Digital Political Ads, and American Presidential Politics

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A. Introduction

Research Question: What is the effect of dollars spent on Facebook political advertisement services targeting a specific state on the average polling performance of the democratic primary candidate in the corresponding state?

Background: Political advertising has become the communication format that dominates presidential campaign budgets [6]. Spending on political advertisements has hit a new high in 2020, officially surpassing the $1 Billion mark. Many studies suggest that spending on mass media services became a primarily effective tool to promote political objectives [4]. Studies of congressional elections have consistently shown that candidate quality and campaign spending affect the vote [2][5]. Shaw [7] studied the impact of advertising in the 1988, 1992 and 1996 presidential campaigns and found that increased political advertising in a state led, in some instances, to increased voting for candidates. Goldstein and Freedman[3] conducted their analysis on the U.S Senate Race and revealed that, the more exposure the candidate has, the more likely the voting for that candidate increased.

In sum, recent studies have found compelling evidence for the effect of increased ad spending on the likelihood of increased voting. Considering these findings, we hypothesize that we will find a significant positive relationship between Facebook ad spending and average state poll performance. In this report, we develop a model representing the effects of political advertising by looking at the impact of dollars spent on Facebook advertising on state polls during the 2020 democratic primary election.

B. Model Data Analysis

The proposed approach is based on the Generalized Linear Model (GLM) methods found in [Dobson]. Table 1 details the variables tested.

Table 1: Variables

Variable	Type	Definition	Unit
Polling	Continuous	The average poll for each candidate per	Percent

(Poll)		state	
Spending (Spending)	Continuous	The dollar value spent in each state per candidate	U.S. Dollar
Age (Age)	Continuous	The age of the candidate	Years
Gender (Gender)	Dummy	The gender of the candidate (0 for female, 1 for male)	0/1
Freshman (Freshman)	Dummy	Debuting presidential race candidate	0/1

Data Source:

- https://projects.fivethirtyeight.com/polls/
- https://www.facebook.com/ads/library

C. Plots of Dependent Variable and Independent Variables

Upon inspection of the histogram of the dependent variable displayed in figure 1.1 of the Appendix, it appears that polling data is approximately normally distributed – with the left tail cut off at 0, and an elongated right tail. Furthermore, the plots of the dependent variable and independent variables displayed in figure 1.2 of the Appendix suggest that polling may have a positive linear relationship with age and gender (meaning males are likely to poll higher), and a negative linear relationship with the freshman indicator. While there appears to be a relationship between poll data and spending, the relationship does not seem to be linear in nature. In figure 1.4 of the Appendix we plot polling data against the log of spending, and the relationship appears to be linear – with contrasting effects between freshman and non-freshman candidates.

D. Model Specification and Regression Estimation Results

```
Call:
glm(formula = Poll ~ spending_freshman + data$Age + data$Freshman)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-25.995   -3.830   -1.035    2.963   39.270

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       13.10592    3.86854   3.388 0.000851 ***
spending_freshman  2.28795    0.68560   3.337 0.001012 **
data$Age           0.16524    0.04842   3.413 0.000780 ***
```

```
data$Freshman     -39.22921    7.60518  -5.158 6.05e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for gaussian family taken to be 65.90489)

    Null deviance: 27797  on 200  degrees of freedom
Residual deviance: 12983  on 197  degrees of freedom
AIC: 1418.2

Number of Fisher Scoring iterations: 2
```

E. Adequacy of the Model

As shown in the Q-Q plot and histogram of the standardized residuals in figure 2.1 of the Appendix, we can comfortably verify that the residuals are approximately normally distributed throughout the data. Plotting the residuals against our fitted values and dependent variables used in the specified model above (figure 2.2 in the Appendix), the residuals also appear to be independent of the fitted values and dependent variables, which further solidifies the model’s adequacy. We do run into problems, however, with the assumption of constant variance when examining the standardized residuals vs. fitted values - suggesting that the residuals may be heteroskedastic. Heteroskedasticity, if unaccounted for, may result in incorrect estimations of the standard errors of the model’s parameters, which would result in misleading tests of significance. We further accounted for the heteroskedasticity issue by re-estimating the model using a robust standard error. The re-estimation results are displayed in section 3 of the Appendix.

