



Milwaukee 2020 Election Analyses

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Statistical Voting Analysis in the Wisconsin 2020 Presidential Election

Milwaukee County

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Contents

Executive Summary	1
Milwaukee: Classical Statistical Analysis	1
Estimating Loss Gains	7

Executive Summary

A team of unpaid citizen volunteer mathematicians, scientists, and engineers collaborated in a statistical vote analysis of Wisconsin in the 2020 Presidential Election. This report focuses specifically on the county and city of Milwaukee.

Milwaukee seems split into three different voting behaviors in 2020. In the heaviest Democratic 1/3 of the city, total votes went down, with candidate Biden receiving almost 8,000 votes less than Hilary Clinton in 2016. In another 1/3 of the city that outpaces Republicans 2:1, the largest gains are seen with every single ward contributing at minimum 100% of the new vote gain to Biden, as well as eating into the previous libertarian vote. The remaining 1/3 of Milwaukee is the minority fraction that behaves anywhere close to how it did in 2016.

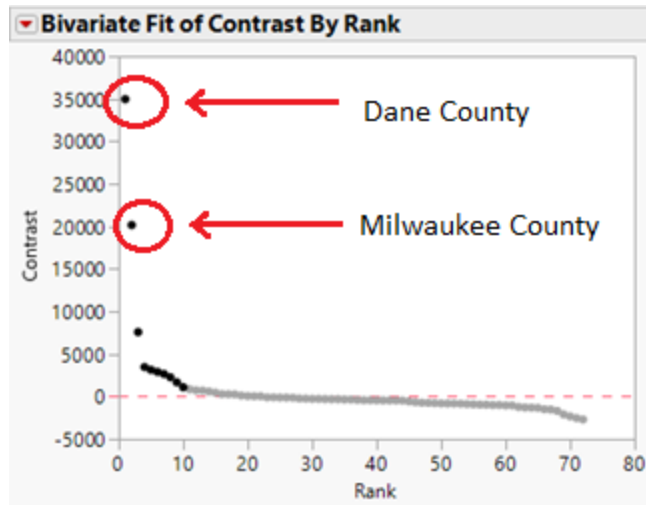
The stable distribution characteristics of each candidate's gain and lost vote average, coupled with an 83% turnout, and 2/3 of the city behaving in very different ways leads to an unexplainable vote signature. The only action to reconcile this result with classical democratic city vote patterns like Atlanta or Philadelphia is to, quite frankly, divide all Biden's votes by 1.5, which takes away roughly 100,000 votes, but stabilizes the vote turnout and Democrat to Republican ratio to what you would see in similar cities.

Milwaukee: Classical Statistical Analysis

A state-wide analysis (listed in a parallel report) shows a bivariate contrast of the vote between 2020 and 2016, calculated as follows

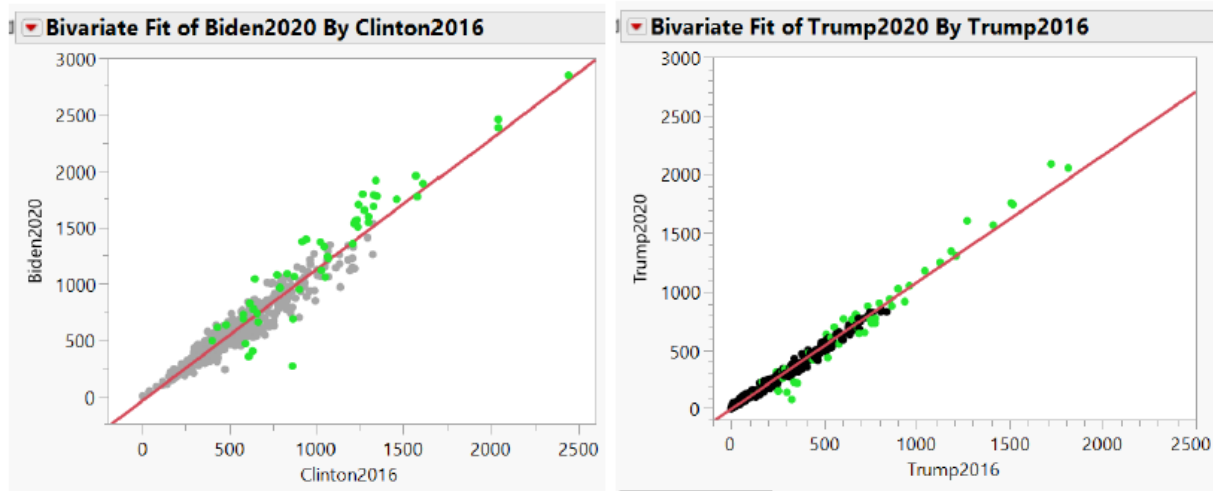
$$\text{Contrast} = (\text{Biden-Trump2020}) - (\text{Clinton-Trump2016}).$$

