding to whether the voter had student loans. This was cleaned to limit the options to “Yes”, “No”.

A small sample of these variables can be seen in the Table 2, which shows rows of respondent data, including their `voted_for`, `household_gun_ownership`, and `student_loan_status`.

2.2 Justification

The reason that we chose a large amount of variables/factors for our paper is so that we can get a bigger representation of the political climate. Should this be limited to a single model, then it may not reflect other correlations that may be present in the data. By using these variables, we take the most significant factors that may influence a voter's decision, and use them to predict who a voter supported in the 2020 election `voted_for`.

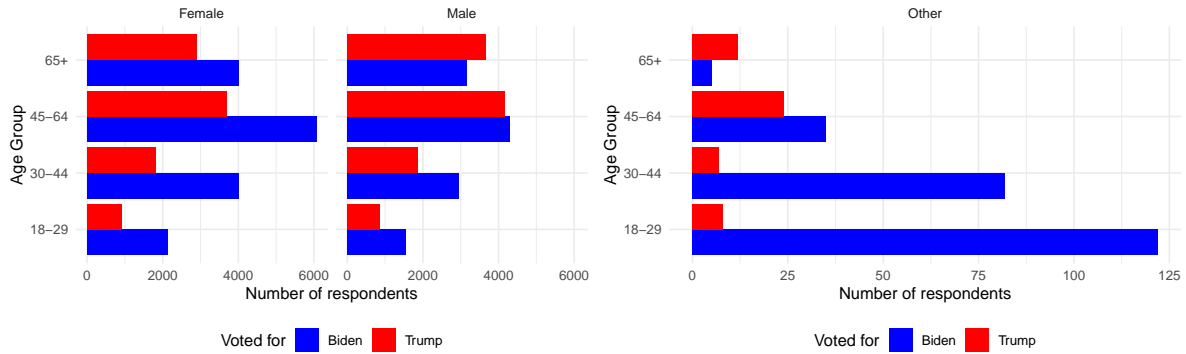
It was important to get the voter's **age**, in order to understand the generational differences and how their experiences and personal interests may influence their voting decision. In our given age buckets, it was discovered that 65% of 18-29 year olds supported the Democrats, whereas only 40% of 65+ year olds supported the Democrats, however, 18-29 year olds only made up 12% of the sample, whereas 65+ year olds made up 30% of the sample. In Figure 1, we can see how respondents' support for the Democrats and Republicans can differ based on their **age** and **gender**. For example, in Figure 1a 'Males' aged 65+ were quite a bit more supportive towards the Republicans as opposed to 'Males' aged 18-29, who showed a noticeably larger gap in support towards the Democrats. In Figure 1b, despite the lower respondent count, we can see how 'Other' gendered respondents had significantly more voters in the 18-29, 30-44 age groups, while also showing a larger gap in support towards the Democrats.

It was also necessary to get the voter's **gender**, and **race**, because it is important to understand the biological differences and how their experiences and personal interests may influence their voting decision. In our dataset, it was clear that 'Female' respondents were more supportive towards the Democrats at 52% as opposed to 43% for 'Males'. In the racial side of the respondent data, it was discovered that 84% and 71% of Black and Asian respondents, respectively, supported the Democrats, whereas only 41% of White respondents supported the Democrats.

Incorporating the voter's **religion**, was a needed factor since it is important to understand that religious beliefs and differences can have a strong influence one's personal beliefs and therefore impact their personal stances on topics such as gun ownership. To put a contrasting example out there, 30% of Protestant/Christian respondents support the Democrats as opposed to 72% by Atheists. This could be attributed to certain parties aligning more to certain religious beliefs. To see a bigger insight into this, take a look at Figure 4, Figure 5 and Figure 6 (figures separated according to respondent count), and notice examples like, 'White Protestants' appear significantly more supportive towards the Republicans as opposed to 'White Catholics' and 'Black Protestants' who appear to be significantly more supportive towards the Democrats.

