A Statistical Study of Swing State Behavior in the 2020 US Presidential Election

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Abstract

This paper studies factors that influenced the voting behavior of 15 key swing states in the 2020 United States presidential election by linking statistical clustering methods with notable political events. In addition to key decisions made in the Trump administration, factors unique to this presidential election such as the global COVID-19 pandemic and the Black Lives Matter movement were investigated. In order to identify the most important swing states, a Swing State Index was derived using the 2012, 2016, and 2020 election outcomes. Next, hierarchical clustering was used to group the 15 swing states based on the Swing State Index, and the relationships between each cluster were attributed with events that may have factored into the cluster behavior. The most representative and significant swing states were identified to be Arizona, Georgia, Wisconsin, and Pennsylvania (based on the clustering history) as well as Michigan and Minnesota (based on the Swing State Index). After analyzing specific events that affected these six states' voting behavior, the Black Lives Matter movement and concerns over health care were the most significant factors in President Trump's defeat. The study of similar events by connecting political science (e.g. government decision-making) and clustering methods can be applied to future elections to better predict the outcome of important swing states and, thus, the overall election results. This paper aims to demonstrate how modern statistical tools can provide more insight into underlying patterns in politics.

Key Words: Political Science, Presidential Election, Swing States, Hierarchical Clustering, COVID-19

1. Introduction

Although Joe Biden has been declared president-elect of the 2020 US presidential election (Kommenda 2020), his road to victory was not a straightforward one, influenced by the unexpected results from several swing states. This election was unique in many respects including the impact of an unsuccessful impeachment, a stock market crash, the COVID-19 pandemic, and a myriad of human rights protests fueled by the revival of the Black Lives Matter movement. The main objective of this project is to analyze the impact of these important events and the Trump administration's decisions on topics such as healthcare, Supreme Court nominations, and its response to COVID-19 on election outcomes. The preliminary research in this section will be used to explain how potential factors may have influenced voting in favor of Joe Biden. The impact of swing states on elections based on the electoral college voting system will also be discussed.

1.1 Important Events Leading Up to the Election

From the many events leading up to the 2020 presidential election, the most notable issues include "an economy in recession, the COVID-19 pandemic, health care, race relations, … and the future of the judiciary" (Memfis 2020). Many of these events are interrelated as the

COVID-19 pandemic helped fuel the stock market crash in early 2020. The economic effects of the pandemic as well as the Trump administration's reaction has caused "40 percent of U.S. adults [to be] … more likely to vote for Democratic candidates in the U.S. election" (Duffin 2020). In addition to the COVID-19 pandemic, the Black Lives Matter movement helped shape the 2020 election, as a survey conducted for the Associated Press showed that "roughly a fifth of all voters said the racial justice protests were the single most important factor when voting in the election" (Ramirez 2020).

Although these events considerably influenced many voters in choosing a candidate in this presidential election, President Donald Trump's reaction to these events proved to be the deciding factor that swayed many to vote for Joe Biden. President Trump's handling of the COVID-19 pandemic - which involved "forgo[ing] a nationwide strategy to combat the coronavirus in favour of allowing state governors to form their own plans" and falsely mocking "the virus as a media conspiracy" (Bennett 2020) despite contracting it himself - has caused many to question his shrewdness and trustworthiness. His constant disregard for the scientific research related to COVID-19 has "undermin[ed] public health experts, scientists, and physicians who have been trying to address this issue," (Wallace 2020). Additionally, his lack of sympathy in the Black Lives Matter movement, such as calling it a "toxic propaganda" (Niedzwiadek 2020) caused him to lose potential voters who supported and partook in the cause. Thus, several decisions made by President Trump, along with his administration's response to certain events, influenced who the voters eventually cast their ballot for.

