# Lab Notebook

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## Experiment Summary:

This notebook contains data analysis performed on the "social polarization" conjoint experiment. As a refresher, respondents were shown two profiles, which had the following attributes:

| Person A | Person B |
|---|---|
| Party | Party |
| Ideology | Ideology |
| Race / Ethnicity | Race / Ethnicity |
| Regional Background | Regional Background |
| Education | Education |
| Income | Income |
| Gender | Gender |
| Religion | Religion |

Where each attribute was randomized and could take one take on one the following values:

- Party: A number, 1-3 (1=Democratic, 2=Independent, 3=Republican)
- Ideology: A number, 1-3 (1=Liberal, 2=Moderate, 3=Conservative)
- Race/Ethnicity: either White, Black, Hispanic, or Asian.
- Regional Background: Northeast,Midwest, South, or West
- Education: One of HS grad, 2-year college, 4-year college, or Post-grad. Coded as a numeric vector 0-3, where 0 is HS grad, and $ is post-grad.
- Income: A number, 1-4 (Under $40K=0, $40-80K=2, $80-120K=3, Over $120K=4)
- Gender: Male (0) or Female (1)
- Religion: Christian, Jewish, Muslim, or Atheist

Respondents were then asked:

> On a scale or 1 (lowest) to 7 (highest), how favorably do you view each of the individuals profiled?
>
> Indicate which individual (A or B) you would prefer in each of the following scenarios:
>
> - Having as a friend
> - Having as a neighbor
> - Having as a son/daughter-in-law

The first question (On a scale of 1 to 7 . . . ) yields a ratio-level measure of favorability, which will be referred to in this document as the ratio-measure. The other two questions forced respondents to pick one of the two profiles that they would prefer to have as a certain kind of acquaintance, yielding binary-choice data.

## Exploratory Data Analysis:

In this section, I perform some exploratory data analysis to better understand the data.

### How Similar Are Answers to the Three Conjoint Questions?

First, I want to understand to what degree are the answers to the three conjoint questions correlated, and do the questions tap into different underlying dimensions? One hypothesis might be that respondents are answering each of the three questions identically, based on which person they like the most in a general sense.

To understand this, I first create a correlation plot showing correlations between answers to the three questions, which can be seen below:

The correlations range between .54 and .67 indicating relatively strong positive correlations between answers to the three questions.

Another way to understand how closely related the three questions are is to look at the percentage of people that preferred one profile to another on all three conjoint questions - 67%. This suggests that the questions do measure similar concepts, but that they do not measure exactly the same thing, as respondents did not uniformly prefer one profile over another in 33% of conjoints.

## Data Analysis

In this section, I proceed to the substantive data analysis. I first regress the interval-level measure of likability on the attributes of the conjoint profile. As a note, the reference category for the region variable is "Northeast," the reference category for the religion variable is "Christian," and the reference category for race is "White." Party is measured on a 1-3 scale, where 1 is a Democrat, 2 is an independent, and 3 is a Republican.

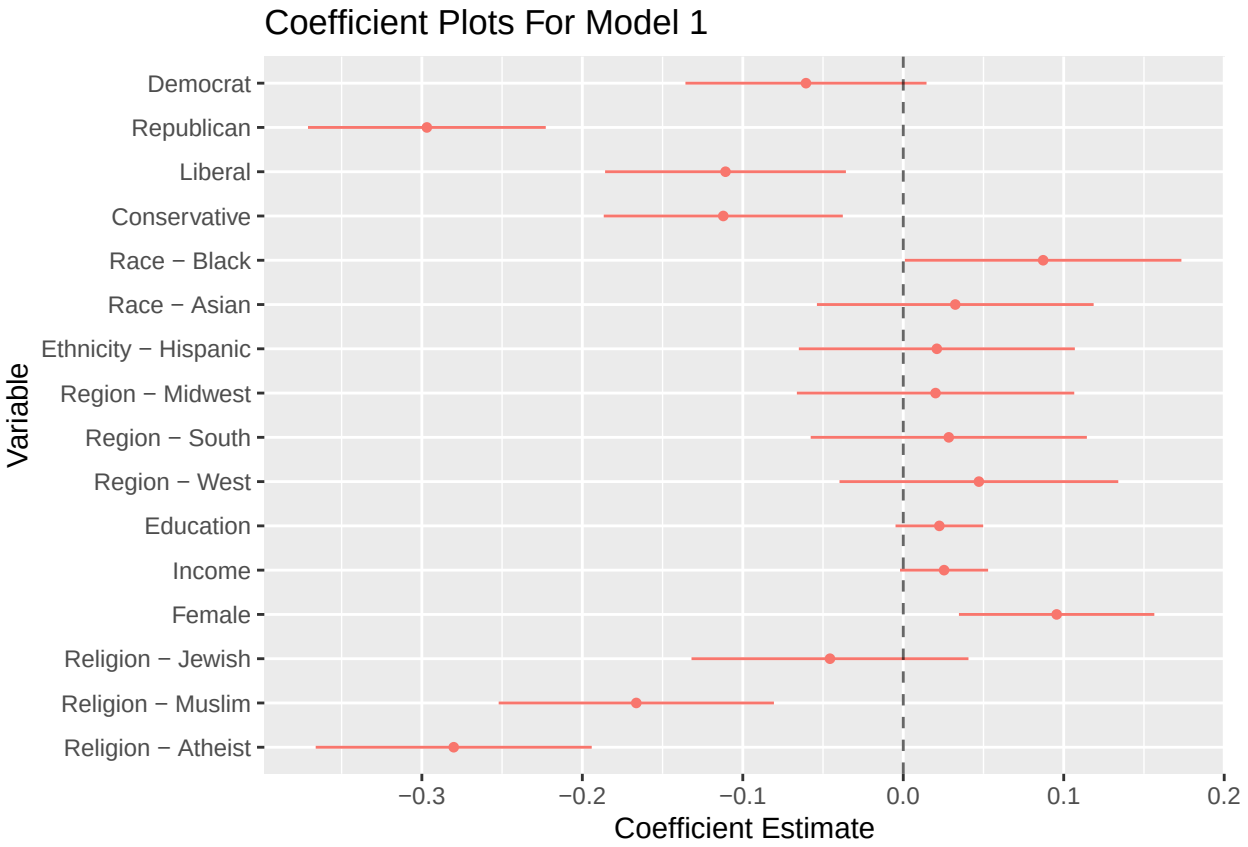
The coefficients associated with a profile being female or black are positive and significant, with coefficient estimates of .09 each. This indicates that a profile who is female or black will receive a predicted rating .09 points higher than an identical profile who is not Black or not Female. As the attribute profiles have been randomized, these estimates are unbiased in expectation, and can be interpreted causally.