The values for the variable Contrast were ranked from largest to smallest and plotted against the integers, 1, 2, 3,..



Many of the values fall on a relatively straight line and they indicate that changes from 2016 to 2020 were very modest for most counties, in keeping with the knowledge that voting patterns not to change much. A number of counties do not follow the pattern of the other counties, with Milwaukee being the second largest deviation from the rest of the state.

A bivariate fit of voting patterns in Milwaukee as compared to 2016 can show us a scatter plot as compared to the expected line – where the expected line is presuming voter preferences do not change. While there is a general consistency of voting patterns from 2016 to 2020, those patterns are more consistent for Trump than for Biden.



The slope of the 2020 vs 2016 results can be used to evaluate the consistency of voting patterns. The slope for Biden is 1.16 whereas for Trump it is 1.08.

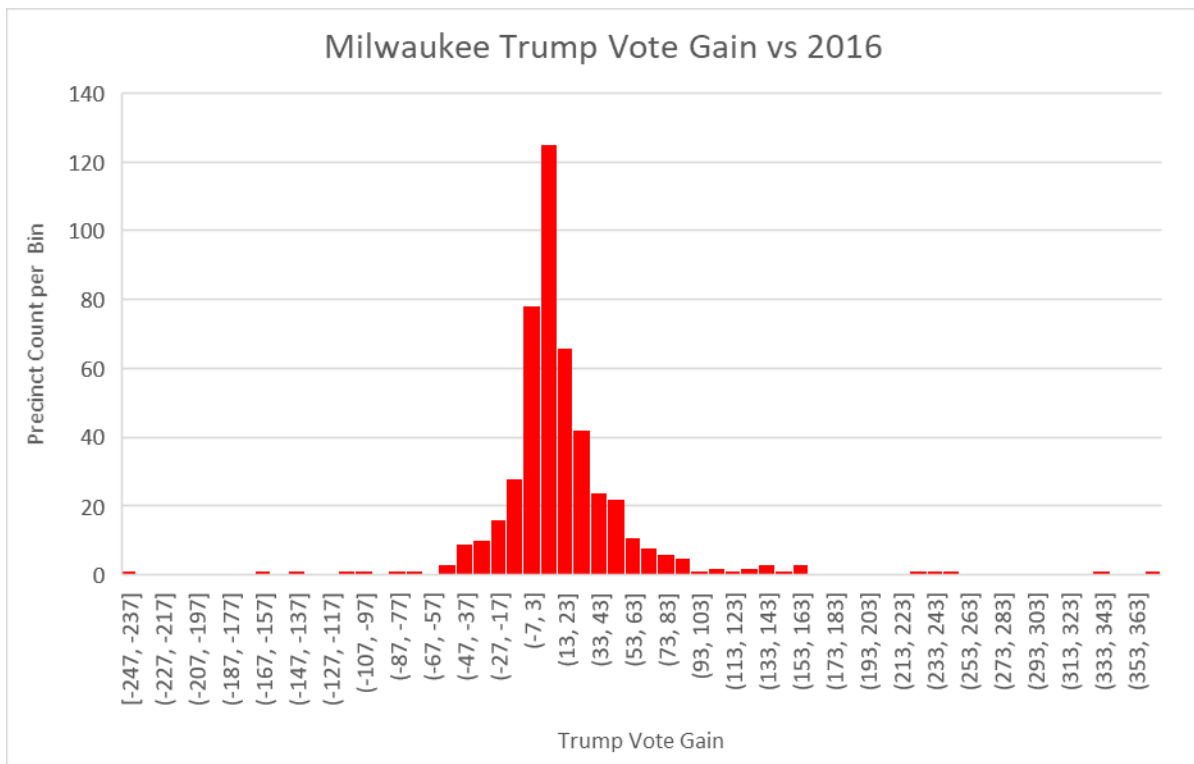
Breaking into distribution plots of the vote changes per ward, we see the following average vote gains per ward for Trump and Biden – both showing a very stable set of characteristics. The Trump curve leans slightly to the positive tail and has long tails, while the Biden curve is incredibly normal as compared to a standard distribution.