A voter's **education**, was important because there may be certain understandings they arrive at during the completion of their education. Perhaps they viewed the world in one way at first, but after becoming more 'educated' in a topic, they feel that they have a better understanding of the world and either become more confident in their initial understanding or change their stance entirely. Figure 2 shows how **education** goes hand in hand with the voter's stance on

gun ownership, `household_gun_ownership`, while Figure 3 shows how `education` goes hand in hand with the voter’s stance on student loans, `student_loan`. It is important to understand how a voter’s personal experiences with gun ownership and student loans may influence their voting decision. To highlight a key example, there was a time of serious consideration during Biden’s tenure where he was considering forgiving student loans (“2020 Presidential Candidates on Student Load Debt” 2020), and this intent alone may have swayed some support in his favour.



(a) Male and Female

(b) Other (Non-binary and Other)

Figure 1: Votes for Candidate given Age Group and Gender

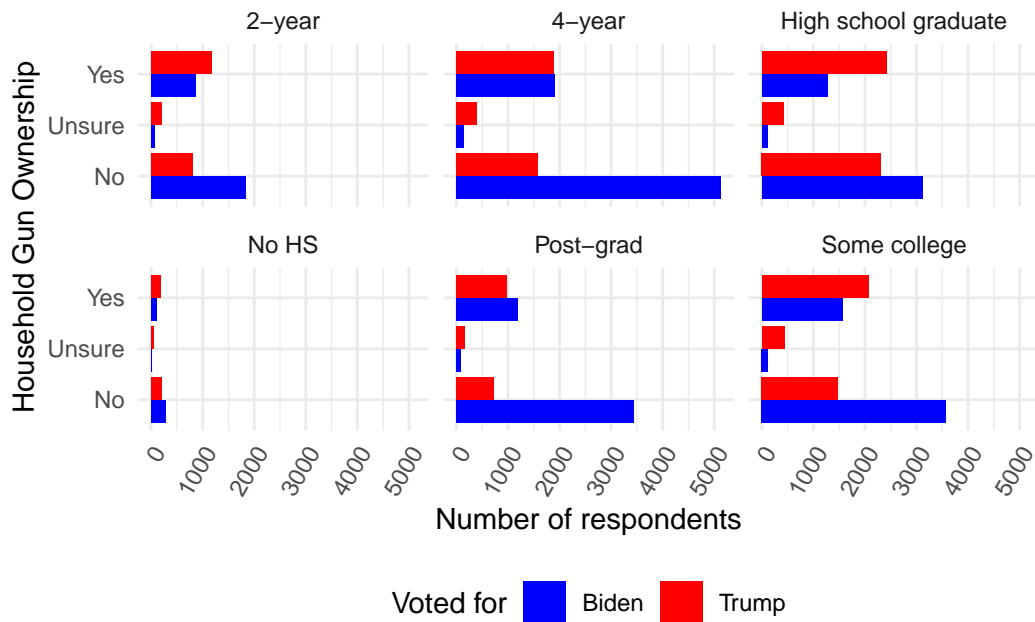


Figure 2: Votes for Candidate given Gun Ownership and Education

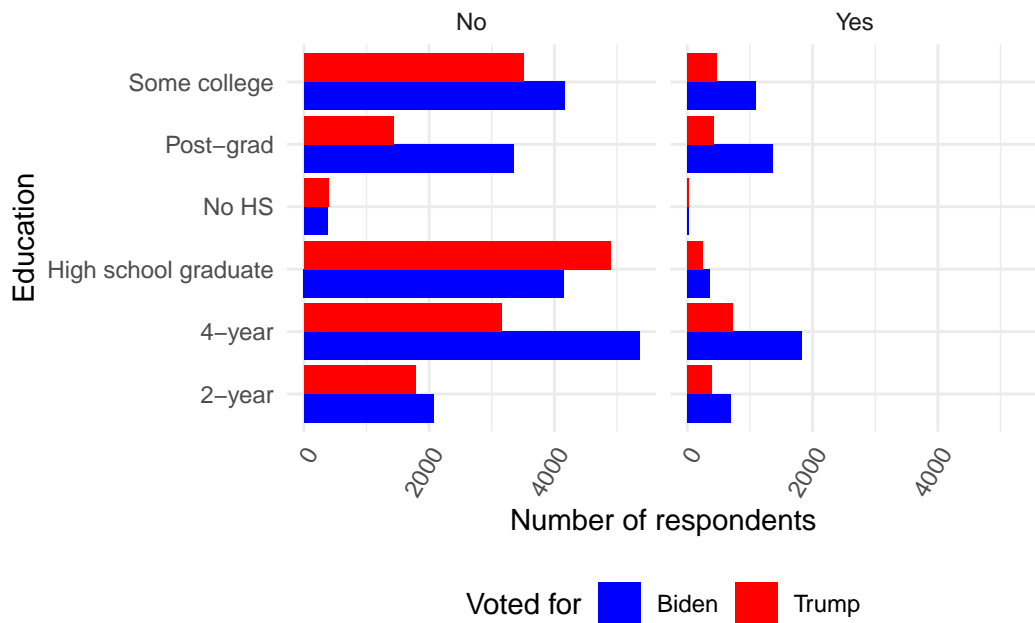


Figure 3: Votes for Candidate given Student Loan Status and Education

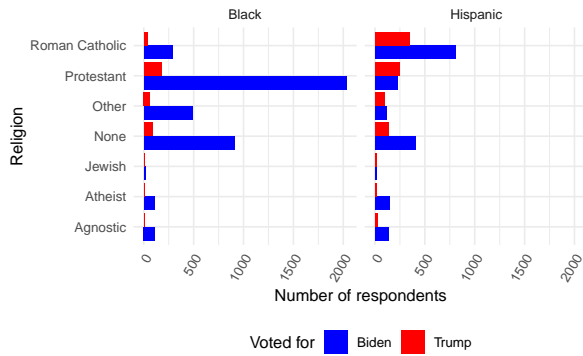


Figure 4: Votes for Candidate given Race and Religion

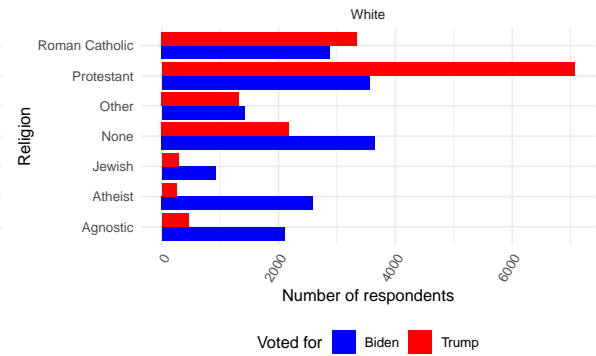


Figure 5: Votes for Candidate given Race and Religion

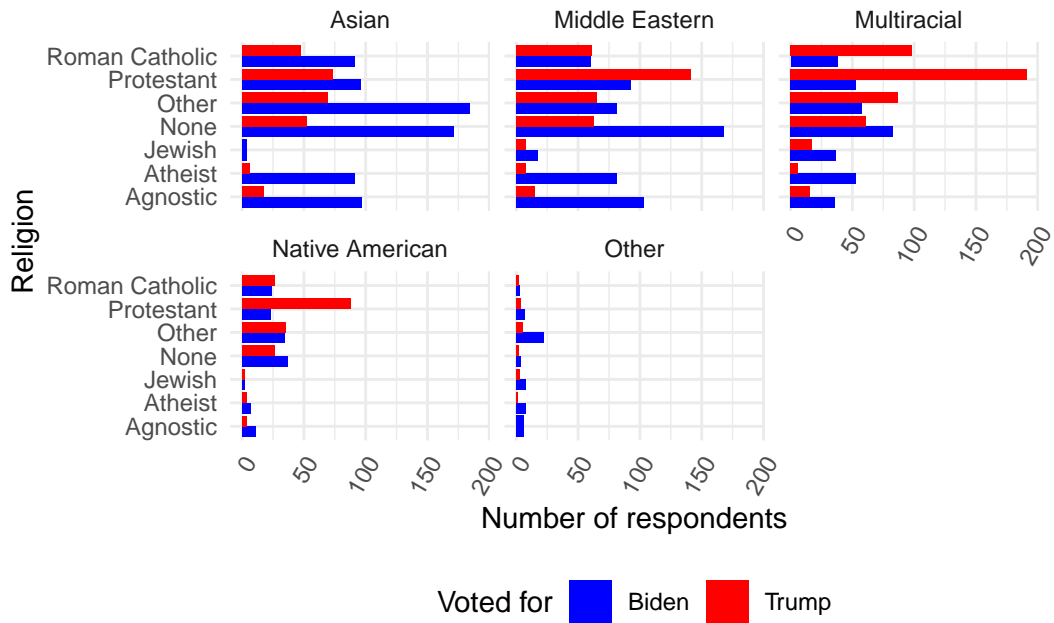


Figure 6: Votes for Candidate given Race and Religion

3 Model