F. Inference

Looking at the log (Spending)*Freshman (Spending Freshman) interaction variable, estimates show that a one percent increase in spending by a freshman candidate will result in a 2.28 percent average increase in average poll performance for that state. Similarly, results show that age is a large component of the equation. An increase of one year in age increases polls by an estimated 0.16 percent, on average. In contrast to

spending and age, the freshman variable has a negative estimated impact on polls. Estimates show that a debuting candidate might experience an average of 39 percent lower polling numbers. After adjusting for heteroskedasticity by re-estimating the model using a heteroskedastic-robust standard error, we find that the estimated coefficients are even more statistically significant (based on the z-test).

G. SUMMARY

Overall, we find that the estimated effect of political ad spending on average poll performance is as hypothesized, conditional on the candidate being a "freshman." As the estimation results show, the substantial positive effect that percentage increases in Facebook ad spending have on average polling performance is highly significant for candidates who have never participated in a presidential primary election before. The contrast in the effect of percentage increases in spending on polling performance for freshman and non-freshman candidates is visually emphasized in figure 1.4 in the Appendix, where polling data is plotted against the log of spending. This finding is not surprising. Assuming that political ad spending increases polling performance by increasing the candidate's exposure to the public - and assuming that exposure exhibits diminishing marginal returns for polling performance - candidates who have already received a substantial amount of exposure in previous elections are unlikely to benefit, on the margin, from increased exposure through ad spending as much as debuting candidates.

This analysis has potential limitations. We can't ignore the fact that heteroskedasticity is present in the data collected. Furthermore, there were limitations in the data available regarding the spending data in the 2020 democratic presidential primary. Ideally, we would like to test the effect of spending on all types of political ads – not just Facebook ads. Due to the fact that presidential elections are relatively infrequent, and we only

recently have collected ad spending data, the sample size was relatively small. Looking forward, we'd like to be able to test the effects of ad spending across multiple elections and obtain more significant results. Finally, we do recognize the possibility of simultaneity bias with the ad spending variable. Assuming diminishing marginal returns for exposure on polling performance, candidates are incentivized to spend more in states where their poll performance is poor, which would result in downward bias on the estimated parameter for the log(spending)*freshman interaction variable. If this is true, then we can safely say that there is still a significant positive impact of ad spending on average polling performance for freshman candidates, but the magnitude of that impact may be even greater than what we estimated. More precise data is needed to control for potential endogeneity in the ad spending variable.