The coefficients associated with being Muslim and Atheist are both significant and negative, indicating that relative to Christians, Muslims and Atheists are rated less-favorably by respondents.

Table 1: Regression of Favorability on Profile Attributes

| | *Dependent variable:* |
|---|---|
| | Favorability Rating (1-7) |
| Democrat | −0.061 |
| | (0.038) |
| Republican | −0.297*** |
| | (0.038) |
| Liberal | −0.111*** |
| | (0.038) |
| Conservative | −0.112*** |
| | (0.038) |
| Race - Black | 0.087** |
| | (0.044) |
| Race - Asian | 0.032 |
| | (0.044) |
| Ethnicity - Hispanic | 0.021 |
| | (0.044) |
| Region - Midwest | 0.020 |
| | (0.044) |
| Region - South | 0.028 |
| | (0.044) |
| Region - West | 0.047 |
| | (0.044) |
| Education | 0.022 |
| | (0.014) |
| Income | 0.025* |
| | (0.014) |
| Female | 0.096*** |
| | (0.031) |
| Religion - Jewish | −0.046 |
| | (0.044) |
| Religion - Muslim | −0.166*** |
| | (0.044) |
| Religion - Atheist | −0.280*** |
| | (0.044) |
| Intercept | 4.971*** |
| | (0.078) |
| Observations | 10,640 |
| $R^2$ | 0.014 |
| Adjusted $R^2$ | 0.012 |
| Residual Std. Error | 1.601 (df = 10623) |

I display the coefficients and standard errors from this model in a coefficient plot, shown below. The plot contains no new information, but is easier to take in at-a-glance.




## Analysis of Binary-Choice Data

Secondly, I run regress the outcomes from the binary choice questions on conjoint profile characteristics. Coefficients in these regressions can be interpreted as average marginal component effects, or the difference in expected vote share[1] between two candidates that have a one-unit difference in the predictor of interest.

As a note, the AMCE is not equal to the expected difference in vote shares in an "election" between the two candidates that differ by one unit on a predictor. Rather, it is equal to the difference in the average vote share each candidate would receive if they were to compete against all other candidates in the population.

