Effect of Endorsements on Political Parties

By: Aishwarya Rane, Aruna Sudarshan, Ryan Shah, and Tanvee Joshi

I. Data Overview

The data is generated through the open Primary Candidates 2018 Election dataset posted on Github. This data is a census because it looks at all the candidates who took part in the Democratic and Republican primary elections for the U.S. Senate, U.S. House and governor. If the dataset is looking at Primary Candidates 2018 Election as a whole, the group that was systematically excluded were third party candidates. It would be helpful to have had this information to gain a more holistic picture of how endorsements affect candidates, particularly with third party candidates who tend to receive less funding from large, well-known organizations and instead rely on federal financing. However, since third party candidates usually are fewer in number and rarely advance past primaries or win the election, it will not affect our conclusion significantly.

Participants were aware of the collection and use of data as primary candidates have to put their qualifications for the public to see so that they would be convinced to vote for them. Each row represents one candidate's demographic data and endorsement information. This impacts the interpretation of our findings because we are able to simplify the analysis down to each individual person or group based on similar characteristics. Selection bias and convenience sampling is not relevant in the context of our data because we are not sampling. There could be a measurement error if endorsements were not listed properly for the candidates.

We would have liked to have more demographic-related columns to the Republican dataset. We had a higher level of detail in the Democratic dataset, as it included the variables "Race," "LGBTQ," "Gender," and "Veteran." These would have been useful to check to see how a candidate's own characteristics impacted whether or not they get endorsements and also ultimately advance.

II. Research Questions

Research Question I: Causal Inference

Our research question is the following: Within each party (Democrats and Republicans), what endorsements and characteristics are associated with advancing in the election? We want to look at the correlation between particular endorsements and primary election outcomes. The real-world decision making application for this particular research question is helpful for both voters and candidates. Voters can be cognizant of the impact of endorsement and its relative reputation on the election outcome. On the other hand, candidates looking to run for office can observe causes and groups they can dedicate their attention towards getting endorsed by or having strong relationships with. Causal inference is a relevant method to be applied in this context because we are trying to observe the relative effect between a particular treatment (Endorsements) and outcome (Primary Election Advancement). Exploring the outcomes of this method allows us to understand

the significance of different groups on advancements before comparing them across parties in hypothesis testing.

Research Question II: Multiple Hypothesis Testing

Based on our results from Causal Inference, we wanted to dive deeper into each political party through multiple hypothesis testing to answer the question "when comparing similar issues across Democrats and Republicans, which party's candidates were more likely to advance based on the endorsements from that entity?" Preliminary trends were observed in the differences in effectiveness of various notable endorsements during exploratory data analysis. As such, multiple hypothesis testing provided an opportunity to explore these trends on a deeper level across parties and understand if those differences were statistically significant. From the same dataset, we felt compelled to understand multiple questions, as just one endorsement cannot effectively capture trends in endorsement effects within a party, particularly when accounting for the fact that each endorsement represents different issues of interest to voters. Knowing which endorsements are important for each specific party is useful for the candidates to know what they need in order to advance from the primary stage. These real-world decisions made by candidates on which endorsements they try to receive from hypothesis testing methods can ultimately determine who the elected candidate will be.

III. EDA

For our EDA we wanted to focus our attention on quantitative and qualitative variables in relation to the following endorsements: Guns Sense (D), NRA (R), Emily's List (D), Right to Life (R), Democratic Party, and Republican Party. These are three three endorsements we decided to explore first because they stood out to us as impactful in advancing initially. For the categorical variables we focused on the count of candidates that advanced or lost based on if they were endorsed. In relation to quantitative variables, we looked at the primary votes received for candidates that were endorsed compared to those who did not. There is nothing unusual with our data, but we do have a few outliers in each of our graphs. The impact of the outliers will be accounted for in our causal inference and multiple hypothesis testing methods.

Trends

Across all of the endorsements we saw that amongst the categorical analysis, candidates that were endorsed were more likely to advance in the primaries. This is in line with our assumption that endorsements tend to improve a candidate's chance of moving forward. While this was a consistent trend across all of the endorsement groups, some had smaller differences between endorsed and unendorsed candidates, notably Right to Life had the smallest difference, while Republican Party Endorsed had a very large difference amongst winners.

