

**W200 - Project 2 - Dec 2020**  
**Presidential Election Swing States**  
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## **Summary**

In the wake of the 2020 Presidential Election, there have been allegations of fraud. Many of these allegations focus on irregular voting patterns (Appendix A). To facilitate better public access to information about voting patterns in the Presidential Election, we gathered voting data from the 2012, 2016, and 2020 Presidential elections, and present it below. Our aim is to present the data in as objective a manner as possible (including providing access to the raw data files).

When conducting this analysis, we made the difficult decision to limit its scope to the states of AZ, FL, GA, MI, NC, OH, PA, and WI, which are referred to below as the states of interest. This has the potential to introduce bias, but we felt it was necessary due to our own resource constraints and the time constraints of potential readers. The states we selected are a subset of states designated as swing states in the 2020 election. Our subset was selected to include the most controversial states in the voter fraud allegations, and also a balance of states that went democratic and states that went Republican in 2020.

## **Research Questions**

In keeping with our aim to present the data in an objective manner, we refrained from making inferences from the data or using the data to support an argument. Instead we focus on questions that describe the data, such as:

- 1) What was the voter turnout in the States of Interest in 2012, 2016, and 2020?
- 2) Which counties had the largest change in voter turnout from 2016 to 2020?
- 3) Which states and counties flipped between the 2012 and 2016 elections and between the 2016 and 2020 elections?
- 4) Did more counties flip from 2016 to 2020?
- 5) What proportion of the voters do flipped counties represent? Were they enough to flip a state?
- 6) Are county metrics a good indicator of state results?
- 7) How have demographic (ethnicity, education, age) voting trends changed between the 2012, 2016, and 2020 elections

## Data Sets

- 1) Voting data: voting data for the 2012 and 2016 presidential election was taken from the [MIT Election Data and Science Lab](#) on the Harvard Dataverse website. Voting data for the 2020 election was downloaded from the official state elections websites for the states of interest on 11/22/2020. Links to these websites are provided in the references section. Because election results continue to be updated in many of these states, our 2020 numbers may differ slightly from the final official election results tabulated in the future.
- 2) Voting age population data: data on voting-age population in the states of interest and their respective counties was downloaded from the [US Census website](#). Because the 2020 census results have not yet been released as of the writing of this report, we used the census estimates for 2019 as a proxy for 2020. This will likely drive a higher voter turnout percentage, as populations tend to increase year over year, however, we have seen this methodology employed by various news organizations, and believe it is the best available estimate.
- 3) US Census demographic data at the county level were downloaded from [Google BigQuery](#) for 2012, 2016, and 2018 (5-year projections). Each dataset had 253 variables so we identified the critical metrics to evaluate how ethnicity, gender, and education affect the presidential elections.

## Data Cleaning

Before beginning our analysis we had to clean and merge five different datasets using a combination of keys.

The US voting data and Census voting age population were joined on year, county, and state. It was essential to merge on all three variables as county names are not unique and are duplicated within multiple states. Only two (Grand Traverse County and St. Croix County) of the 1953 counties had to be manually mapped due to variations in spelling between the datasets. We cleaned the data by ensuring the county names matched and removing any duplicate records.

The US Census Demographic data used a Federal Information Processing Standards (FIPS) County Code instead of a county name. This required us to first map the county code to its county name and state using a mapping file from the US Census website before joining it with the voting data set.

After creating the final dataset which included the voting, age, and additional demographic data, we derived additional variables from our data to be used in the analysis. These included creating metrics for the percentage of republican and

democratic votes in each county as well as percentage values for ethnicity, education, gender, and age to help compare counties.

## **Sanity Checks**

### **Sanity Check #1 Vote Totals:**

Early on we performed a sanity check and noticed a discrepancy in the MIT election lab data. The 2016 numbers for Gila, Graham, and Greenlee county in AZ were inconsistent. Their candidate vote numbers did not sum to match the total votes column. Upon further investigation we found that in the entire datasets from 2000-2016 there were only 5 instances of this issue (including the 3 in AZ for 2016). We checked the 2016 voting data from the official AZ website, and confirmed it was an entry error in the total votes column.

### **Sanity Check #2 County Counts:**

After merging together the vote data set and census data set we checked county counts by state to ensure no counties had been duplicated as a result of the merge. We found through this check that the 2020 Worth County, Georgia datum was duplicated. The county was duplicated as a result of duplication within the Census data frame. This duplication in the Census data was corrected to remove the duplication in the full data set. The county counts for each state were also checked against state websites to ensure no counties were missing from all three years of voter data.

### **Sanity Check #3:**

After merging all three datasets we ran a quick analysis to confirm there were no anomalies in the data:

- All 1953 counties were represented for all 3 elections
  - No mismatched counties or years
- County vote totals never exceeded total population
- No NULL values in variables analyzed

## Section 1 - Voter Turnout:

### 1) Metrics:

Total voter turnout was calculated as  $[\text{total votes cast}] / [\text{voting age population}]$ .

Republican voter turnout was calculated as  $[\text{Votes cast for the republican candidate}] / [\text{Voting age population}]$ .

Democrat voter turnout was calculated as  $[\text{Votes cast for the democrat candidate}] / [\text{Voting age population}]$

### 2) Voter turnout by state:

Total voter turnout was up across all the states of interest in 2020 with the largest increases in MI, GA. and AZ.