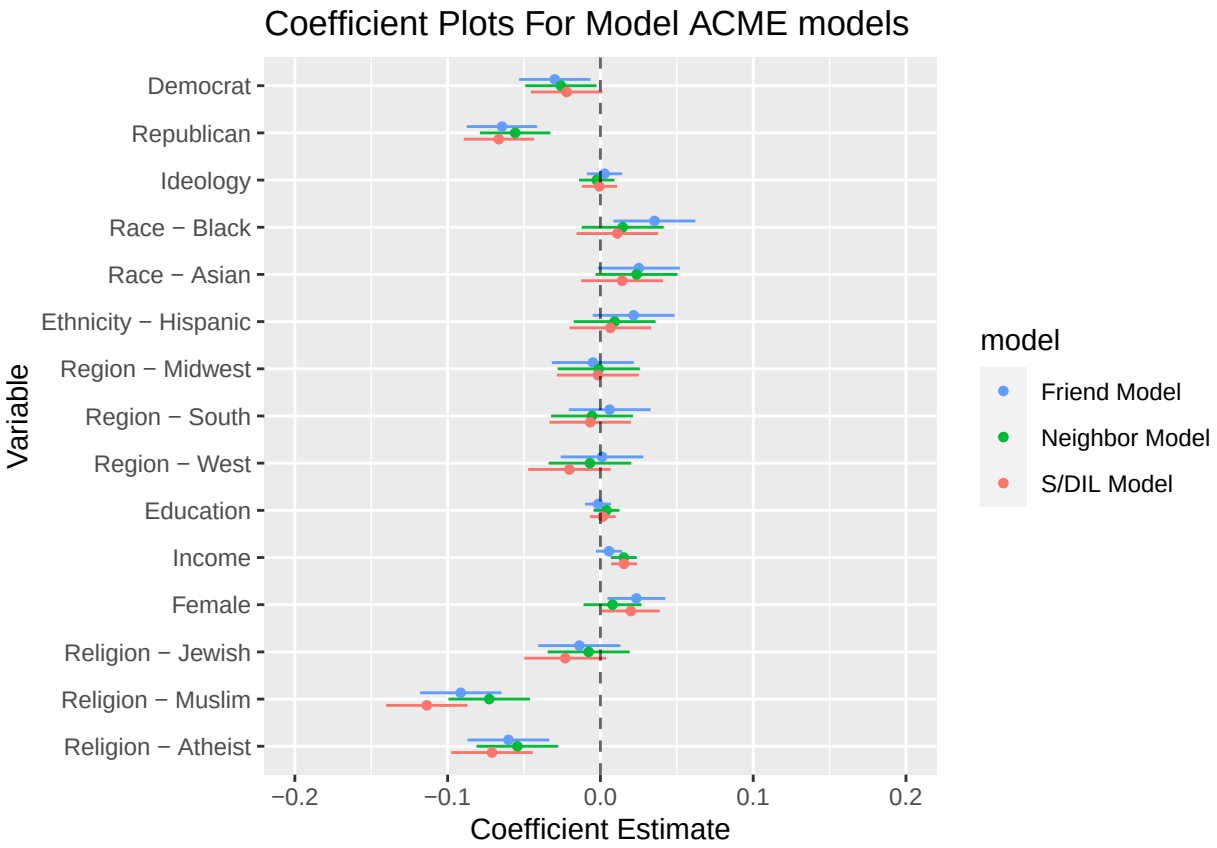
To give an example, the coefficient associated with a profile being black in the first regression model suggests that a black profile will receive on average 3.5% more votes than an otherwise-identical white profile, across all elections.

I also present the point estimates and confidence intervals in a graphical form, as before. Again, the graph below contains no new information, but is slightly easier to read at-a-glance.

[1] taken over the joint distribution of candidate attributes

Table 2:

| | *Dependent variable:* | | |
|---|---|---|---|
| | Friend | Neighbor | S/DIL |
| | (1) | (2) | (3) |
| Democrat | $-0.030^{**}$ | $-0.026^{**}$ | $-0.022^{*}$ |
| | (0.012) | (0.012) | (0.012) |
| Republican | $-0.064^{***}$ | $-0.056^{***}$ | $-0.067^{***}$ |
| | (0.012) | (0.012) | (0.012) |
| Ideology | 0.003 | −0.002 | −0.001 |
| | (0.006) | (0.006) | (0.006) |
| Race - Black | $0.035^{***}$ | 0.015 | 0.011 |
| | (0.014) | (0.014) | (0.014) |
| Race - Asian | $0.025^{*}$ | $0.024^{*}$ | 0.014 |
| | (0.014) | (0.014) | (0.014) |
| Ethnicity - Hispanic | 0.022 | 0.009 | 0.007 |
| | (0.014) | (0.014) | (0.014) |
| Region - Midwest | −0.005 | −0.001 | −0.002 |
| | (0.014) | (0.014) | (0.014) |
| Region - South | 0.006 | −0.006 | −0.007 |
| | (0.014) | (0.014) | (0.014) |
| Region - West | 0.001 | −0.007 | −0.020 |
| | (0.014) | (0.014) | (0.014) |
| Education | −0.002 | 0.004 | 0.002 |
| | (0.004) | (0.004) | (0.004) |
| Income | 0.006 | $0.015^{***}$ | $0.015^{***}$ |
| | (0.004) | (0.004) | (0.004) |
| Female | $0.024^{**}$ | 0.008 | $0.020^{**}$ |
| | (0.010) | (0.010) | (0.010) |
| Religion - Jewish | −0.014 | −0.008 | $-0.023^{*}$ |
| | (0.014) | (0.014) | (0.014) |
| Religion - Muslim | $-0.091^{***}$ | $-0.073^{***}$ | $-0.114^{***}$ |
| | (0.014) | (0.014) | (0.014) |
| Religion - Atheist | $-0.060^{***}$ | $-0.054^{***}$ | $-0.071^{***}$ |
| | (0.014) | (0.014) | (0.014) |
| Intercept | $0.525^{***}$ | $0.506^{***}$ | $0.530^{***}$ |
| | (0.026) | (0.026) | (0.026) |
| Observations | 10,640 | 10,640 | 10,640 |
| $R^2$ | 5 0.010 | 0.008 | 0.013 |
| Adjusted $R^2$ | 0.008 | 0.006 | 0.011 |
| Residual Std. Error (df = 10624) | 0.498 | 0.498 | 0.497 |
| F Statistic (df = 15; 10624) | $6.885^{***}$ | $5.380^{***}$ | $9.208^{***}$ |




## Split-Sample Estimates:

In this section, I report the results of split-sample estimates of the effects of profile attributes on the 1-7 likability scale question. In each section, I repeat the same analyses as above on subgroups of the sample (Republicans, Democrats, etc).