In relation to our quantitative variables, we saw overarching trends of candidates that were endorsed having a higher primary %. This is indicative of them having a higher median share of votes than those that were not, indicated by the line in between the plot. As noted above in our

qualitative graphs, it is associated with endorsed candidates being more likely to win. However, there is a higher spread between the min and max as well as the difference between the 1st and 3rd quartile.

IV. Causal Inference

Methods

In looking at this data set, we noticed that there were a significant amount of NaN values, particularly when looking at columns that represented endorsement from leaders, such as Biden. While we initially dropped these NaN values, upon observing the data and its meaning more closely, we concluded that a NaN represents a lack of endorsement and opinion on the candidate while "No" represents a much stronger disinterest in a candidate. However, both NaN and "No" still represent a lack of sufficient interest in endorsing the candidate, and prevent the candidate from reaping the benefits of an endorsement. Therefore, for the purposes of understanding the effect of endorsements, specifically, we opted to convert the NaN values to "No."

Our datasets contain several categorical values, so in order to run OLS on the data, we had to binarize some of this data. We binarized the "Yes" and "No" values for "Primary States", and "Party Support" / "Rep Party Support" for the Democratic and Republican dataset respectively. Finally we performed one-hot encoding on both datasets for the "State" column. This allowed us to make new columns in each of the datasets that represent each state. Under each state's column, the candidate would have a value of 1 if they were from that state and 0 if they were not.

After taking into account confounding variables, we needed to adjust our datasets, so for the Democratic dataset we binarized the "Emily Endorsed?" and "Guns Sense Candidate" columns. To further explore confounding variables, we binarized the "Race", "LGBTQ?", "Veteran?", "Self Funder?", "Elected Official?", and "STEM?" columns.

With this cleaned data we are now able to cleanly run multiple different models taking different variables into account. When it came to choosing our methods for conducting causal inference, we first noted that due to the high amount of confounding variables in the dataset, there are no instrumental variables. Instrumental variables must only influence the outcome through the treatment, and in the case of election data, variables that we hypothesized would influence the treatment would also influence the outcome. For example, gender and being a part of the Democratic party are a prerequisite to being endorsed by Emily's List. However, both independently affect a candidate's likelihood of advancing in the election in ways that are not related to the candidate being endorsed by Emily's List, such as gender-related biases and stereotypes possessed by voters. As a result of this, we were unable to utilize 2SLS to eliminate bias. Rather, we had to take an OLS estimate, accounting for the many confounding variables available in the dataset. Furthermore, we could not use matching or propensity scores algorithms. This is because it is difficult to make sure each candidate has all the same attributes as another and we are not able to calculate the probability of a candidate winning or receiving an endorsement. Therefore, we opted to utilize OLS.

Considering all confounding variables- demographic variables and states - we could assume that Party endorsement and candidate's primary results are conditionally independent given the specified confounders.

For our OLS regression, we also added in other endorsements as control variables in order to see a more accurate causal effect between Party endorsement and candidate advancing.

There are no colliders in the dataset, but a collider variable to consider when doing further research are candidates who ultimately won the whole election. Winning the primaries and getting an endorsement both cause a difference in whether or not a candidate wins overall.

Results

Simple (naive) OLS - Democratic & Republican (Respectively)

When accounting for party support as a treatment variable for Democrats, we found that party support was statistically significant with a very high difference between the standard error and the coefficient. The coefficient of 0.9487 is far more than 2 times greater than the standard error of 0.038. This indicates that party support is a strong indicator and a predictor of candidates advancing in the Democratic party.

For Republicans, we found that Republican Party Support was statistically significant. We see that the coefficient 0.6190 is more than 2 times the size of the standard error, which is 0.069. With this evidence, we can conclude that Republican Party Support is a strong predictor of candidates within the Republican party advancing in the primaries.

OLS - Accounting for States as a confounder for Democrats & Republicans (Respectively)

When accounting for states as a confounder for the democratic party we found that the following states are statistically significant- ND, SD, UT, ID, WV, AR, WA, MS, NE, CO, KS, MO, AL, KY, VA, NC, MD, TN, OK, SC, GA, IN, MI, NY, IL, PA, OH, CA, TX. We noticed that those with fewer candidates had significantly high correlations such as North Dakota with a coefficient of 1, this is likely because the few candidates that were running won. Additionally, the states with the highest number of representatives have the lowest standard error, Texas and California respectively. There is a level of uncertainty we should acknowledge with this prediction, as we likely have not accounted for other confounders, particularly within each state.