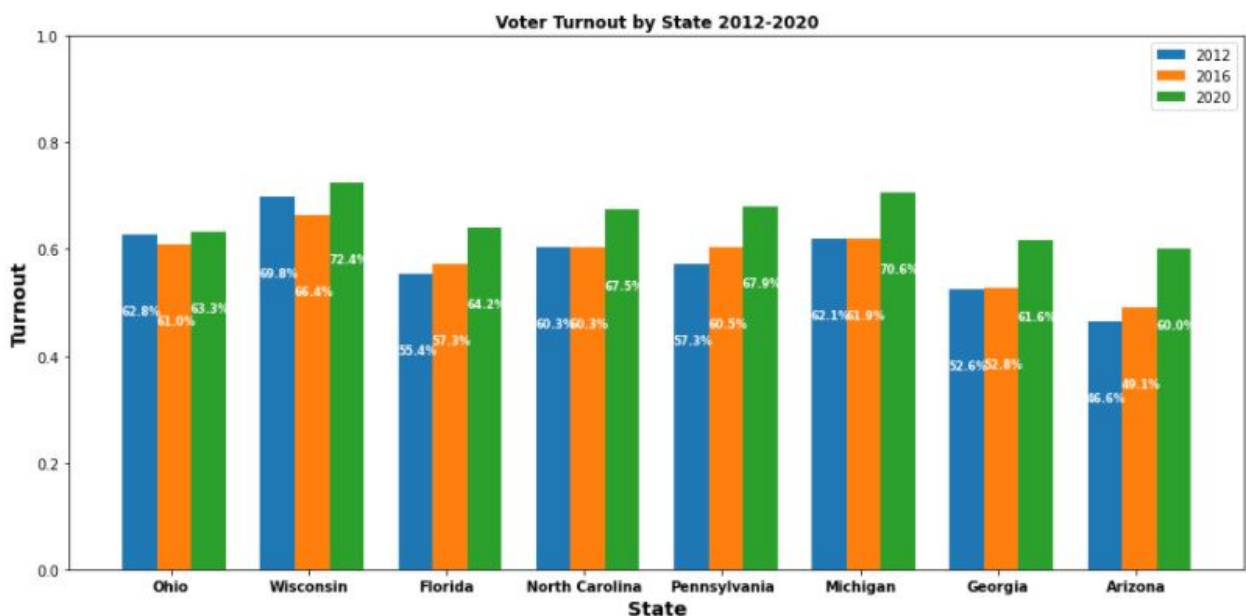


Figure 1.1  
Voter turnout by State 2012-2020

### 3) Voter turnout by county:

The vast majority of counties saw voter turnout increase from 2016 to 2020. This was true for both parties.

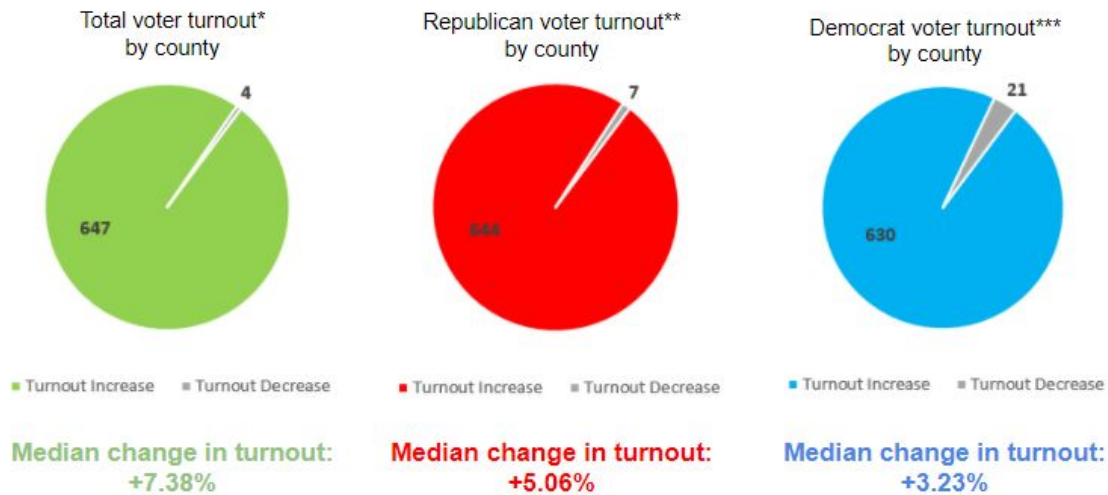


Figure 1.2  
Change in County Turnout 2016 to 2020

#### 4) Largest changes in voter turnout at the county level:

There were counties with large increases in voter turnout in many states. Most of the counties with large increases in voter turnout went red. This is consistent with that fact that the majority of counties overall went red.

Figure 1.3  
Counties with Largest Increase in Turnout 2020

#### Top 20 Counties by Increase in Total Voter Turnout (2020-2016)

Rank	State	County	Turnout		Winner		Turnout Increase (2020 - 2016)	Voting Age Pop 2020
			2016	2020	2016	2020		
1	Florida	GULF COUNTY	53.7%	73.2%	red	red	19.5%	11,147
2	Georgia	BRYAN COUNTY	60.0%	76.3%	red	red	16.3%	27,979
3	Georgia	DAWSON COUNTY	62.8%	77.1%	red	red	14.4%	20,853
4	Michigan	GOGEBIC COUNTY	56.8%	71.1%	red	red	14.3%	11,633
5	Arizona	APACHE COUNTY	53.8%	67.0%	blue	blue	13.3%	52,462
6	Georgia	JACKSON COUNTY	56.1%	69.1%	red	red	13.1%	54,499
7	North Carolina	DARE COUNTY	67.8%	80.5%	red	red	12.7%	30,088
8	Michigan	OSCODA COUNTY	60.9%	73.3%	red	red	12.5%	6,646
9	Pennsylvania	PIKE COUNTY	58.2%	70.6%	red	red	12.4%	46,099
10	Arizona	NAVAJO COUNTY	51.0%	63.3%	red	red	12.2%	81,804
11	Georgia	JASPER COUNTY	57.8%	70.0%	red	red	12.2%	10,924
12	Michigan	BENZIE COUNTY	71.7%	83.9%	red	red	12.2%	14,621
13	Georgia	EFFINGHAM COUNTY	54.6%	66.7%	red	red	12.1%	47,339
14	Georgia	LIBERTY COUNTY	36.6%	48.6%	blue	blue	12.0%	44,034
15	Arizona	MOHAVE COUNTY	47.4%	59.2%	red	red	11.8%	176,822
16	Michigan	MISSAUKEE COUNTY	63.4%	75.1%	red	red	11.6%	11,658
17	Michigan	LIVINGSTON COUNTY	72.1%	83.7%	red	red	11.6%	151,981
18	Georgia	GILMER COUNTY	53.4%	65.0%	red	red	11.6%	25,438
19	Georgia	WEBSTER COUNTY	53.9%	65.4%	red	red	11.5%	2,124
20	Georgia	CHEROKEE COUNTY	62.1%	73.6%	red	red	11.4%	196,911



5) Voter turnout by party at the county level:

Republican voter turnout increases by county were larger than Democrat voter turnout increases by county. However, large increases in Democrat voter turnout occurred in counties with larger populations.