It is important to remember in reading the regression tables that The difference between a statistically significant and a statistically insignificant point estimate may not itself be statistically significant[2].

This is to say that if a coefficient is significant for one group but insignificant for another, this does not mean that the difference in the effects is significantly different between the two groups. To calculate the standard error associated with the difference in the two groups, we must use the following formula:

$$S.E._{\text{Difference}} = \sqrt{S.E._{\text{Group 1}}^2 + S.E._{\text{Group 2}}^2}$$

### Democrats VS Republicans:

First, I regress likability measured on the 1-7 scale on the conjoint profile attributes among just Democratic-leaning respondents, and just Republican-leaning respondents.

The coefficients for party and ideology are significantly different, and in the directions one would expect; Republican respondents like republican profiles more than democratic ones, while Democrats like republican profiles less than otherwise-identical democratic ones.

The difference between the coefficient for a Black profile is positive for democrats and negative for republicans and the difference is statistically significant at the $p = .05$ level, suggesting that democrats view Black profiles

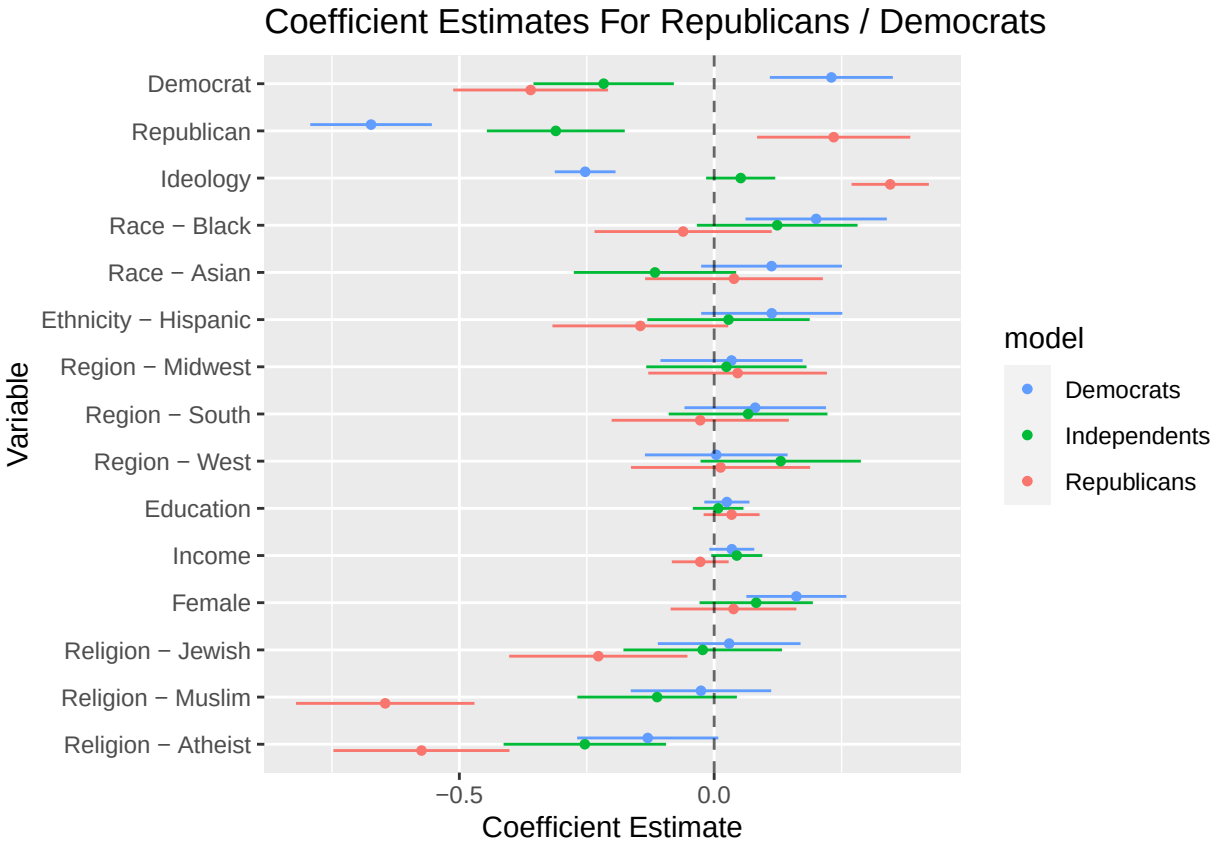
[2]see here for more

more favorably than republican respondents.

Finally, the difference between how Democrats and Republicans view Muslim and Atheist (although not Jewish) profiles are also statistically significant. Republicans view Jewish, Muslim and Atheist profiles significantly more negatively than otherwise-identical Christian profiles, and the differences between the estimates for Democrats and Republicans are statistically significant for the Muslim and Atheist profiles.