When accounting for states as a confounder for the Republican party we found that some states were statistically significant while others were not. We wanted to add states as confounding variables because individual states tend to have varying confounding variables that ultimately impact the election results. The variable Republican Party Support was statistically significant and had the lowest standard error of the variables with a standard error of 0.064 compared to other standard errors which were greater than or equal to 0.143. We found that IA, NC, CO, RI, NM, VA, MA, GA,

NY, HI, WI, CT, MI, OK, NJ, IL, MN, WA, TN, IN, PA, MD, OH, and FL are all statistically significant.

Both parties have a large number of states, and there are several potential reasons why they may be statistically significant. States like PA, WI, and FL, they are known to be highly contested swing states, which can influence the type of outcome a candidate is likely to face coming from that state as opposed to those that are strictly Republican or Democratic. This can also suggest that candidates, being from a swing state, are likely to face a different election outcome than states that are not. There is a reasonable amount of uncertainty associated with our prediction since our sample is not necessarily representative of all of the candidates. We can not assume causality of the results because our data is not a randomized control trial (RCT) and we inevitably may not have accounted for all of the confounders such that the true effect of party support is measurable.

OLS - Accounting for Endorsements control variables for Democrats & Republicans (Respectively)

The control variables we decided to include as Democratic Party endorsements were Emily's List, Guns Sense Candidates, Our Revolution, and Biden. These were picked because they reflect issues that are pertinent to every election: abortion, gun rights, taxation, and a major politcal party representative endorsement. When we ran the OLS regression accounting for these control variables, we noticed that all of these variables were statistically significant except being endorsed by Biden. It makes sense that these endorsements are important and relevant predictors for advancing in the election since they represent a candidate's strong support for a particular issue It is interesting that an endorsement from Biden was not statistically significant, a reason for this can be due to him not being an elected representative during the time of the election and having less of an influence as such.

For the Republican Party, the control variables we included for Endorsements were Right to Life Endorsed, NRA Endorsed, Trump Endorsed, and Club for Growth Endorsed. The reason why we chose each of these is because right to life, gun ownership, influence from the current President, and issues such as trickle-down economics and taxation have been central issues in numerous Republican debates. When we ran this OLS regression we saw that all of these variables are statistically significant, which is in line with our predictions. In the case of Trump's Endorsement, we also expected it to be statistically significant given that he was an elected official with significant voter support and interest. Of these confounding variables, Trump Endorsement had the highest coefficient, followed by Club for Growth, NRA, and Right to Life. This is in line with the idea that Trump's influence over the current voting population and candidates is likely higher than any other entity, given that he was in office at that time. Republican Party Support is still statistically significant when including the controls, and in fact, has the highest coefficient, showing the importance of party support in Republican candidates' success.

From domain knowledge, we know that PACs advocate strongly for core issues for respective parties and provide funding that can improve candidate's success and voter interest. As an

example, the NRA is highly influential amongst those who support gun ownership, and seeing the NRA direct support towards a candidate, would likely incentivize such voters to more strongly support the candidate.

Party Support - Democratic versus Republican

While it is integral to understand each respective party, it's also important to evaluate the results of our causal inference research in comparison to each. As such, our calculation shows that there is a stronger correlation between the Democratic Party support and election advancement, with a value of 0.948, than for the Republican party, which had a value of 0.619. This distinction can be attributed to several factors, for example the fact that there was much more missing information in the Republican dataset than the Democratic dataset . As noted above, party support's effect on our primary outcome is weaker for the Republican party candidates due to missing data.

Discussion

A limitation of our methods is that we cannot assume causality because our treatment is not randomly assigned. As such we cannot necessarily be certain about the causal effect between our chosen treatment (Party Endorsement) and the outcome (Election Advancement). Another limitation of our methods is that we only know which candidate advanced to the election, but additional data on the election outcome past advancement would be helpful to potentially evaluate the strength of endorsement over time. For example, if an endorsement in the primaries continues to have a strong or negative effect on whether or not a candidate eventually gets elected into office.