H. Appendix

Section 1: Plots of Dependent Variable and Independent Variables

Figure 1.1

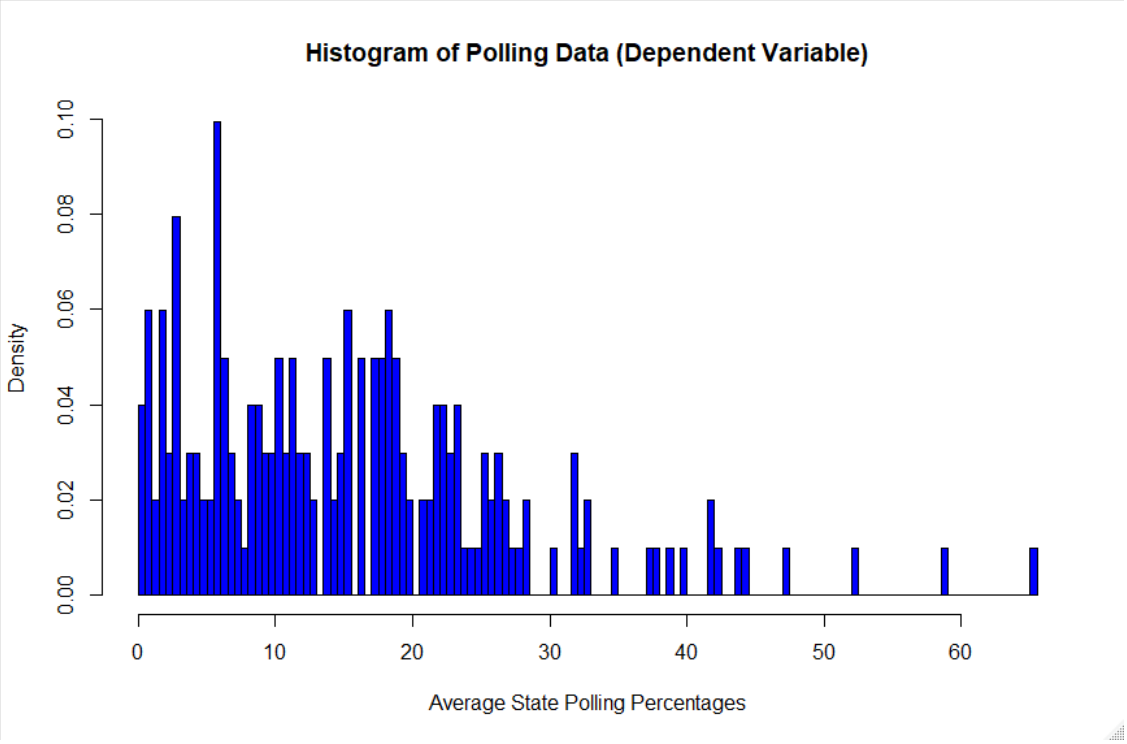


FIGURE 1.2

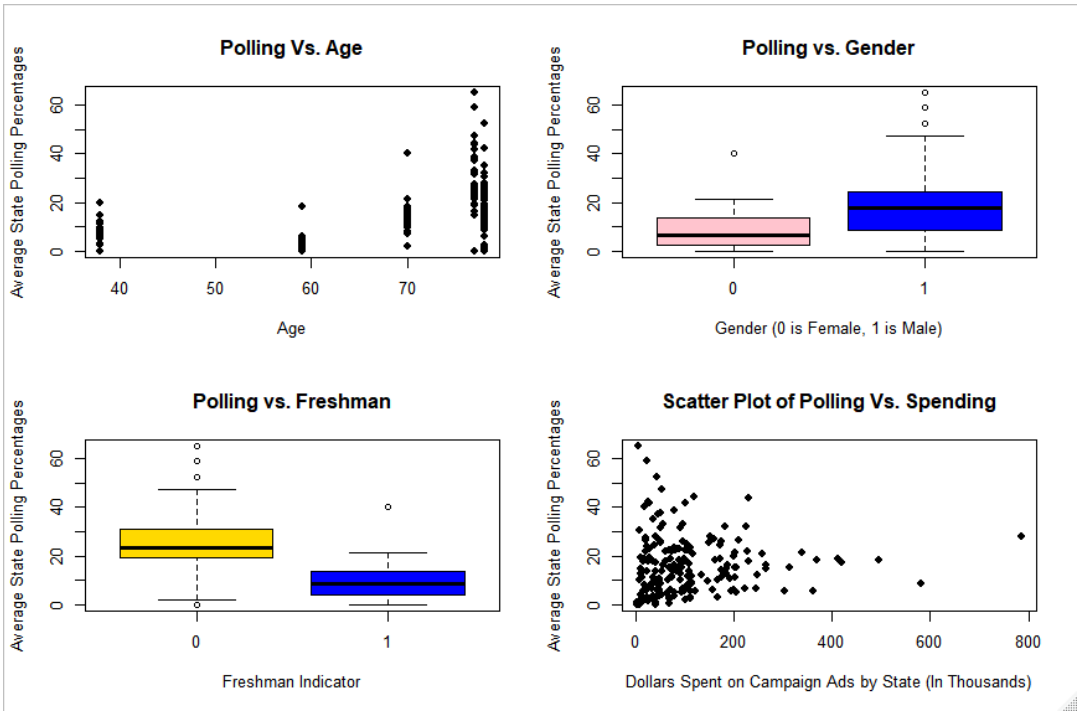