Besides the COVID-19 pandemic and the Black Lives matter movement, President Trump's decision and policies on other aspects such as Supreme Court justice replacements and healthcare reforms caused many voters in the middle of the political spectrum to cast their vote for Joe Biden. His nomination of more conservative Supreme Court judges: Neil Gorsuch, Brett Kavanaugh, and Amy Coney Barrett, may have caused voters to lean towards a more liberal, Democratic presidential candidate so that the three federal branches (legislative, executive, and judicial) have a greater chance of remaining more balanced. Furthermore, the Trump administration made significant efforts to weaken the Affordable Care Act (ACA) formed under the Obama administration by eliminating the health insurance mandate in 2019 which caused President Trump to lose some supporters who depended on government-backed healthcare benefits. Under Trump's presidency, 2.3 million Americans lost health insurance, leading to at least 4000 deaths (Woolhandler 2020). Additionally, Judge Amy Coney Barrett's nomination to the Supreme Court further "heighten[ed] the existential threat to the ACA" (Thompson 2020) as Barrett has repeatedly called into question the ACA's constitutionality, significantly decreasing the number of President Trump's supporters who rely on the ACA to cover a portion of their medical bills. Additionally, President Trump has been unable to significantly lower the prices of prescription drugs (which remains a major concern for many American seniors) during his term, only reducing "less than 1 percent … out-of-pocket costs" (Rapfogel 2020). In addition to his own impeachment and his efforts to delegitimize mainstream media, these policies and decisions made under the Trump administration may have greatly shifted voters towards a Democratic candidate.

1.2 Electoral College
Although the previous section covered important events that influenced the election outcome, only the swing states' voting behavior could ultimately decide it. Swing states can reasonably be won by either the Democratic or Republican presidential candidate while safe states consistently lean towards one party. The importance of swing states is reflected

in the electoral college, the system used by the United States for determining presidents, which allocates each state a fixed number of electoral votes. A candidate must win a majority of the electoral votes in a state to win the entire state (with the exception of Maine and Nebraska which are both historically safe states), rendering the election process a mostly an all-or-nothing system. In order to win the U.S. presidential election, a candidate must win a minimum of 270 electoral votes. States that have a history of being undecided or "swung" by a presidential candidate greatly influence the election outcome because all of their electoral votes can be won by only a small margin of popular votes. In the next section, a swing state index will be derived to weigh the importance of different swing states which will be later extended to study the overall election behavior.

2. Data Collection and Swing Index

The election outcome was heavily influenced by 15 key swing states as shown in Table 1. These states were chosen based on their impact on past elections in 2012, 2016, and 2020 (Sand 2019; Sabato 2016). Positive percentages indicate that the state voted in favor of the Republican Party and negative percentages indicate that the state voted in favor of the Democratic Party for that year. Next, the Swing State Index was derived using the formula (2016%-2012%)(2020%-2016%)*10,000. The larger the magnitude and the more negative the swing index, the more that state has "swung" in the past three elections. If the two differences (2020-2016 and 2016-2012) are the same, then it indicates that the state has had the same voting trend across the past 8 years (either becoming more Democratic and "bluer," or Republican and "redder"), and the Swing State Index will be positive (negative*negative or positive*positive). However, if the state changes direction, then the signs of the two differences will not be equal, and the Swing State Index will be negative, displaying more of a swing behavior. As seen in Table 1, the two states that "swung" the most are Minnesota and Michigan which will be further studied in Section 3. Using a swing index calculated using (2012%)*(2016%)*(2020%) was initially considered to assess the swing behavior via a switch to another party's presidential candidate (a switch of signs) instead of trending direction. However, small differences in voting behavior can change the sign of this index, causing only the magnitude (not the sign) to be a reliable indicator for the degree of "swing" of a state.