**Top 20 Counties with the Largest Increase in Republican Voter Turnout (2020-2016)**

Rank	State	County	Republican Turnout		Rep Turnout Increase (2020-2016)	Republican Votes 2020	Voting Age Pop 2020
			2016	2020			
1	FL	GULF COUNTY	39.2%	54.8%	15.6%	6,113	11,147
2	GA	JASPER COUNTY	41.7%	53.3%	11.6%	5,822	10,924
3	GA	DAWSON COUNTY	52.8%	64.2%	11.4%	13,398	20,853
4	GA	HEARD COUNTY	37.8%	48.6%	10.9%	4,516	9,284
5	GA	HARALSON COUNTY	43.8%	54.5%	10.6%	12,331	22,637
6	MI	MISSAUKEE COUNTY	46.7%	57.0%	10.3%	6,648	11,658
7	AZ	MOHAVE COUNTY	34.6%	44.4%	9.9%	78,535	176,822
8	GA	PIERCE COUNTY	44.0%	53.7%	9.7%	7,899	14,696
9	MI	OSCODA COUNTY	42.5%	52.2%	9.7%	3,466	6,646
10	PA	FULTON COUNTY	49.1%	58.5%	9.5%	6,824	11,655
11	GA	BRYAN COUNTY	41.6%	50.9%	9.3%	14,244	27,979
12	PA	ELK COUNTY	40.9%	50.2%	9.3%	12,140	24,173
13	GA	HART COUNTY	36.3%	45.5%	9.2%	9,464	20,783
14	GA	FRANKLIN COUNTY	40.5%	49.7%	9.2%	9,069	18,249
15	GA	JACKSON COUNTY	44.9%	54.1%	9.2%	29,497	54,499
16	WI	OCONTO COUNTY	44.5%	53.7%	9.2%	16,266	30,302
17	GA	PIKE COUNTY	53.3%	62.5%	9.2%	9,127	14,613
18	PA	BEDFORD COUNTY	50.3%	59.5%	9.2%	23,025	38,720
19	MI	MONTCALM COUNTY	34.7%	43.8%	9.0%	21,815	49,856
20	GA	UNION COUNTY	52.0%	61.0%	9.0%	12,651	20,737
						SUM	596,233

**Top 20 Counties with the Largest Increase in Democrat Voter Turnout (2020-2016)**

Rank	State	County	Democrat Turnout		Dem Turnout Increase (2020-2016)	Democrat Votes 2020	Voting Age Pop 2020
			2016	2020			
1	AZ	APACHE COUNTY	33.2%	44.4%	11.2%	23,293	52,462
2	GA	HENRY COUNTY	30.8%	41.8%	11.0%	73,276	175,285
3	GA	ROCKDALE COUNTY	34.9%	45.4%	10.4%	31,244	68,889
4	MI	LEELANAU COUNTY	37.8%	48.1%	10.4%	8,795	18,267
5	GA	FAYETTE COUNTY	27.3%	37.5%	10.2%	33,065	88,100
6	GA	GWINNETT COUNTY	25.3%	35.2%	9.9%	241,827	687,242
7	MI	GRAND TRAVERSE COUNTY	28.7%	38.5%	9.8%	28,683	74,544
8	GA	COBB COUNTY	28.3%	38.0%	9.8%	221,846	583,231
9	AZ	COCONINO COUNTY	29.3%	39.0%	9.7%	44,698	114,726
10	WI	MENOMINEE COUNTY	33.2%	42.8%	9.7%	1,303	3,041
11	GA	DOUGLAS COUNTY	29.7%	39.4%	9.6%	42,809	108,767
12	WI	BAYFIELD COUNTY	40.2%	49.5%	9.3%	6,155	12,431
13	PA	CHESTER COUNTY	35.7%	44.8%	9.1%	182,372	407,024
14	MI	WASHTENAW COUNTY	43.3%	52.4%	9.1%	157,136	299,837
15	MI	EMMET COUNTY	26.5%	35.6%	9.1%	9,662	27,161
16	PA	MONTGOMERY COUNTY	40.0%	49.0%	9.0%	319,511	652,435
17	MI	KENT COUNTY	28.6%	37.6%	9.0%	187,915	499,890
18	GA	FORSYTH COUNTY	14.9%	23.6%	8.8%	42,203	178,574
19	MI	BENZIE COUNTY	28.8%	37.5%	8.7%	5,480	14,621
20	GA	DEKALB COUNTY	44.0%	52.7%	8.7%	308,227	584,968
						SUM	4,651,495

Figure 1.5  
Counties with Largest Increase in Turnout by Party 2020

## Section 2 - Flipped States and Counties

One of the central points of contention during the 2020 election has been the visible flipping of multiple states as vote counts were updated in the week following the election. As established in the previous section, voter turnout was at the highest levels since 2012 in all states of interest. The next question we consider is what states and counties flipped between 2016 and 2020 and how does that compare to the change from 2012 to 2016.

The 2020 election saw five states flip, all swing states. Arizona, Georgia, Michigan, Pennsylvania, and Wisconsin flipped from Republican to Democratic in the 2020 election. Of these five states, three were Democratic in every election since 1992 except for the 2016 elections. The other two states, Georgia and Arizona, are more interesting. For both, this was the first year the state went Democratic since 1992 and 1996 respectively.

From 2012 to 2016 a total of 69 counties flipped parties. We can see from Figure 2.1 that a large portion of the counties that flipped, went Republican in 2016. In fact, only three of the states in our sample had counties that flipped Democratic in 2016. A total of 64 counties or about 93% of the counties that flipped in these states went Republican. Table 2.1 gives the breakdown of county party flips for 2016 by state.