To create the generalized linear model we made use of the `rstanarm` (Goodrich et al. 2024) package.

In particular the models we had created are logistic regression, all predicting who the participant voted for during the 2020 US Presidential Election.

3.1 Cultural Model

The first model that was created was intended to discover whether we can forecast who a respondent was likely to vote for, knowing their cultural background, including their age, gender, race, and religion.

We expect that due to various differences in experiences due to this background, whether it be because of a generational difference, a difference in culture between countries, or a difference in beliefs in religions, a voter who identifies in those demographics would vote differently, voting for the candidate who most understands their experiences.

Therefore the model we are interested in is:

$$\begin{aligned} y_i | \pi_i &\sim \text{Bern}(\pi_i) \\ \text{logit}(\pi_i) &= \beta_0 + \beta_1 \times \text{age-group}_i + \beta_2 \times \text{gender}_i \\ &\quad + \beta_3 \times \text{race}_i + \beta_3 \times \text{religion}_i \\ \beta_0 &\sim \text{Normal}(0, 2.5) \\ \beta_1 &\sim \text{Normal}(0, 2.5) \\ \beta_2 &\sim \text{Normal}(0, 2.5) \\ \beta_3 &\sim \text{Normal}(0, 2.5) \end{aligned}$$

Where y_i is whether they voted for Biden or not in the 2020 election, age-group_i is the age group the respondent falls in, gender_i is the gender of the respondent, race_i is the race of the respondent, and religion_i is the religion of the respondent.

Table 3 shows a model summary for this model, this will be discussed further in the [results](#) section.