Table 1: Data Collection and Swing Index

States	Electoral Votes	2012 (Actual)	2016 (Actual)	2020 (Actual)	Swing Index
Iowa	6	-5.8%	9.4%	8.2%	-1.1
Ohio	18	-3.0%	8.1%	8.2%	0.14
Georgia	16	7.8%	5.1%	-0.3%	2.31
North Carolina	15	2.0%	3.7%	1.3%	-0.55
Arizona	11	9.0%	3.5%	-0.3%	2.92
Florida	29	-0.9%	1.2%	3.3%	1.27
Wisconsin	10	-6.9%	0.8%	-0.7%	-1.13
Pennsylvania	20	-5.4%	0.7%	-1.0%	-1.12
Michigan	16	-9.5%	0.2%	-2.7%	-4.56
New Hampshire	4	-5.6%	-0.4%	-7.2%	-1.42
Minnesota	10	-7.7%	-1.5%	-7.2%	-3.50
Nevada	6	-6.7%	-2.4%	-1.6%	0.21
Colorado	9	-5.4%	-4.9%	-13.0%	-0.33
Virginia	13	-3.9%	-5.3%	-9.4%	0.76
New Mexico	5	-10.2%	-8.2%	-10.6%	-0.23

3. Statistical Analyses

The Swing State Index for each state was analyzed using hierarchical clustering to study the behaviors of each of the clusters, which were then further investigated using the clustering history. Although the Swing State Index reveals the voting patterns over the past three elections and the states that have historically "swung" the most, it does not describe key events that may have influenced their voting behaviors. Therefore, hierarchical clustering was applied to study states with similar voting behaviors and list potential factors that affected their voting behavior. From the discovered clusters, more research specific to each state was conducted and linked back to the preliminary findings in Section 1 to identify the most influential events in the 2020 presidential election.

3.1 Hierarchical Clustering

The hierarchical clustering method divided the 15 swing states into four clusters, using the 2012, 2016, and 2020 election results as seen in Figure 1. Hierarchical clustering was chosen due to its "bottom-up" approach where every observation (in this case state) is its own cluster before they were merged one at a time (and moved up the hierarchy). The dendrogram (the top graph in Figure 1) provides a visual representation of the cluster groupings (e.g. Iowa and Ohio belong to the same cluster as they are both colored red) and indicates the relationship between the cluster members (states). Four clusters were chosen based on the Scree plot (the bottom graph) which identifies the optimal number of clusters from where the graph "bends" like an elbow.
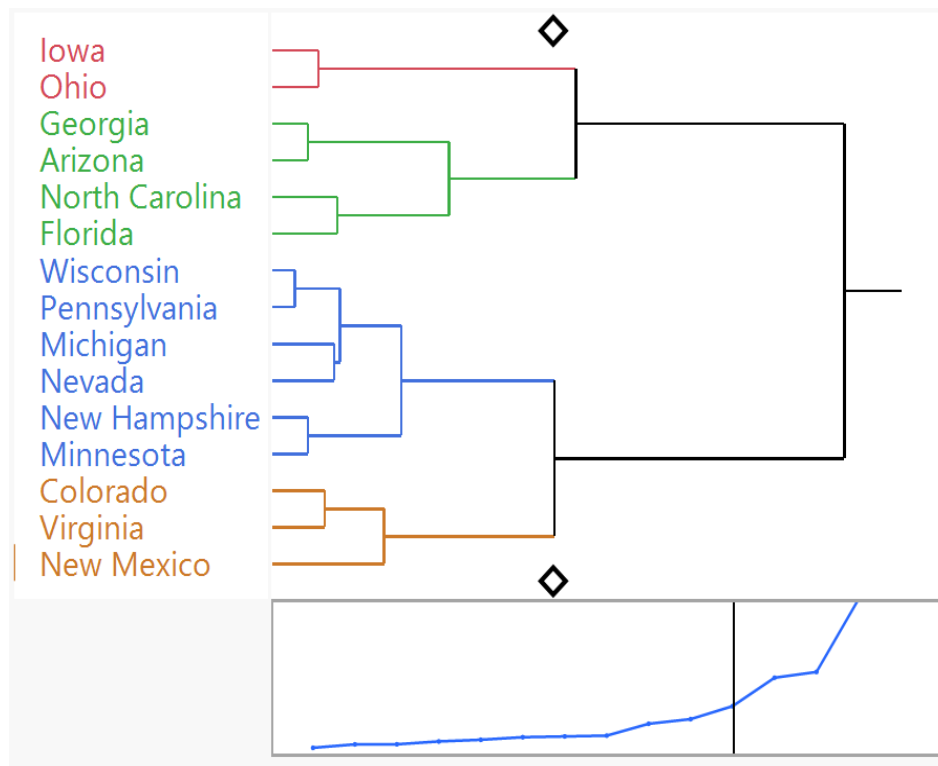