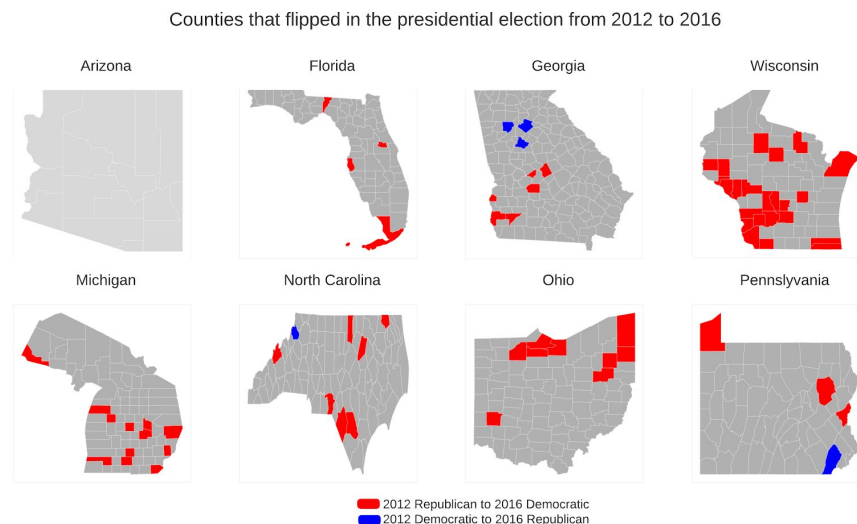


Figure 2.1  
State maps of counties that flipped parties in the 2016 election.

state	1216_Flip	Num_Counties
Florida	Dem to Rep	4
Georgia	Dem to Rep	6
	Rep to Dem	3
Michigan	Dem to Rep	12
North Carolina	Dem to Rep	7
	Rep to Dem	1
Ohio	Dem to Rep	9
Pennsylvania	Dem to Rep	3
	Rep to Dem	1
Wisconsin	Dem to Rep	23

Table 2.1  
Count of counties that flipped parties in the 2016 election by state.

How does that compare to the 2020 election? A total of 18 counties flipped from 2016 to 2020, or about 75% fewer counties in our states of interest flipped in 2020. In figure 2.2 we can see a distinct shift from 2016. In 2020 all but 4 counties that flipped, went Democratic. Table 2.2 gives the breakdown of county party flips for 2020 by state.

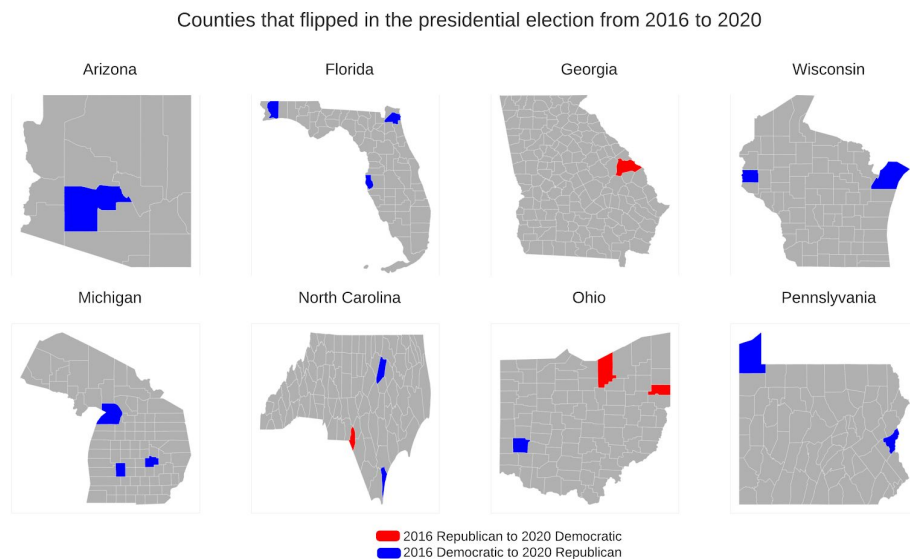


Figure 2.2  
State maps of counties that flipped parties in the 2020 election.

Of note in figure 2.2 is that only one county in Georgia flipped in 2020, yet the state overall flipped Democratic. This can be attributed to the increase in Democratic voter turnout as seen in figure 1.1 as well as an initial Democratic flip in the 2016 election of three suburban counties of Atlanta: Cobb County, Gwinnett County, and Henry County.



state	1620_Flip	Num_Counties
Arizona	Rep to Dem	1
Florida	Rep to Dem	3
Georgia	Dem to Rep	1
Michigan	Rep to Dem	3
North Carolina	Dem to Rep	1
Ohio	Rep to Dem	2
	Dem to Rep	2
Pennsylvania	Rep to Dem	1
	Rep to Dem	2
Wisconsin	Rep to Dem	2

Table 2.2  
Count of counties that flipped parties in the 2020 election by state.

Comparing between the 2016 and 2020 elections there were only 8 counties that flipped in both elections (table 2.3). All of these eight counties flipped Republican in 2016 and then back to Democratic in 2020. Table 2.3 shows the pattern of all flipped counties in the 2016 and 2020 elections.

1216_Flip	1620_Flip	count
Dem to Rep	No Change	56
	Rep to Dem	8
No Change	Dem to Rep	4
	No Change	572
	Rep to Dem	6
Rep to Dem	No Change	5

Table 2.3  
Count is the number of counties within the 5 sampled states that followed the flip pattern in the first to columns.

### Section 3- Voter Distribution and Margin of Victory

As seen in the previous section and table 2.3 most counties that flipped Republican in 2016 did not flip back in 2020 and 4 additional counties flipped Republican in 2020. Looking at an election map of the United States or figure 3.1 it may appear that all of the states in our sample should be Republican since so much of the state is red. This argument has been used repeatedly to back up claims of election fraud in the 2020 election.