V. Multiple Hypothesis Testing

Methods

We have broken our multiple hypothesis testing method down so that we have a null hypothesis and alternative hypothesis for each of the six different tests. Since we are looking at which endorsements affect a party more, we have compared similar issues across Democrats and Republicans. The categories include party endorsement, gun rights, abortion rights, elected official support, and general major issues. We chose one sided versus two sided hypothesis testing when we wanted to see if there is a difference versus if one endorsement was more powerful than the other.

1) Democratic Party Endorsement
    a) Null hypothesis: There is no difference to the candidate's likelihood of advancement if the candidate receives the Democratic Party endorsement.
    b) Alternative hypothesis: There is a difference to the candidate's likelihood of advancement if the candidate receives the Democratic Party endorsement. (two-sided hypothesis test)
    c)
2) Republican Party Endorsement
    a) Null hypothesis: There is no difference to the candidate's likelihood of advancement if the candidate receives the Republican Party endorsement.

b) Alternative hypothesis: There is a difference to the candidate's likelihood of advancement if the candidate receives the Republican Party endorsement. (two-sided hypothesis test)

3) NRA versus Gun Sense
    a) Null Hypothesis: There's no difference to the candidate's likelihood of advancement between receiving an endorsement from NRA and Gun Sense.
    b) Alternative Hypothesis: NRA endorsed candidates are more likely to advance than Guns Sense endorsed candidates. (one-sided hypothesis test)

4) Emily's List vs Right to Life
    a) Null Hypothesis: There's no difference to the candidate's likelihood of advancement between receiving an endorsement from Emily's List and Right to Life.
    b) Alternative Hypothesis: Emily's List endorsed candidates are more likely to advance than Right to Life endorsed candidates. (one-sided hypothesis test)

5) Biden versus Trump
    a) Null Hypothesis: There's no difference to the candidate's likelihood of advancement between receiving an endorsement from Biden and Trump.
    b) Alternative Hypothesis: Biden endorsed candidates are more likely to advance than Trump endorsed candidates. (one-sided hypothesis test)

6) Our Revolution vs. Club for Growth
    a) Null Hypothesis: There's no difference to the candidate's likelihood of advancement between receiving an endorsement from Our Revolution and Club for Growth.
    b) Alternative Hypothesis: Club for Growth endorsed candidates are more likely to advance than Our Revolution endorsed candidates. (one-sided hypothesis test)

We are testing each hypothesis through two methods. The first method is the two-proportion Z-test. Through a two-proportion Z-test, we would be able to denote whether the endorsement is more relevant to the Democrat party or the Republican party. This is achieved through calculating the proportion of candidates who have advanced and received the endorsement for each party. The two-proportion Z-test will then determine whether the differences between the parties are statistically significant.

The second method is Bootstrapping. Bootstrapping will give us the confidence to infer results for primary elections going forward from results found by sampling with replacement. After calculating 500 proportion differences for each test, we would determine if 0 fell in the 95% confidence interval or not. If it didn't, that would allow us to infer which endorsement has a greater importance in advancing the candidate in comparison to the other.

To correct for our multiple hypothesis tests, we are running Bonferroni correction and the Benjamini-Hochberg method. Through Bonferroni correction, we are controlling for the family-wise error rate (the probability of getting at least one false positive) and with Benjamini-Hochberg, we are controlling for the false discovery rate (the expected false discovery proportion). For each of our six hypothesis tests, we have calculated a set of p-values for which we are controlling for these error rates, outputting a set of decisions for which we have controlled using an alpha level of 0.05.

Results

Democratic Party Endorsement

Through the 2-proportions z-test, we received a p-value of 0.00000000000000002105, which is significantly smaller than our naive p-value threshold of 0.05. Hence, we rejected the null hypothesis, which suggests that our alternative hypothesis is true. There is a difference to the candidate's likelihood of advancement if the candidate receives the Democratic Party endorsement.

From the Bootstrapping method, we found that the 95% confidence interval is from [0.6011, 0.7214]. Since this does not include 0, receiving Democratic Party Support is statistically significant. This implies that a candidate receiving Democratic Party support has a greater chance of advancing.