Fig.1: Hierarchical clustering dendrogram (top) and Scree plot (bottom)

Next, the attributes of the states in each cluster were analyzed to understand the differences between the four respective groups. The two states in the first cluster, Iowa and Ohio, were both "blue" in 2012, but red in the 2016 and 2020 elections. Thus, their general voting trend is to become more Republican. In contrast to the first cluster, the fourth cluster (Colorado, Virginia, and New Mexico) contains states that are all relatively quite negative and "blue." The second cluster has states with election trends pointing in one direction (either becoming "bluer" or `"redder"), except for North Carolina in the second cluster that became "redder" in 2016 and then "bluer" in 2020. As seen on the left-hand side of Figure 2, the swing index for all states but North Carolina were positive, indicating that they have the same trends. On the other hand, all states except for Nevada in the third cluster have a negative swing index due to a change of voting trend, suggesting that they are the most inconsistent swing states. Michigan and Minnesota, the states which have the greatest swing tendency (as discussed in Section 2), are both in this cluster. In summary, each cluster represents its own pattern - the first with a change of results in 2012, the second with a trend in one direction, the third filled with the most volatile swing states (changes in trend), and the fourth with the most stable and predictable swing states.
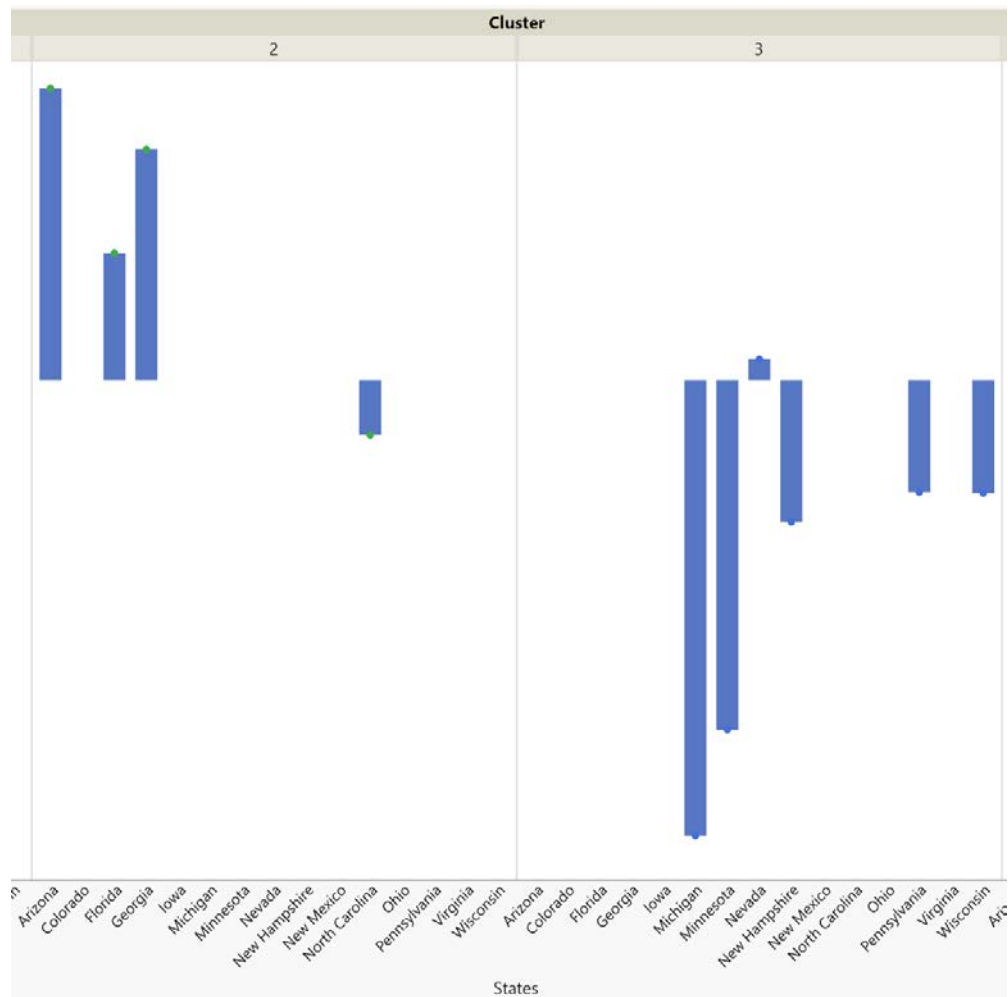