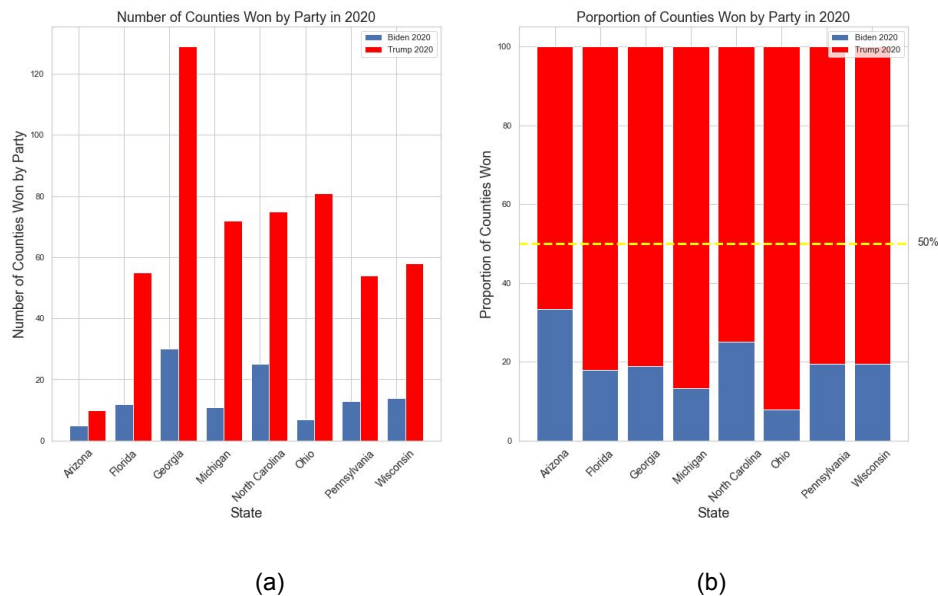


Figure 3.1  
(a) Number of counties won by party for the eight sample states in the 2020 election.  
(b) Proportion of counties won by each party for the eight sample states.

However, figure 3.1 does not give an accurate representation of the portion of votes won by each party. Populations are not evenly distributed between counties; to account for this county is weighted by its voter contribution to the total state votes. The variable  $p\_state20$  was calculated for each county as  $(\text{total county votes})/(\text{total state votes})$ . Figure 3.2 is similar to figure 3.1b but each county is weighted by its contribution to the total number of voters in 2020. When weighted by the proportion of voters in each county the picture changes drastically with Biden winning counties worth over fifty percent in all but two states. This weighting of counties can help us begin to understand why even though only 14 counties flipped republican 5 states flipped Democratic.

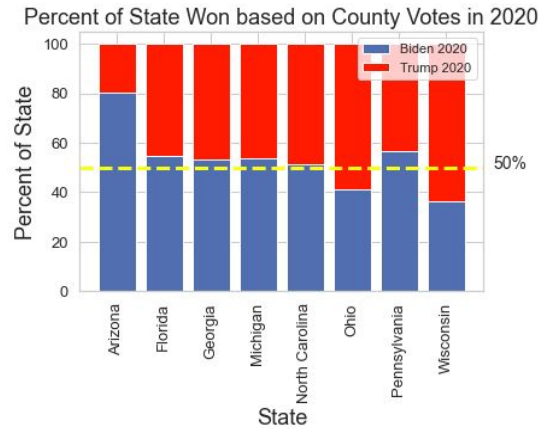


Figure 3.2

Proportion of state won calculated and the sum of the  $p\_state20$  values for each county won by a party.

In Figure 3.3, a heat map of  $p\_state20$  in Arizona, the county with the highest  $p\_state20$  value is the one county that flipped to Democratic in Arizona. This is Maricopa county

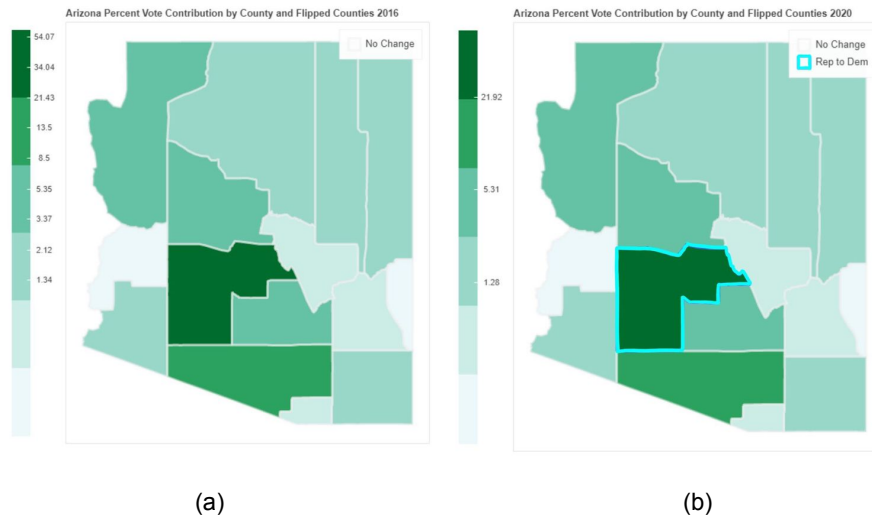


Figure 3.3

Counties are shaded by their  $p\_state$  value and outlined in the color of the party that the county flipped to for the 2016 election (a) and 2020 election(b).

and contains over sixty percent of the total vote for Arizona. Maricopa County also saw an increase in voter turnout of just over 13% and a ~1% higher Democratic turnout than Republican. A flip from the 2% lead in voter turnout for Republicans in 2016 and 5% in 2012 (table 3.2).

state	1216_Flip	Win_16	p_state16
Arizona	No Change	blue	20.18
		red	79.82
Florida	Dem to Rep	red	7.25
	No Change	blue	43.11
Georgia	Dem to Rep	red	0.63
		blue	35.77
	No Change	red	45.18
		blue	18.42
Michigan	Dem to Rep	red	18.21
	No Change	blue	45.75
		red	36.04
North Carolina	Dem to Rep	red	3.55
	No Change	blue	47.98
		red	47.83
	Rep to Dem	blue	0.63
Ohio	Dem to Rep	red	14.53
	No Change	blue	42.48
		red	42.99
Pennsylvania	Dem to Rep	red	6.58
	No Change	blue	48.66
		red	40.37
	Rep to Dem	blue	4.40
Wisconsin	Dem to Rep	red	17.49
	No Change	blue	35.46
		red	47.04

(a)

state	1620_Flip	Win_20	p_state20
Arizona	No Change	blue	19.15
		red	19.75
Florida	Rep to Dem	blue	61.09
	No Change	blue	42.91
		red	45.23
Georgia	Rep to Dem	blue	11.87
	Dem to Rep	red	0.21
	No Change	blue	53.27
Michigan	No Change	red	46.52
		blue	45.10
	Rep to Dem	red	46.21
		blue	8.69
North Carolina	Dem to Rep	red	0.27
	No Change	blue	47.77
		red	48.63
	Rep to Dem	blue	3.33
Ohio	Dem to Rep	red	4.65
	No Change	blue	36.78
		red	54.02
	Rep to Dem	blue	4.55
Pennsylvania	No Change	blue	52.38
	Rep to Dem	red	43.17
		blue	4.46
Wisconsin	No Change	blue	34.49
		red	63.80
	Rep to Dem	blue	1.71