Table 3: Explaining whether a voter supported Biden or Trump in 2020 given their gender, age, race, and religion

		Support Biden
(Intercept)		2.286 (0.669)
Male		−0.537 (0.149)
Other Gender		23.740 (20.653)
Age (30-44)		0.634 (0.273)
Age (45-64)		0.045 (0.254)
Age (65+)		0.110 (0.259)
Black		0.994 (0.633)
Hispanic		−0.578 (0.613)
Middle Eastern		−0.501 (0.800)
Multiracial		−1.606 (0.805)
Native American		−0.925 (0.948)
Other Race		47.330 (44.616)
White		−0.970 (0.582)
Atheist		1.874 (0.673)
Jewish		−0.737 (0.491)
Non-Religious		−0.832 (0.321)
Other		−1.512 (0.348)
Protestant		−1.668 (0.307)
Roman Catholic		−1.155 (0.310)
Num.Obs.		1000
R2		0.177
Log.Lik.		−585.616
ELPD	11	−604.2
ELPD s.e.		13.7
LOOIC		1208.4
LOOIC s.e.		27.4
WAIC		1208.1
RMSE		0.45

3.2 Political Importance Model

The second model aims to forecast a respondents vote knowing their prominent political ideals including education, gun ownership status, and student loan status. These are common political standpoints in the U.S.. Gun policy and student loan forgiveness is often a key political issue that separates the candidates. For the 2020 election, the candidates we are predicting for, Joe Biden and Donald Trump had opposing positions on student loan forgiveness. Whilst Trump proposed grants that would help with future students, Biden proposed to forgive a large amount of undergraduate tuition-related student debt (“2020 Presidential Candidates on Student Load Debt” 2020). In similar opposition, they held different opinions on gun laws, with Trump advocating for the right to bear arms and Biden advocating gun safety policies aimed at holding manufacturers accountable (“2020 Presidential Candidates on Student Load Debt” 2020).