Republican Party Endorsement

Through the 2-proportions z-test, we received a p-value of 0.0000003883, which is significantly smaller than our naive p-value threshold of 0.05. Hence, we rejected the null hypothesis, which suggests that our alternative hypothesis is true. There is a difference to the candidate's likelihood of advancement if the candidate receives the Republican Party endorsement.

From the Bootstrapping method, we found that the 95% confidence interval is from [0.2717, 0.4119]. Since this does not include 0, receiving Republican Party Support is statistically significant. This implies that a candidate receiving Republican Party support has a greater chance of advancing.

NRA vs Gun Sense

Through the 2-proportions z-test, we received a p-value of 0.0003939, which is smaller than our naive p-value threshold of 0.05. Hence, we rejected the null hypothesis, which suggests that our alternative hypothesis is true. NRA endorsed candidates are more likely to advance than Guns Sense endorsed candidates.

From the Bootstrapping method, we found that the 95% confidence interval is from [-0.4379, -0.0620]. Since this does not include 0, the difference between receiving NRA and Guns Sense endorsement is statistically significant. This means that when there is an NRA endorsed candidate versus Guns Sense endorsed candidate, the NRA endorsed one is more likely to advance.

Emily's List vs Right to Life

Through the 2-proportions z-test, we received a p-value of 0.0007304, which is smaller than our naive p-value threshold of 0.05. Hence, we rejected the null hypothesis, which suggests that our alternative hypothesis is true. Emily's List endorsed candidates are more likely to advance than Right to Life endorsed candidates.

From the Bootstrapping method, we found that the 95% confidence interval is from [0.1651, 0.4039]. Since this does not include 0, the difference between receiving Emily's List and Right to Life endorsement is statistically significant. This means that when there is an Emily's List versus Right to Life endorsed candidate, the Emily's List endorsed one is more likely to advance.

Biden versus Trump

Through the 2-proportions z-test, we received a "nan" value. This is because we do not have a big enough sample size to determine a causal effect. From comparing simple differences of means (SDO), we found the difference between Biden Endorsement and Trump Endorsement to be 0.1176, meaning that Biden's endorsement is probably more powerful, but no conclusion can be made. This is confirmed by our Bootstrapping method, which returned a 95% confidence interval of [0.0, 0.222], hence concluding that our results are statistically insignificant.

Our Revolution vs. Club for Growth

Through the 2-proportions z-test, we received a p-value of 0.01396, which is smaller than our naive p-value threshold of 0.05. Hence, we rejected the null hypothesis, which suggests that our alternative hypothesis is true. Club for Growth endorsed candidates are more likely to advance than Our Revolution endorsed candidates.

From the Bootstrapping method, we found that the 95% confidence interval is from [0.1096, 0.4439]. Since this does not include 0, the difference between receiving Our Revolution and Club for Growth endorsement is statistically significant. This means that when there is a Club for Growth versus Our Revolution candidate, the Club for Growth endorsed one is more likely to advance.

The Bonferroni correction method is controlling for the family-wise error rate, while the Benjamini-Hochberg procedure is controlling for the false discovery rate. The family-wise error rate is the probability that at least one result is a false positive. For our 500 samples, we are minimizing the probability that we have a false positive by the amount we assign as our alpha level, which is 0.05. The false discovery rate is the number of decisions that we have deemed "true" over the total number of decisions made. In our case, we are trying to reduce this proportion as much as possible. So, by setting our alpha at 0.05, we are setting a threshold such that each of our p-values can be corrected to output a corrected set of decisions. These decisions are corrected so that we are willing to accept a false positive result only 5% of the time.

Discussion

For the correction procedures for all of our tests, we used an alpha level of 0.05. For Republican party endorsement, 314/500 samples remained significant after Bonferroni correction while 500/500 samples remained significant after applying the Benjamini-Hochberg procedure. For Democratic party endorsement, 500/500 samples remained significant after both Bonferroni and Benjamini Hochberg. For our Emily's List vs Right to Life question, 9/500 samples remained significant after Bonferroni and 466/500 samples remained significant after Benjamini-Hochberg. For the Our Revolution vs Club for Growth question 1/500 samples remained significant after Bonferroni while 4/500 remained significant after Benjamini-Hochberg. For the Gun Sense vs NRA question 0/500 samples remained significant after the Bonferroni method was applied. For the Biden vs Trump question 0/500 samples also remained significant after the Bonferroni method was applied. For the last two questions, we were unable to run the Benjamini Hochberg procedures due to very high valued p-values. Because of this, Benjamini-Hochberg would not run, since no p-value was able to satisfy the rejection rule. We could've adjusted the alpha level to account for this issue, but we did not feel comfortable allowing a false positive more than 5% of the time.