(b)

Table 3.1

Breakdown by proportion of state won by flip status (xxxx\_Flip) and the winning party. p\_statexx is the sum of the p\_statexx values for all counties within the category. Table a is the 2016 election and table b is the 2020 election.

	state	county	year	total	dem	gop	AGE18PLUS_TOT	repturnout	demturnout	turnout	winner
21	Arizona	MARICOPA COUNTY	2012	1376558	602288	749885	2936120	0.255400	0.205131	0.468836	red
22	Arizona	MARICOPA COUNTY	2016	1567834	702907	747361	3211784	0.232693	0.218853	0.488151	red
23	Arizona	MARICOPA COUNTY	2020	2068144	1040774	995665	3432976	0.290030	0.303170	0.602435	blue

Table 3.2

Election statistics for Maricopa County in the 2012, 2016, and 2020 elections.

Georgia is a particularly interesting case to study. Georgia flipped Democratic in the 2020 election but only one county flipped and it went Republican (figure 3.4). However, from table 3.1 and figure 3.4 we can see that this county has a low p\_state value, 0.21, whereas the three counties mentioned previously which flipped Democratic in 2016 represent over 18% of the total votes. In fact, these three counties appear in the top 8 of the top 20 counties with the largest democratic voter turnout increase from 2016 to 2020 (figure 1.5).

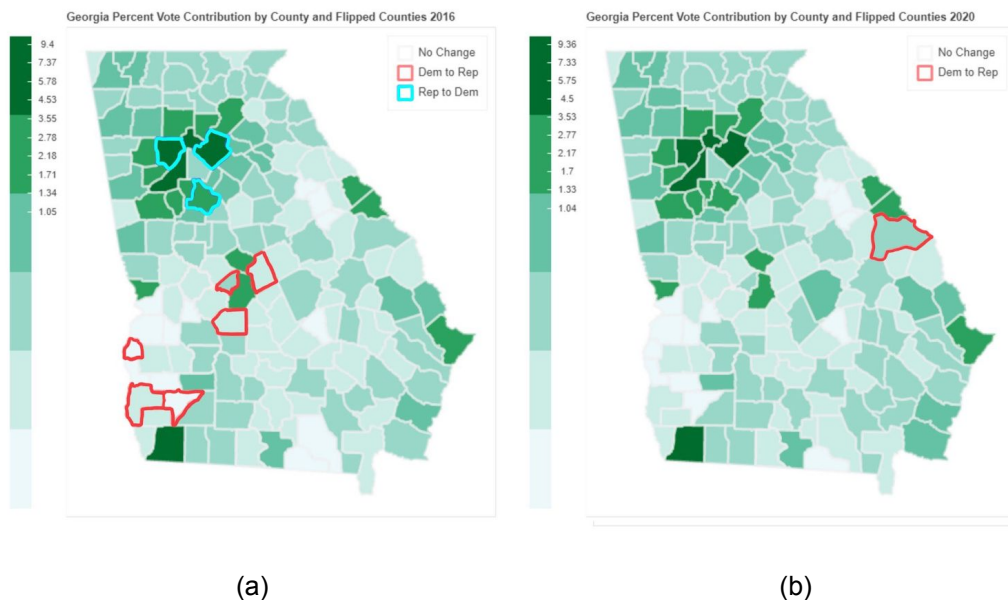


Figure 3.4

Counties are shaded by their  $p\_state$  value and outlined in the color of the party that the county flipped to for the 2016 election (a) and 2020 election (b).

Two states do not appear to follow table 3.1 or figure 3.2. The data presented in table 3.1 and figure 3.2 would suggest that Florida and Wisconsin should have done Democratic and Republican respectively, which is a direct contradiction of official results. State elections are awarded by popular vote. Thus, we must consider the margin of victory within each county. The margin of victory was calculated as the absolute value of  $((dem - gop)/total)*100$  for each county. Figure 3.5 shows that in Florida the margin of victory for Democratic counties is lower than a large number of Republican counties. This same pattern is mirrored in Ohio which also went Republican in 2020.

The comparison of  $p\_state20$  and margin of victory in figure 3.5 for Wisconsin show a distinctly different pattern. In Wisconsin  $p\_state20$  for Republican counties is below 4% for all but 2 counties. The three highest margins of victory are all Democratic counties, two of which are the two highest  $p\_state20$  counties.

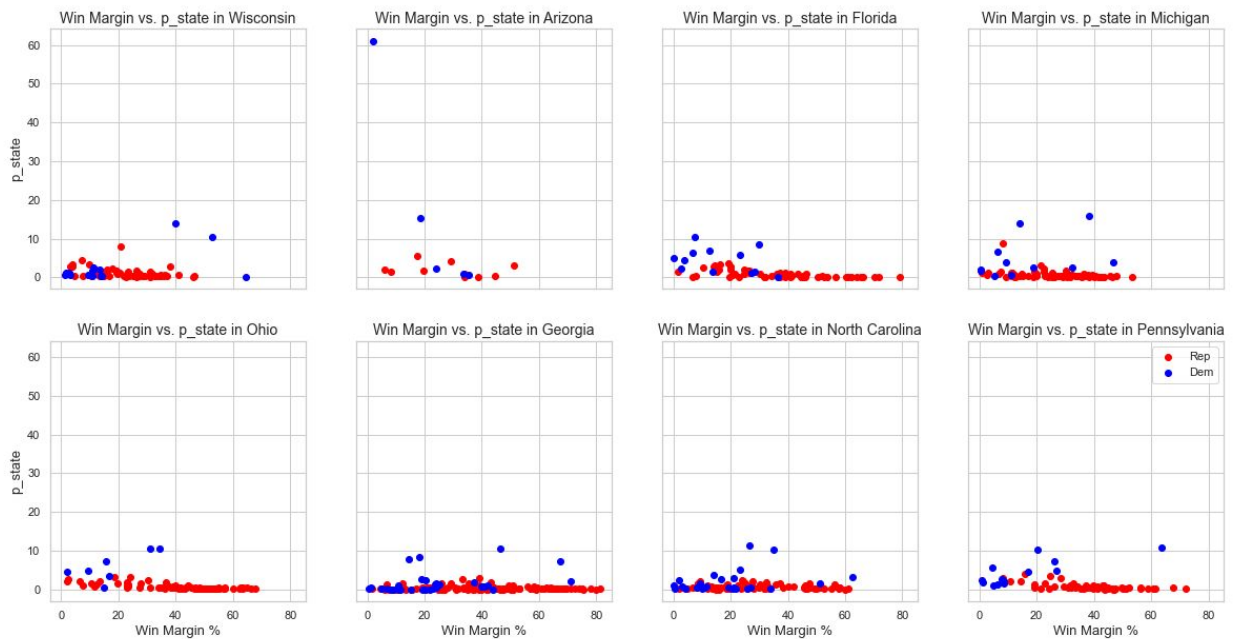


Figure 3.5

Win margin (percent) versus p\_state20 for each county in all states of interest. Red points are counties won by the Republican party and blue are counties won by the Democratic party.