As such, we expect that there would be a strong correlation with the respondents gun ownership and student loan status to the candidate they supported in the 2020 election.

Therefore the model we are interested in is:

$$\begin{aligned}y_i|\pi_i &\sim \text{Bern}(\pi_i) \\ \text{logit}(\pi_i) &= \beta_0 + \beta_1 \times \text{education}_i + \beta_2 \times \text{student-loan-status}_i \\ &\quad + \beta_3 \times \text{household-gun-ownership}_i \\ \beta_0 &\sim \text{Normal}(0, 2.5) \\ \beta_1 &\sim \text{Normal}(0, 2.5) \\ \beta_2 &\sim \text{Normal}(0, 2.5) \\ \beta_3 &\sim \text{Normal}(0, 2.5)\end{aligned}$$

where y_i is whether they voted for Biden or not in the 2020 election, education_i is the highest education the respondent completed, $\text{student-loan-status}_i$ is if the respondent has student loans, and $\text{household-gun-ownership}_i$ is if the respondent or someone within their household owns a gun.

Table 4 shows a model summary for this model, this will be discussed further in the [results](#) section.

4 Results

From those models we are able to see correlation between the factors chosen and their vote during the 2020 Presidential election.

Table 4: Explaining whether a voter supported Biden or Trump in 2020 given their education, household gun ownership, and student load status.

	Support Biden
(Intercept)	0.594 (0.213)
4 year Education	0.267 (0.246)
High School	0.005 (0.251)
No High School	0.450 (0.658)
Post Graduate	0.400 (0.269)
Some College	0.255 (0.252)
Household Owns Guns	−1.152 (0.147)
Has Student Loans	0.587 (0.188)
Num.Obs.	948
R2	0.097
Log.Lik.	−593.812
ELPD	−602.1
ELPD s.e.	11.0
LOOIC	1204.2
LOOIC s.e.	22.0
WAIC	1204.2
RMSE	0.47

4.1 Cultural Model

Table 3 first suggests a that males were less likely to vote for Biden, and more likely to vote for Trump. Looking at Figure 1a this is not an obvious correlation to make with the votes for Biden and Trump being close for each age group, with Trump only winning more votes with the male and above 65 demographic. However, looking at the 90% confidence intervals in Figure 7 for the coefficients of that model, specifically that for being male, we can see that the model is 90% confident that this relationship is around strictly negative against voting for Biden. We also see the disagreement within the 45+ community that Figure 1a shows, and the agreement within the younger community (18 - 45), with Table 3 showing a large correlation between being 30-44 to supporting Biden, with being aged 45-65 or 65+ having very little correlation to support Biden, supported by the 90% confidence interval shown in Figure 7 for those coefficients spanning both negative and positive, suggesting an uncertain preference. Although the model included being: Female, Asian, 18-29, and Agnostic, in the intercept, for Figure 1a, Figure 6, and Figure 4, Figure 5 and Figure 6 respectively, it reasonable to say that each graph suggests that being Female, Asian, 18-29, and Agnostic has a correlation with voting for Biden, each demographic having a significant amount more votes for Biden than Trump.

Now looking at the coefficients corresponding to race and religion, Table 3 suggests that respondents identifying themselves as being Black or Atheist were more likely to have voted for Biden. Additionally, as mentioned before those who are Agnostic or Asian as per Table 5, who were included as the intercept are suggested to have voted for Biden. The respondents identifying as White, Hispanic, Middle Eastern, Multiracial, and Native American are suggested to be less likely to vote for Biden.