Fig.2: Swing Index vs. Swing State for clusters 2 and 3

3.2. Studying the Most Important Swing States

In addition to Minnesota and Michigan which have the greatest swing tendency, other noteworthy states were chosen using the hierarchical clustering results and the clustering join pattern. The clustering history indicates how states join to form clusters (e.g. for 14 clusters, the first two states that "paired up" were Wisconsin and Pennsylvania while the other 13 states remained in their own cluster). Each individual cluster was then combined with other clusters one at a time until the optimal number of clusters was reached (which was chosen as four based on the Scree plot).

After selecting the most important states based on the clustering join history, potential factors that may have influenced the voting behavior of these states were investigated and interpreted according to the clusters they were grouped into and the cluster's own characteristics (as discussed in Section 3.1). As seen in Figure 3, the first two pairs chosen to be joined into a cluster were Georgia/Arizona and Wisconsin/Pennsylvania, respectively. Interestingly, these four states are members of the two clusters that contain all the states that "switched sides" in the 2020 election. Thus, by studying events that influenced the two most strongly connected pairs in Cluster 2 and 3 in addition to the two states that "swung" the most, the most important incidents that affected the 2020 election in general can also be identified (as these events may also influence other states in their clusters to switch parties).

Number of Clusters	Distance	Leader	Joiner
14	0.194112187	Wisconsin	Pennsylvania
13	0.302497298	Georgia	Arizona
12	0.305005698	New Hampshire	Minnesota
11	0.394441634	Iowa	Ohio
10	0.446849363	Colorado	Virginia
9	0.527686265	Michigan	Nevada
8	0.553445115	North Carolina	Florida
7	0.577730743	Wisconsin	Michigan
6	0.951416439	Colorado	New Mexico
5	1.096840607	Wisconsin	New Hampshire
4	1.505588474	Georgia	North Carolina

Fig. 3: Join history of the hierarchical clustering for the 15 swing states

3.2.1 Georgia and Arizona
Georgia and Arizona have become bluer in the past 8 years, both making the change from red to blue in 2020. In Georgia, "almost half of Biden's gains came from the four largest

counties...with large Black populations" (Kat 2020), indicating the power that black voters had in this election in "flipping" key swing states. The organizers and activists of the Black Lives Matter movement in Georgia held "Biden accountable for [his] promises of economic investment, tackling systematic racism, policing reforms, and improv[ing] health care" (Kat 2020). Like Georgia, Arizona's primary reason for turning blue may be because of the unrest fueling the Black Lives Matter movement and shifting demographics (Lah 2020). A poll conducted by Monmouth University revealed that Arizona voters are worried about the COVID-19 pandemic, economic stability, and access to health care, but were "even more worried about the potential breakdown of law and order" that the Black Lives Matter movement exposed (Santos 2020). Additionally, important demographic factors such as a greater showing of Latino voters and dwindling power from rural votes (Moore 2020) also played a role in Arizona's vote for Biden, despite having not voted blue in over 60 years. Therefore, issues revolving around racial injustice appear to have a significant hand in Georgia and Arizona's move towards a bluer state.