From the previous analysis, it is clear that focusing on one metric can easily obfuscate the results of the election and indicate a different outcome. County metrics used holistically can be good indicators of the state outcome but should not be used individually to justify the outcome of a state election.



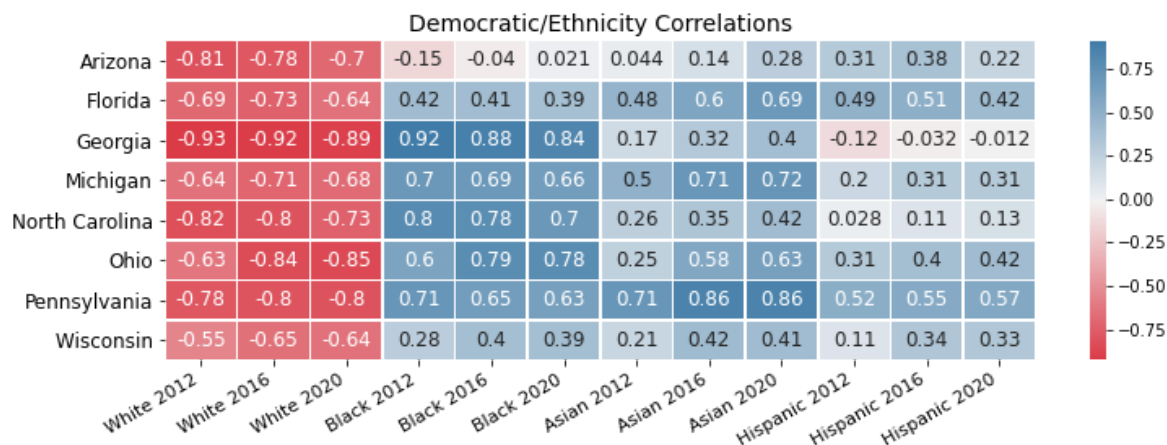
## Section 4 - Voter Demographics:

One way to help understand why states and counties flip parties over in different elections is to look at the demographics of the voting population. The following work will focus on how the different demographic traits (Ethnicity, Age, Gender, and Education) changed among the swing states between 2012, 2016, and 2020.

### 1. Ethnicity

Using the US Census data we are able to evaluate the White, Black, Asian, and Hispanic populations in each state and county of AZ, FL, GA, MI, NC, OH, PA, and WI to understand how they correlate with the voting for a certain party and the total number of votes.

First, we look at how the percentage of each ethnicity in a county correlates with the percentage of Republican or Democratic votes to determine how counties have changed between 2012, 2016, and 2020. In general, a correlation strength of .7 or above is considered meaningful between two variables using Pearson correlation. The correlations are shown in the figure below:



Overall the results showed across all states a white population correlated negatively with Democratic votes. Across all 3 elections, a higher percentage of white population correlated to a higher percentage of votes for the GOP at an average of .75 coefficient.

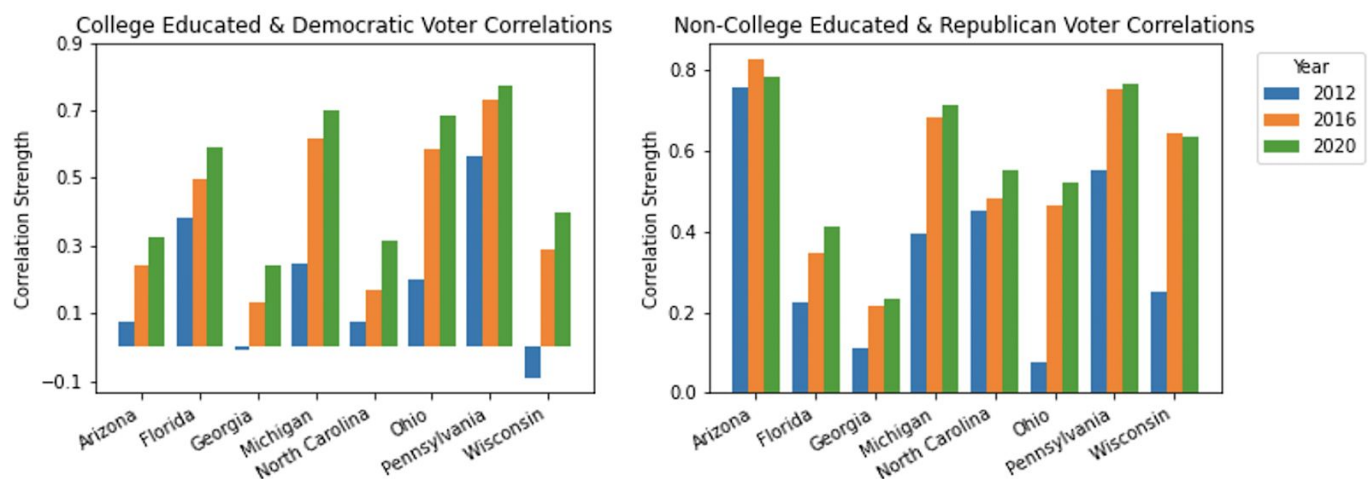
As we look at other ethnicities, the results become more nuanced with different states having a variety of correlation strengths. GA, MI, NC, OH, and PA all have a strong correlation between African American voters and Democratic votes. One important insight is that the correlation strength either stayed consistent or had a downward trend across all three elections. This may be explained by the strong relationship between Barack Obama and African American voters compared to Hilary Clinton or Joe Biden.