The individual tests demonstrate that there are specific endorsements that a candidate should acquire in order to advance. Since Democratic Party support's confidence interval of proportion differences were higher than Republican's, we can infer that party support is more necessary for Democrats than it is for Republicans. On the gun rights issue, NRA is a more critical endorsement while with the abortion issue, Emily's List Endorsement is more important. Club for Growth endorsement had a higher significance than Our Revolution. These results in aggregate portray which endorsements are heavily valued in the eyes of the voters. If candidates are able to secure these endorsements, they will be more likely to advance. For example, a Democratic Party candidate should put more effort in acquiring its own party support and Emily's List endorsement. For the Republican party, a candidate should put more effort in acquiring its own party support, NRA, and Club for Growth endorsements.

One of the limitations that we experienced during our multiple hypothesis testing, and specifically while doing our error rate correction, was that we were getting very high p-values for a few of our tests. Because of this, the standard alpha level of 0.05 was too low of a cutoff for the Benjamini-Hochberg Procedure to even run. An adjusted p-value could have accounted for this issue, but we were not willing to accept a false positive result more than 5% of the time. In this way we avoided p-hacking because we would rather leave our alpha level at 0.05 than increase it in order to show statistically significant results. Finally, we lacked information on many major figures in the Democratic and Republican parties, including Mike Pence and Obama, both of whom were either current or previously pivotal political figures. This limited our understanding of the influence of endorsements from major figures, which are key in influencing how and where candidates campaign and how voters think.

VI. Conclusions

Our final results for both our causal inference research question and hypothesis testing question research question respectively showed interesting results. For causal inference, we found that there was a high correlation with advancing in the primaries for both parties after receiving the treatment of being endorsed by their party. When accounting for states as a confounder, we found that most of the states were statistically significant, which helps us understand that a candidate being from that state affects their likelihood of advancing in the primaries. Finally, we settled upon 4 major endorsement groups for each respective party which highlighted what we believe are significant policy issues in most elections: abortion, guns rights, taxation, and endorsement by a majority party figure. When accounting for this for democrats, we found that being endorsed by Emily's List, Guns Sense Candidacy, and Our Revolution were all statistically significant, while being endorsed by Biden was not. For republicans, all 4 endorsement variables were statistically significant as represented by: Right to Life, NRA, Club for Growth, and Trump. Our causal inference method helped us understand the relationship between particular variables such as states and endorsement groups. A call to action from these results is for party leaders within respective parties to better understand the dynamics of different PACs that are best suited for resulting in advancing in the primaries.

For hypothesis testing, we found that having Party Support, NRA, Emily's List, and Club for Growth endorsements were more important than their respective counterpart endorsements in the opponent party. Candidates can decide which endorsements they should seek first in order to build their campaign. In addition, they can build their campaign policies around the more salient issues found from the endorsements.

We did not merge different data sources, because data on endorsements in particular is not very centralized and can be unreliable. As such, there could be an unknowing effect of a particular endorsement or lack thereof on a candidacy. A major limitation in our dataset is only having access to 2018 data. Having endorsement data over time is integral in understanding an endorsement's impact on campaigns historically and account for anomalies in elections that we may not understand from one year of data. Another limitation in our dataset is knowledge of how endorsements are made for each respective PAC, this data is mainly domain knowledge, but can also help us analyze demographic characteristics or qualifications that result in particular endorsements. Finally, an adjacent topic of interest that can supplement our work is analysis on the funding that candidates received in relation to their endorsements. While getting an endorsement alone is integral in a candidate advancing, most PACs often fund candidates campaigns which allows them to also have access to more resources that lead to their eventual win. Super PAC funding has been a contentious topic of interest in recent elections, especially in a Post Citizens United Era.