Table 3: Regression of Favorability on Profile Attributes

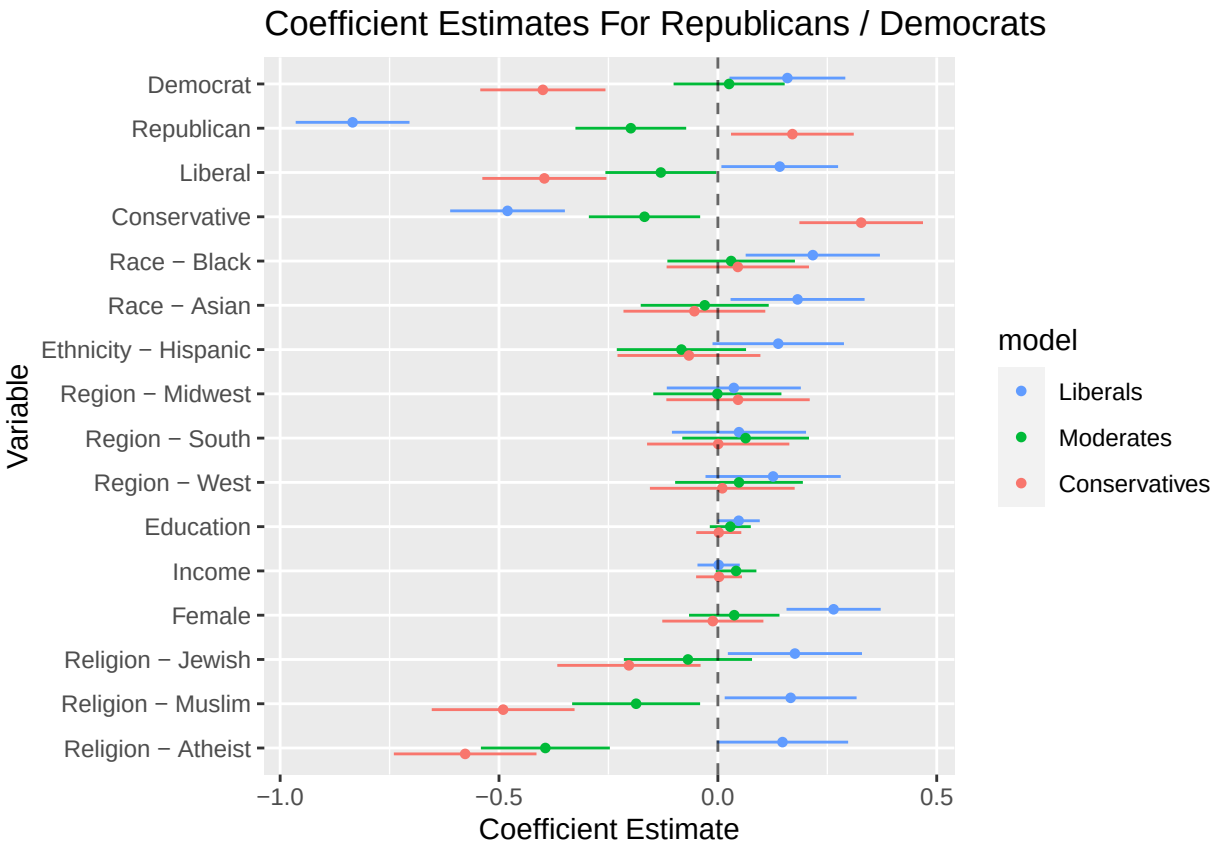
| | *Dependent variable:* | | |
|---|---|---|---|
| | Favorability Rating (1-7) | | |
| | Democrats | Independents | Republicans |
| | (1) | (2) | (3) |
| Democrat | 0.230*** | −0.217*** | −0.360*** |
| | (0.062) | (0.070) | (0.077) |
| Republican | −0.673*** | −0.311*** | 0.235*** |
| | (0.061) | (0.069) | (0.077) |
| Ideology | −0.253*** | 0.052 | 0.345*** |
| | (0.030) | (0.035) | (0.039) |
| Race - Black | 0.200*** | 0.124 | −0.061 |
| | (0.071) | (0.080) | (0.089) |
| Race - Asian | 0.113 | −0.116 | 0.039 |
| | (0.070) | (0.081) | (0.089) |
| Ethnicity - Hispanic | 0.113 | 0.028 | −0.145* |
| | (0.071) | (0.081) | (0.088) |
| Region - Midwest | 0.034 | 0.024 | 0.046 |
| | (0.071) | (0.080) | (0.089) |
| Region - South | 0.080 | 0.067 | −0.027 |
| | (0.071) | (0.079) | (0.089) |
| Region - West | 0.004 | 0.130 | 0.013 |
| | (0.071) | (0.080) | (0.090) |
| Education | 0.025 | 0.008 | 0.034 |
| | (0.023) | (0.025) | (0.028) |
| Income | 0.035 | 0.044* | −0.027 |
| | (0.022) | (0.026) | (0.028) |
| Female | 0.161*** | 0.082 | 0.038 |
| | (0.050) | (0.057) | (0.063) |
| Religion - Jewish | 0.029 | −0.022 | −0.227** |
| | (0.071) | (0.079) | (0.089) |
| Religion - Muslim | −0.026 | −0.112 | −0.645*** |
| | (0.070) | (0.080) | (0.089) |
| Religion - Atheist | −0.130* | −0.254*** | −0.574*** |
| | (0.071) | (0.081) | (0.088) |
| Intercept | 5.398*** | 4.700*** | 4.494*** |
| | (0.135) | (0.153) | (0.171) |
| Observations | 3,960 | 2,904 | 2,600 |
| $R^2$ | 0.078 | 0.019 | 0.077 |
| Adjusted $R^2$ | 0.075 | 0.014 | 0.071 |
| Residual Std. Error | 1.558 (df = 3944) | 1.531 (df = 2888) | 1.620 (df = 2584) |