FIGURE 1.3

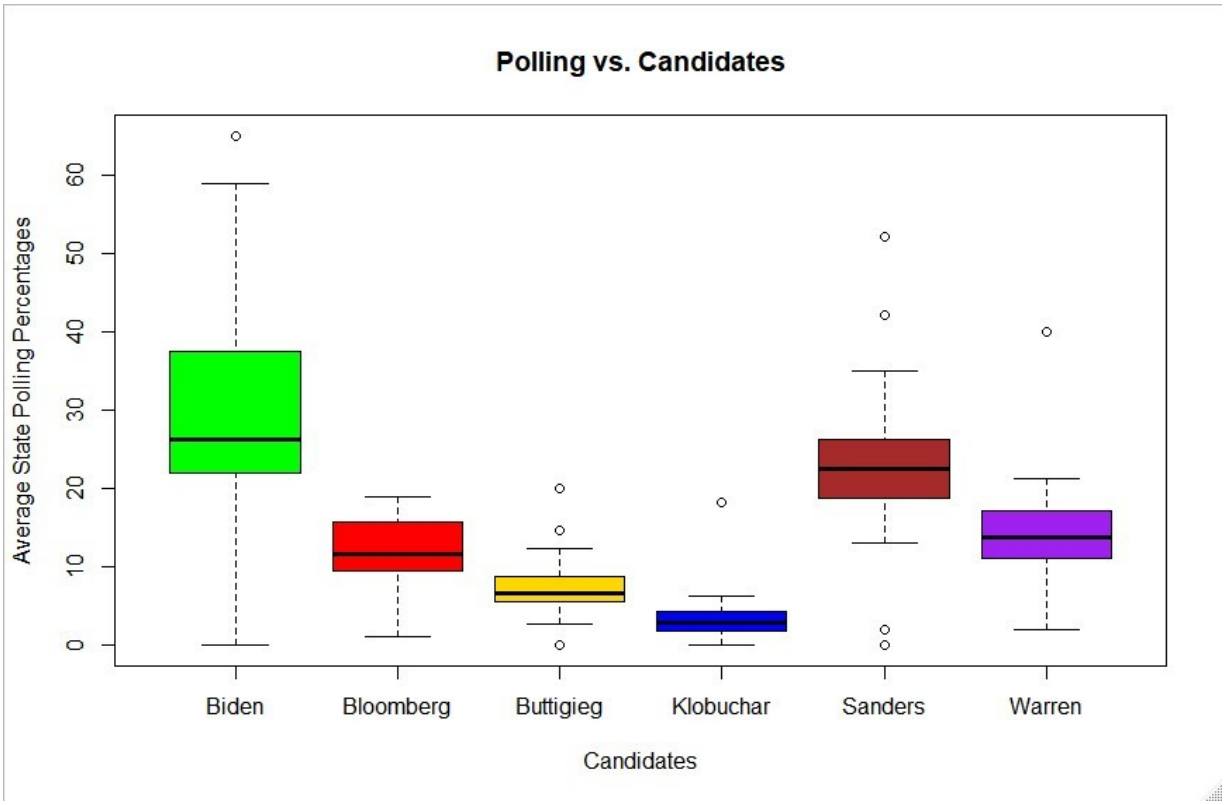
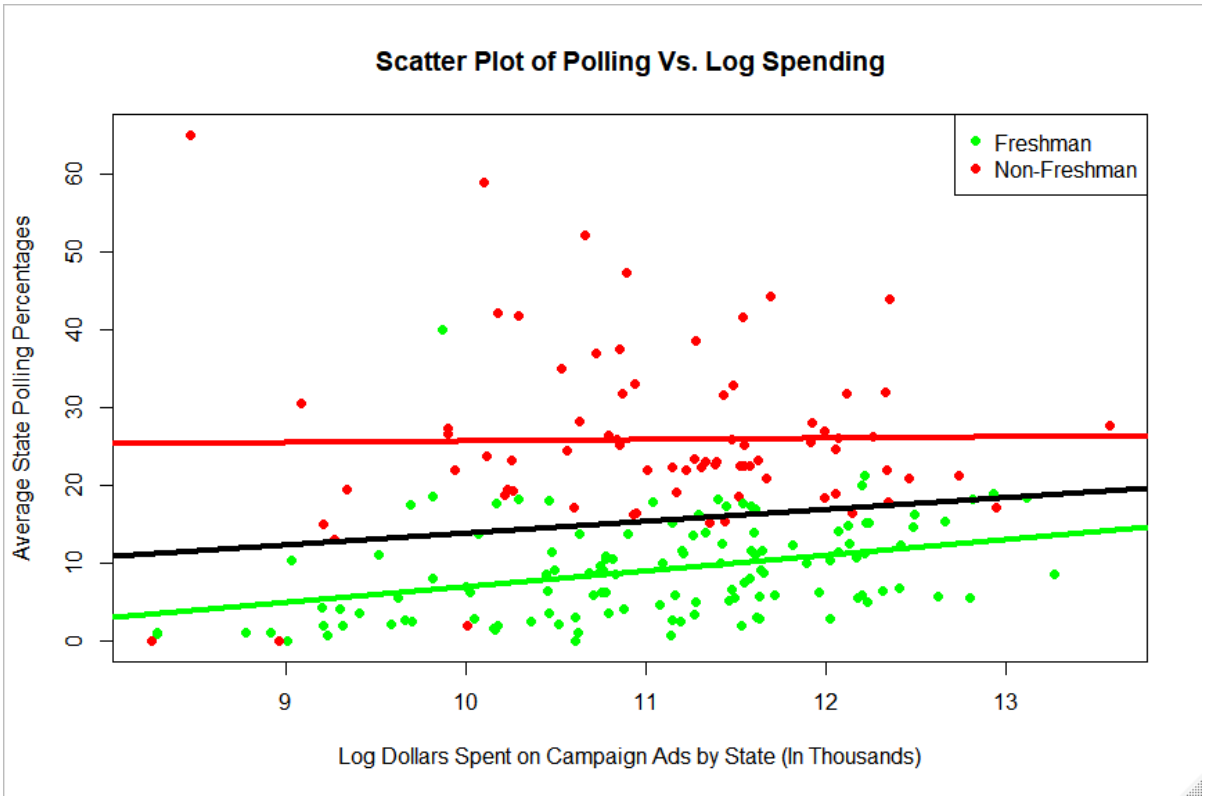