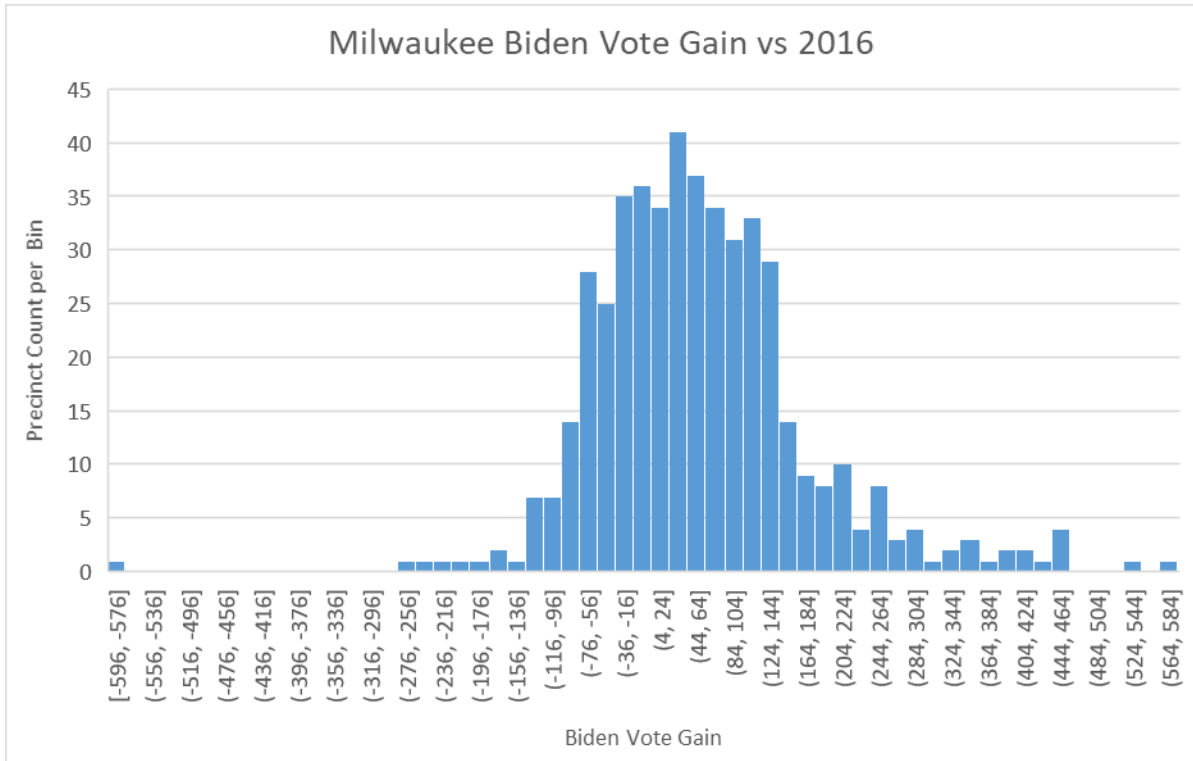
Trump Votes Diff vs 2016 Per Ward

MEAN	17.3
STDDEV	45.9
SKEW	2.1
KURT	17.7

Biden Votes Diff vs 2016 Per Ward

MEAN	58.5
STDDEV	120.3
SKEW	0.6
KURT	3.5





However, looking at the comparative averages of both distributions, Milwaukee County shows a new vote distribution well outside the 2016 norm. Specifically, both candidates achieved the total 2016 vote count and added to their sums, consistent with new turnout. What's curious is that above the 2016 totals, a new vote ratio appears in contrast to the voting history of the area – showing new voters going 77% Democrat vs 23% Republican – an 8-point gain for Democratic new voters above their recent history. This means for every new Trump voter over 2016, there were 3.38 new Biden voters above 2016.

Gained Votes over 2016 Avg per Ward	
<i>Trump</i>	17.3
<i>Biden</i>	58.5
<i>Diff</i>	41.2
<i>2020 Dem/Rep Gain Ratio</i>	3.38
<i>%</i>	77D / 23R
<i>2016 Dem/Rep Historical Ratio</i>	2.29
<i>%</i>	69D / 31R

Looking at the turnout gain averages per Ward, we see Trump’s numbers across Milwaukee averaged a 6.6% vote gain vs 2016.

Trump 2020 vs 2016 Averages per Ward	Average 2020 Gain	2016 Average	Gain %
	17.3	263.8	6.6%

Looking at Biden’s turnout, we see an anomalous gain. In spite of the fact that Biden wasn’t taking from Trump’s 2016, and arguably not from the Libertarian column, the Democratic vote gain shows not only a turnout equal to the Trump voter, but in excess of the Trump voter. Biden’s average vote gain shows a 9.7% increase vs 2016, which is 3.1% more turnout than Trump managed.

Biden 2020 vs Clinton 2016 Averages per Ward	Average 2020 Gain	2016 Average	Gain %