# Results by Ideology

Table 4: Regression of Favorability on Profile Attributes

| | *Dependent variable:* | | |
|---|---|---|---|
| | Favorability Rating (1-7) | | |
| | Liberals | Moderates | Conservatives |
| | (1) | (2) | (3) |
| Democrat | 0.159** | 0.026 | −0.400*** |
| | (0.067) | (0.065) | (0.073) |
| Republican | −0.834*** | −0.199*** | 0.170** |
| | (0.066) | (0.065) | (0.071) |
| Liberal | 0.141** | −0.130** | −0.396*** |
| | (0.068) | (0.065) | (0.072) |
| Conservative | −0.481*** | −0.168*** | 0.327*** |
| | (0.067) | (0.065) | (0.072) |
| Race - Black | 0.217*** | 0.030 | 0.046 |
| | (0.078) | (0.074) | (0.083) |
| Race - Asian | 0.182** | −0.030 | −0.054 |
| | (0.078) | (0.075) | (0.083) |
| Ethnicity - Hispanic | 0.138* | −0.083 | −0.066 |
| | (0.077) | (0.075) | (0.083) |
| Region - Midwest | 0.036 | −0.001 | 0.046 |
| | (0.078) | (0.075) | (0.084) |
| Region - South | 0.048 | 0.063 | 0.001 |
| | (0.078) | (0.074) | (0.083) |
| Region - West | 0.126 | 0.048 | 0.010 |
| | (0.079) | (0.074) | (0.084) |
| Education | 0.048* | 0.028 | 0.002 |
| | (0.025) | (0.024) | (0.026) |
| Income | 0.002 | 0.042* | 0.003 |
| | (0.025) | (0.024) | (0.027) |
| Female | 0.264*** | 0.037 | −0.012 |
| | (0.055) | (0.053) | (0.059) |
| Religion - Jewish | 0.176** | −0.068 | −0.203** |
| | (0.078) | (0.075) | (0.083) |
| Religion - Muslim | 0.166** | −0.187** | −0.491*** |
| | (0.077) | (0.075) | (0.083) |
| Religion - Atheist | 0.148* | −0.394*** | −0.577*** |
| | (0.076) | (0.075) | (0.083) |
| Intercept | 4.762*** | 5.139*** | 5.153*** |
| | (0.136) | (0.131) | (0.147) |
| Observations | 3,232 | 3,120 | 3,088 |