Overall, this model reinforces our expectations that suggest that the cultural background of a person has a considerable effect on their expected vote. Religion and Race especially have considerable leanings to one candidate over the other, suggesting a strong impact of race and religion in political ideals.

4.2 Political Importance Model

An strong finding that Table 4 displays is household gun ownership's effect on their vote. As mentioned in the model's justification, Trump held a pro-gun-ownership stance, whilst Biden pushed for reform to gun laws. Table 4 mirrors these stances, predicting that respondents who own or have people in their household own guns are much more likely to vote for Trump, who aligns with their own personal gun ownership stance. This is strongly supported by Figure 9, which shows that the model is 90% confident that the likelihood of a respondent whose household owns guns is between around -0.9 to -1.8, a strongly negative correlation. This is supported by Figure 2 showing that that most respondents who do not own guns, had voted for Biden, and Trump was only able to secure a majority vote for any level of education, when the respondent's household owned guns.

Similarly, Table 4 shows a correlation between having student loans and supporting Biden. Also mentioned in the model’s justification, the student loan forgiveness stance that more widely benefited current student loan holders was held by Biden. This fact is supported by the model that suggests a respondent who has student loans is more likely to support Biden over Trump. Being such an significant difference in everyday finances, whether they have to think about paying off student loans or not, it is reasonable to expect the outcome that respondents would want to vote for the candidate who can help take that burden off.

It is also important to note education’s impact on respondent’s voting habits. The 90% confidence interval the model has for a respondent with no high school education in Figure 9 is significantly large, spanning from around -0.6 to +1.6, signifying an uncertainty among that demographic about who to vote for, those with higher education agree more on who to vote for. High school graduates slightly favour Biden, and those with University, College, or Post Graduate education are suggested by Table 4 to be more likely to support Biden. As this relates to gun ownership as in Figure 2, we can also see here that the impact of owning a gun or not is offset by the respondents education. The votes are much closer between Biden and Trump for those with higher education and own guns compared to those without higher education and own guns.

5 Discussion

In this paper we aimed to verify our expectations that ones cultural background and what one holds to personal importance affect their decision making process when it comes to elections. As expected, being of different cultural background impacted who they voted for. Exactly what those ideals that they chose to vote with we did not define here, but we know that correlation exists. Better defined here is the specific ideals that a respondent holds, modeling gun ownership and student loans and education levels in this paper. Also as expected we find that knowing a respondent’s opinions on key political topics, in this case gun laws and student loan forgiveness, can allow us to predict who they are voting for, specifically here Trump who was in support of gun ownership laws and Biden who was in support of student loan forgiveness.

Although there seems to be a strong correlation between if a voter identifies as an other gender to supporting Biden, and a strong correlation between if a voter identifies as an other race to supporting Biden as suggested by the 90% confidence interval for each shown in Figure 8, but these must be considered carefully as within the sample (with seed 302), only 5 and 1 voters identified in those categories respectively. There were various other demographics in the dataset that had relatively small sample sizes, such as: **race** where non Black, White, or Hispanic respondents made up a small portion of the sample, or non Catholic, Protestant, or Atheist respondents in **religion**. To get a more accurate reading in regards to these features, it would be necessary to train a model which includes a larger sample size of these demographics or to find a way to account for these values while still making use of them. This was a scenario

that one may expect to see as there can always be underrepresented demographics in a 60000 respondent sized sample. This is a big limitation to our models, and is something that should be considered when interpreting the results.