3.2.2 Pennsylvania and Wisconsin

Both Wisconsin and Pennsylvania marginally voted for President Trump in 2016, but they voted for Biden in 2020. In a recent article interviewing Wisconsin voters, many voters said that they switched to Trump in 2016 after their health insurance costs went up in 2012 under Obama (Brewster 2020) as they believed that Trump would cut them back down. Nevertheless, despite President Trump's promise to lower medical costs during his 2016 presidential election campaign, many were unsatisfied with what he delivered with regard to health and healthcare, including his administration's response to COVID-19. A recent poll that surveyed Wisconsin voters found that the economy (22%) and health care (20%) are the top issues for them. Although Wisconsin voters were equally divided on their views on President Trump's handling of the economy, a large percent of voters (58%) believe President Trump is not doing well in other issues such as health care (Kirzinger 2019). In Pennsylvania, 97% of voters, aged 50+, stated that healthcare was their top consideration in the 2020 election as the Trump administration had unsuccessfully attempted to appreciably lower out-of-pocket costs (Rapfogel 2020). Thus, both Wisconisn and Pennsylvania voters appear to have been keen on health care improvements which may have caused them to vote Democratic.

3.2.3 Michigan and Minnesota

Although Michigan and Minnesota did not appear to be paired in the clustering history in Figure 3, both have a negative swing score of the largest magnitude. In Michigan, the record-breaking turnout seen in the 2020 election caused cities such as Detroit "that [are] nearly 80% Black" (Karson 2020) to vote blue. The increase in black voters largely voted Democratic, with "94 percent [of them] support[ing] the Black Lives Matter movement" (Haddad 2020) and were offended by President Trump's view that the movement was toxic. Although Minnesota has voted blue consistently in the 2012, 2016, and 2020 election, it remains the second "largest" swing state due its change in party trend (decrease in Democratic support in 2016 and increase in 2020). Similar to Michigan, it was an increase in voter turnout of another demographic, college voters, that caused it to increase its blue margin. Young voters "overwhelmingly [chose] Biden … [and] 66% of Minnesota youth voted for Biden, compared to just 32% for Trump" as many were "looking for a more progressive candidate .. [and] wanted to see a swift COVID-19 response" (Jackson 2020). The election behavior of Michigan and Minnesota is largely attributed to a change in voting demographics, but recurring events such as the COVID-19 pandemic and Black Lives Matter movement continue to be the underlying motives for many of the Biden-leaning voters.

4. Results and Conclusions

Both a Swing State index and Hierarchical Clustering methods were used to study the swing state patterns for 15 key states, and the four clusters from the hierarchical clustering revealed different voting patterns across the swing states in the last 3 presidential elections. While election results for states in the second cluster like Arizona and Georgia were mostly affected by issues regarding civil rights, Pennsylvania and Wisconsin in the third cluster voted for Biden due to economic, health, and environmental reasons. The two greatest swing states, Michigan and Minnesota, voted for Biden partly due to a greater voter turnout in certain demographics. Ultimately, a worsening COVID-19 situation, reinvigorated movements like Black Lives Matter, and increasing dissatisfaction towards Trump's policies (mostly healthcare-related) fueled several states to turn from red to blue. Biden was able to keep all states that voted blue in 2016 and turn 5 of the 9 swing states that had voted for Trump. Future events can be paralleled with the impact of past events and decisions on election results using clustering methods to increase the ability to predict outcomes of key swing states and therefore improve the accuracy of election predictions. This paper demonstrates how the innovative use of statistical modeling can help recognize comprehensive patterns more effectively and efficiently in the realm of politics.

Acknowledgements

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