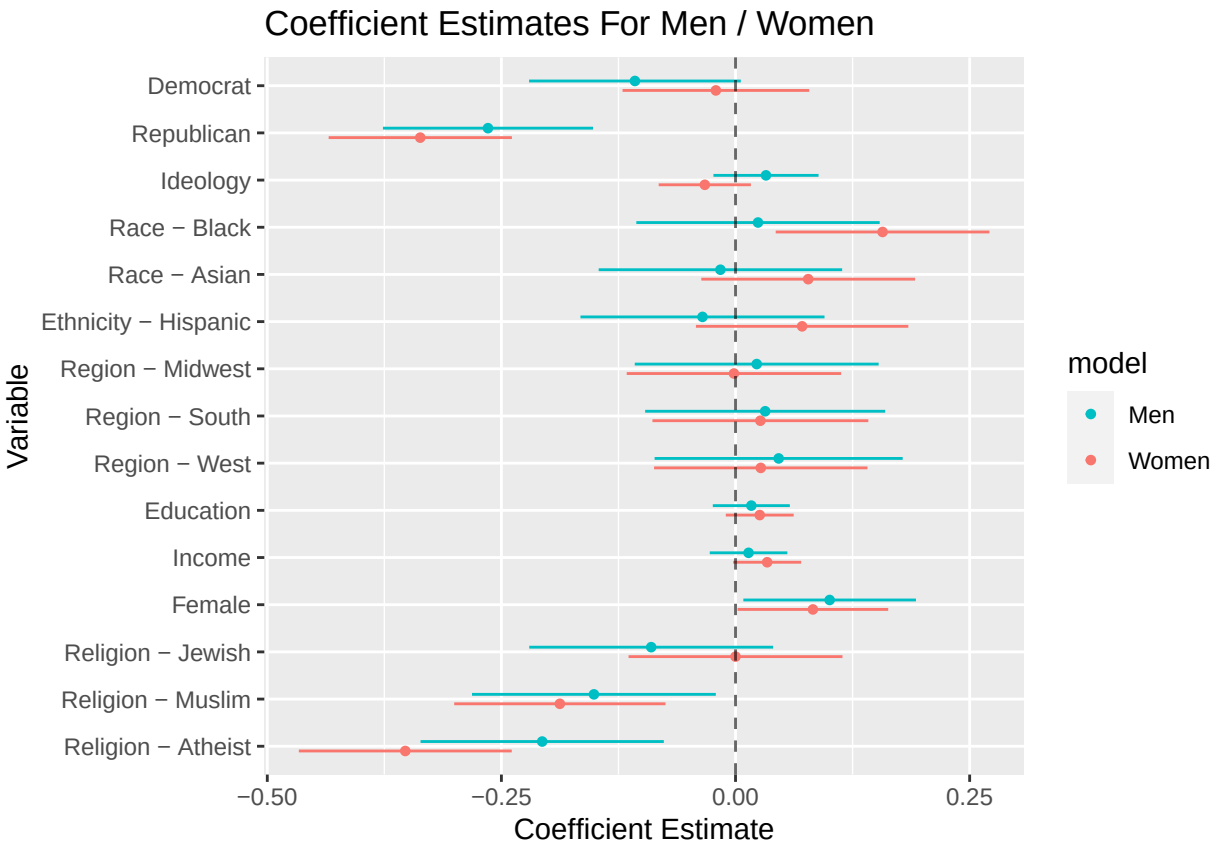

## Men VS Women

I repeat the same split-sample analysis for Men vs Women. The interpretations of the coefficients are the same as above.

Men and Women appear to react to the partisanship of a profile in different ways; while both appear to react negatively to republican profiles on average, Women appear to react more negatively, and the difference is statistically significant.

Table 5: Regression of Favorability on Profile Attributes

| | *Dependent variable:* | |
|---|---|---|
| | Favorability Rating (1-7) | |
| | Men | Women |
| | (1) | (2) |
| Democrat | $-0.107^{*}$ | $-0.021$ |
| | (0.058) | (0.051) |
| Republican | $-0.264^{***}$ | $-0.337^{***}$ |
| | (0.057) | (0.050) |
| Ideology | 0.033 | $-0.033$ |
| | (0.029) | (0.025) |
| Race - Black | 0.024 | $0.157^{***}$ |
| | (0.066) | (0.058) |
| Race - Asian | $-0.016$ | 0.078 |
| | (0.066) | (0.058) |
| Ethnicity - Hispanic | $-0.035$ | 0.071 |
| | (0.066) | (0.058) |
| Region - Midwest | 0.023 | $-0.002$ |
| | (0.066) | (0.058) |
| Region - South | 0.032 | 0.027 |
| | (0.065) | (0.059) |
| Region - West | 0.046 | 0.027 |
| | (0.068) | (0.058) |
| Education | 0.017 | 0.026 |
| | (0.021) | (0.018) |
| Income | 0.014 | $0.034^{*}$ |
| | (0.021) | (0.019) |
| Female | $0.100^{**}$ | $0.083^{**}$ |
| | (0.047) | (0.041) |
| Religion - Jewish | $-0.090$ | $-0.00000$ |
| | (0.066) | (0.058) |
| Religion - Muslim | $-0.151^{**}$ | $-0.188^{***}$ |
| | (0.066) | (0.058) |
| Religion - Atheist | $-0.206^{***}$ | $-0.353^{***}$ |
| | (0.066) | (0.058) |
| Intercept | $4.813^{***}$ | $5.010^{***}$ |
| | (0.125) | (0.113) |
| Observations | 5,072 | 5,568 |
| $R^2$ | 0.008 | 0.022 |
| Adjusted $R^2$ | 0.005 | 0.019 |
| Residual Std. Error | 1.688 (df = 5056) | 1.514 (df = 5552) |