For future steps, we hope to be able to observe any changes that arise in the upcoming 2024 election. Since the results we have interpreted from the 2022 CES dataset are based on voter's stances at the time, there could be a possibility that the voter's stances have changed nearing the end of Biden's term. It would also be good to see if the results from the our models are consistent with the results from the upcoming 2024 election. Should there be any consistency, would it raise the question of whether the voter's stances are more influenced by their cultural background and personal stances, or if their support is more influenced by the continuously changing platform that each party stands on. There are some areas that would be interesting to observe if Harvard were to conduct a 2024 CES survey, such as if previous Biden voters would still vote for him considering how he has handled the student loan forgiveness situation. Would a voter who has their student loans forgiven this term still vote for Biden since their needs have already been met? It would also be note worthy to take a look at how stances have changed on household gun ownership and if it has affected their support in the presidential election. As more shootings in the country are recorded, will the number of gun owners increase? Will this affect which party they support, considering the different stances on gun ownership laws? These are all questions that we hope could be answered after the outcome of the 2024 election.

Table 5: Explaining whether a voter supported Biden or Trump in 2020 given their race

	Support Biden
Asian	0.809 (0.511)
Black	1.036 (0.577)
Hispanic	−0.243 (0.554)
Middle Eastern	0.007 (0.742)
Multiracial	−1.429 (0.745)
Native American	−0.597 (0.901)
Other Race	50.072 (46.614)
White	−0.657 (0.515)
Num.Obs.	1000
R2	0.057
Log.Lik.	−648.214
ELPD	−656.0
ELPD s.e.	8.9
LOOIC	1312.1
LOOIC s.e.	17.8
WAIC	1311.9
RMSE	0.48