FL, MI, and PA all had a strong correlation between the Asian population and Democratic votes. It was also the only ethnicity where the correlation grew stronger for every election across all states. Finally, Hispanic populations had no states that correlated stronger than a .6 coefficient.

Arizona and Pennsylvania are two outlier states in terms of ethnicity. In Arizona, no minority population has a strong correlation to Democratic votes. In contrast, all minority ethnicities in PA correlated at a .5 or above.

## 2. Education

Next, we look at the correlation between education level and voter trends for all three elections. We derived two separate variables college educated (population with a bachelor's degree or a master's degree) and non college educated (associate's degree, high school, etc.)

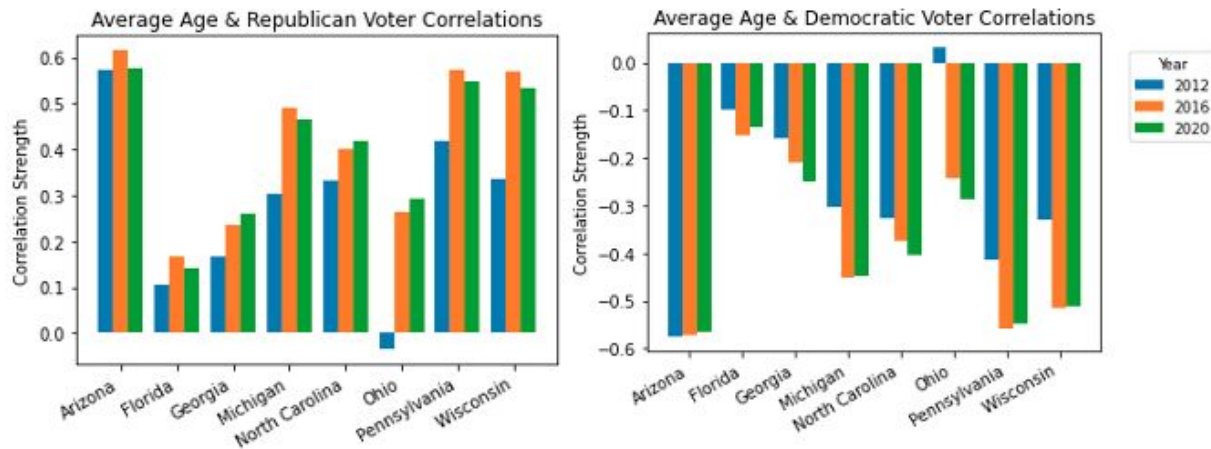


Overall counties with a higher percentage of college educated voters correlated positively with voting Democratic while counties with non-college educated voters correlated to voting Republican. MI, OH, and PA had the highest correlation strength for both education types, but non-college voters had a higher average correlation strength across all states.

The average correlation strength for both college and non-college voters increased dramatically between 2012 and 2016 for almost every state. This highlights Donald Trump's appeal to more blue-collar workers compared to Mitt Romney as well as the aversion to him among the college educated population.

## 3. Age

Finally, we look at the correlation between average age and voter trends by county.



Overall, the correlation between average age and DEM and GOP voter percentage never exceeded -.6 or .6. This means it is less of a demographic indicator compared to education and ethnicity. Even with the lower correlation strength, a higher average age correlated with voting Republican. The correlation strength increases dramatically between 2012 and 2016 in MI, PA, and WI showing a difference in support between Mitt Romney and Donald Trump.

## Conclusion

From our analysis we can conclude that the 2020 election results align with many continuing trends that have been seen in previous elections. Our analysis of voter turnout directly contradicts election fraud claims such as over 100% voter turnout in counties. Our analysis also did not show an unusually large shift in counties compared to previous shifts such as those seen in 2016. Demographic and Education analysis shows continuing trends from 2012 through to 2020.

From our analysis, it is clear that many variables affect election results and examining a single variable will not be able to explain why a state's voting patterns have changed. Many election fraud arguments such as turnout or arguments based on the distribution of color on an election map focus on one variable at a time which obfuscates the state outcome by selectively choosing data that supports an argument. Election data should instead be considered holistically to account for the different variables that contribute to state outcomes.

## Appendix A:

- 1) On [11/4/2020](#)<sup>[i]</sup> and [11/5/2020](#)<sup>[ii]</sup>, Eric Trump retweeted messages alleging election fraud based on irregular voting patterns.
- 2) The website <https://everylegalvote.com/>, a website established to investigate election fraud, states in its primer: “There are numerous counties in the 2020 election with over 100% voters supposedly voting and some states have astronomically high turnout percentages, such as Wisconsin.”.
- 3) During a press conference on 11/26/2020, Donald Trump stated, “They have Biden beating Obama, beating Obama’s votes, in areas that matter for the election, in swing states, and yet he’s losing to Obama all over the place”.

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[i] <https://twitter.com/EricTrump/status/1324085320296574979?s=20>

[ii] <https://twitter.com/EricTrump/status/1324447793918971904?s=20>

[iii]

<https://www.cnn.com/videos/politics/2020/11/26/trump-thanksgiving-inauguration-biden-question-vpx.cnnr.cnn.com>

## References

### Voting Data:

<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/VOQC>

<https://elections.wi.gov/node/7234>

<https://results.arizona.vote/#/featured/18/0>

<https://floridaelectionwatch.gov/CountyReportingStatus>

<https://results.enr.clarityelections.com/GA/105369/web.264614/#/summary>

[https://mielections.us/election/results/2020GEN\\_CENR.html](https://mielections.us/election/results/2020GEN_CENR.html)

<https://www.ncsbe.gov/results-data/election-results>

<https://liveresults.ohiosos.gov/>

<https://www.electionreturns.pa.gov/>

### Census Data:

<https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-detail.html>

<https://console.cloud.google.com/marketplace/product/united-states-census-bureau/us-census-data>

### Raw Data Files:

[https://github.prod.oc.2u.com/UCB-INFO-PYTHON/Project2\\_Cuffney\\_Miller\\_Simmeth/tree/master/Raw%20Data%20Files\\_Simmeth](https://github.prod.oc.2u.com/UCB-INFO-PYTHON/Project2_Cuffney_Miller_Simmeth/tree/master/Raw%20Data%20Files_Simmeth) (2u.com)