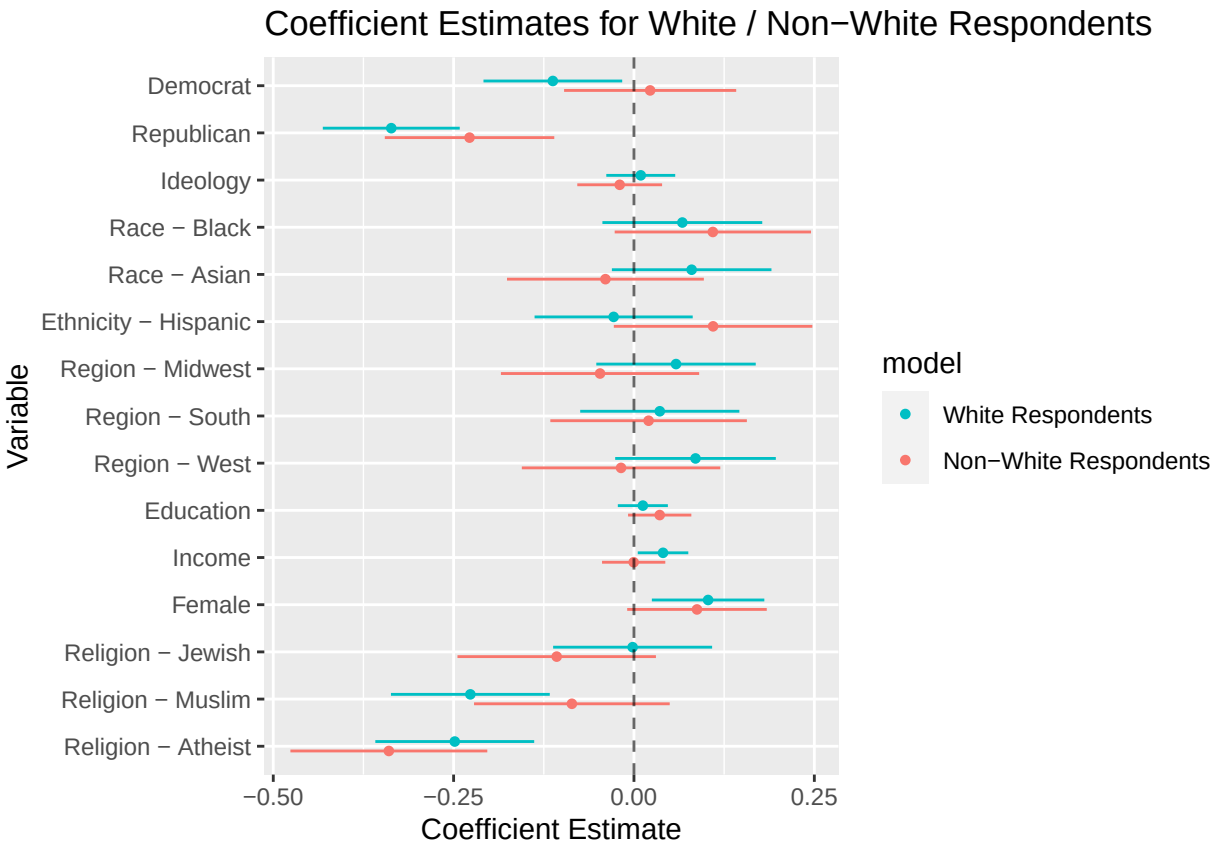



## White VS Non-White Respondents

Finally, I run the same regressions on white vs non-white respondents. The differences between the two groups are not statistically significant.

Table 6: Regression of Favorability on Profile Attributes

| | *Dependent variable:* | |
|---|---|---|
| | Favorability Rating (1-7) | |
| | White Respondents | Non-White Respondents |
| | (1) | (2) |
| Democrat | $-0.112^{**}$ | 0.022 |
| | (0.049) | (0.061) |
| Republican | $-0.336^{***}$ | $-0.228^{***}$ |
| | (0.048) | (0.060) |
| Ideology | 0.009 | $-0.020$ |
| | (0.024) | (0.030) |
| Race - Black | 0.067 | 0.109 |
| | (0.057) | (0.069) |
| Race - Asian | 0.080 | $-0.040$ |
| | (0.056) | (0.070) |
| Ethnicity - Hispanic | $-0.028$ | 0.110 |
| | (0.056) | (0.070) |
| Region - Midwest | 0.058 | $-0.047$ |
| | (0.056) | (0.070) |
| Region - South | 0.036 | 0.020 |
| | (0.056) | (0.069) |
| Region - West | 0.085 | $-0.018$ |
| | (0.057) | (0.070) |
| Education | 0.012 | 0.036 |
| | (0.018) | (0.022) |
| Income | $0.040^{**}$ | $-0.0004$ |
| | (0.018) | (0.022) |
| Female | $0.103^{***}$ | $0.087^{*}$ |
| | (0.040) | (0.049) |
| Religion - Jewish | $-0.002$ | $-0.107$ |
| | (0.056) | (0.070) |
| Religion - Muslim | $-0.227^{***}$ | $-0.086$ |
| | (0.056) | (0.069) |
| Religion - Atheist | $-0.248^{***}$ | $-0.340^{***}$ |
| | (0.056) | (0.070) |
| Intercept | $4.759^{***}$ | $5.132^{***}$ |
| | (0.108) | (0.133) |
| Observations | 6,208 | 4,432 |
| $R^2$ | 0.017 | 0.014 |
| Adjusted $R^2$ | 0.014 | 0.010 |
| Residual Std. Error | 1.593 (df = 6192) | 1.598 (df = 4416) |




### Created Hierarchical Models from Jensen et al. (2021)

Finally, I have written hierarchical Bayesian models to understand heterogeneity in effects across the popultaion. I have coded and tested the models, but not yet applied them to the survey data.

All the models take the same form as before, modelling responses as a linear combination of profile attributes. However, in these models, the effect of each profile attribute also modelled as a linear combination of the demographic characteristics of each respondent.

Specifically, I model the rating that a profile, recieves, $Y$ from a person, $i$ as:

$$Y = \beta_i^T X$$

Where $\beta_i$ is a vector that describes the effect each attribute of a conjoint profile has on a specific respondent's rating. Each $\beta_{ij} \in \beta_i$ comes from a linear combitation of respondent attributes and population weights.

$$\beta_i = \gamma^T Z_j$$

## References

Jensen, Amalie, William Marble, Kenneth Scheve, and Matthew J. Slaughter. 2021. "City Limits to Partisan Polarization in the American Public." *Political Science Research and Methods* 9 (2): 223–41. https://doi.org/10.1017/psrm.2020.56.