Appendix

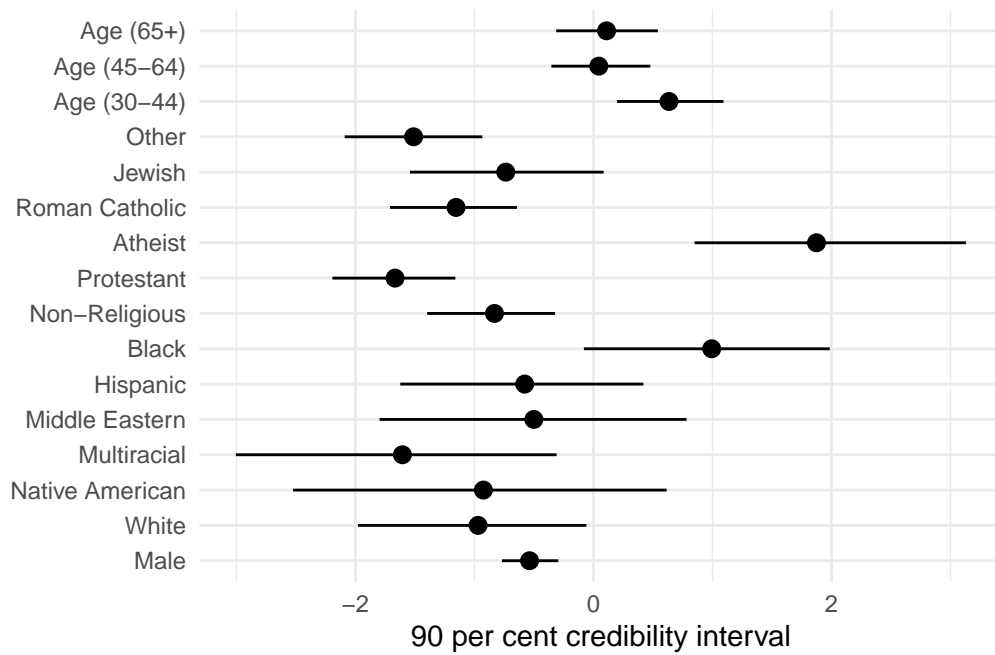


Figure 7: Cultural Model 90% Confidence Intervals

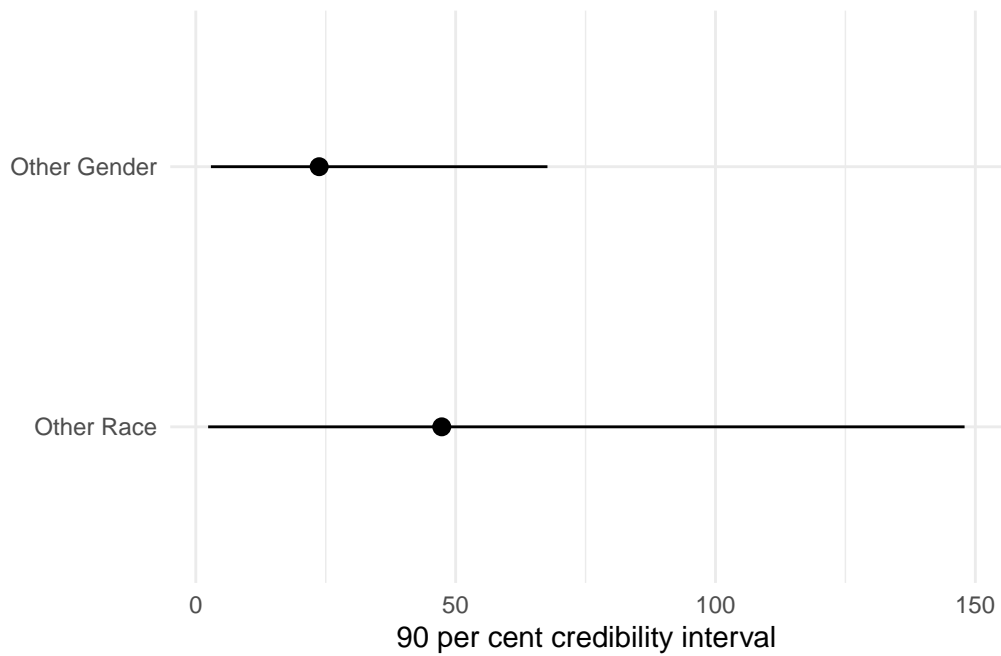


Figure 8: Cultural Model 90% Confidence Intervals (Race and Gender Other)

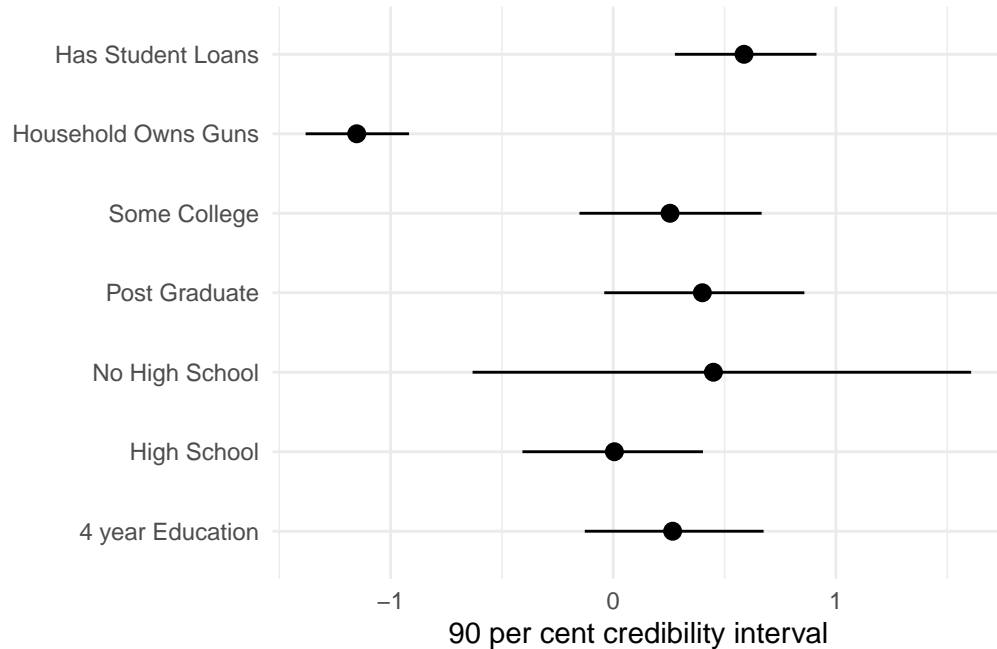


Figure 9: Key Topics Model 90% Confidence Intervals

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[arrow](#).

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