FIGURE 1.4



SECTION 2: RESIDUAL ANALYSIS

FIGURE 2.1

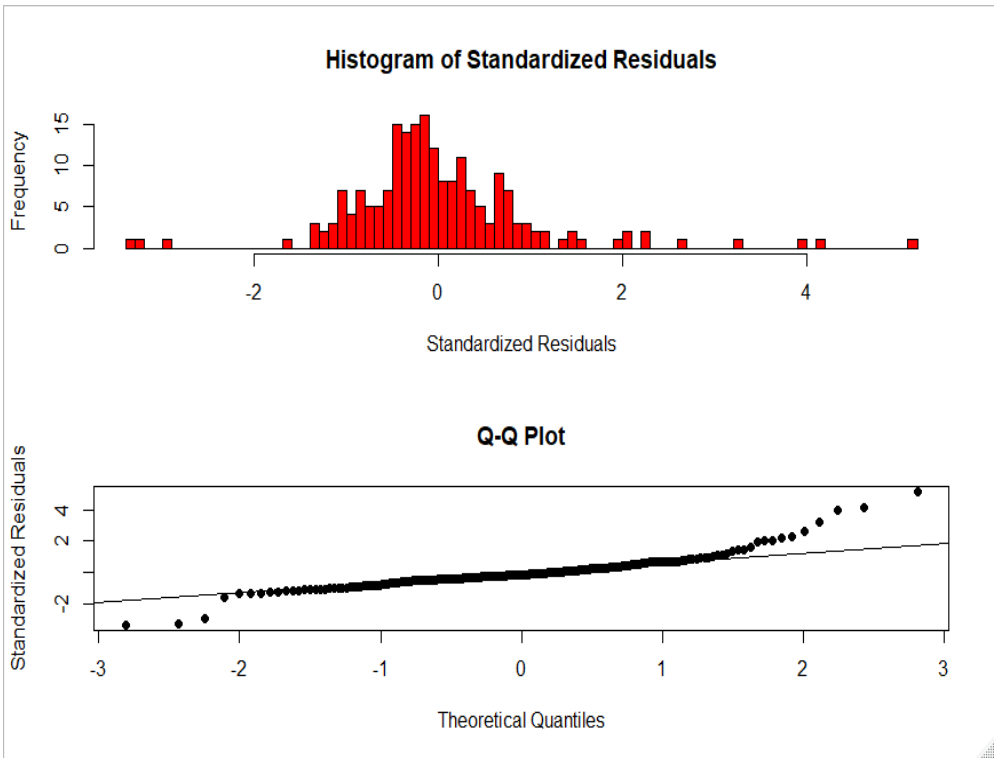
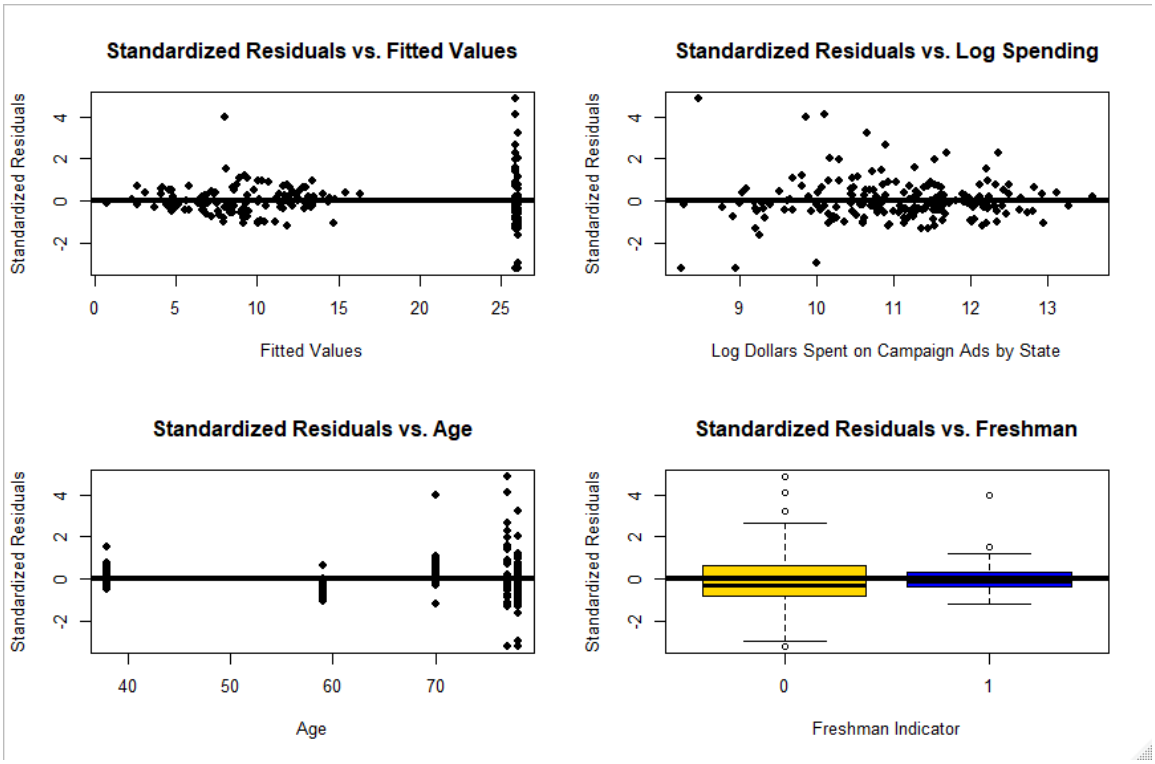


FIGURE 2.2



SECTION 3: HETEROSKEDASTIC-ROBUST SIGNIFICANCE

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z test of coefficients:

                   Estimate Std. Error z value  Pr(>|z|)
(Intercept)        13.105917   2.434505  5.3834 7.309e-08 ***
spending_freshman   2.287948   0.406224  5.6322 1.779e-08 ***
data$Age            0.165244   0.026118  6.3268 2.503e-10 ***
data$Freshman     -39.229206   5.016752 -7.8196 5.297e-15 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Bibliography

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