	58.5	605.2	9.7%

This surge of new voters is best seen when contrasting to other heavy democrat dominated in critical swing states in the same election. Milwaukee alone has 23-25% more turnout than these other critical cities.

City	Turnout	Dem/Rep
<i>Milwaukee</i>	83%	69/29
<i>Atlanta</i>	65%	72/26
<i>Philadelphia</i>	63%	81/18

What’s more curious about this result is that the majority of these gains appeared mainly in more moderate Democratic wards (“moderate Democratic wards” in Milwaukee means around 70D / 30R according to this data). Here, Biden not only took every single new voter above 2016, but most of the previous Libertarian votes as well. In 213 wards (44% of the city), Biden gained votes at a 14:1 ratio, meaning for every 1 new Trump voter in these wards, there were 14 new Biden voters.

Wards with Biden taking >100% of the new vote	Trump New Vote	Biden New Vote	LIB New Vote	Total New Vote	% Dem of new vote	2016 avg D/R	2020 gain D/R
213 Wards (44% of city)	1917	26790	-10925	17782	151%	73D / 27R	93D / 7R

In contrast, the heaviest Democratic ward strongholds mostly LOST votes for Biden vs 2016. Thus, the more moderate wards not only exceeded their history with new voters, but managed to do overwhelmingly as to cover the losses of the classic strongholds and still post gains. In these areas, which number 163 wards (34% of the city), Biden lost votes at a -44:1 ratio, meaning for every 1 new Trump voter in these wards, Biden lost 44 votes vs 2016.

Wards with overall vote losses vs 2016	Trump New Vote	Biden Lost Vote	LIB Lost Vote	Total Lost Vote	% Dem of lost vote	2016 Avg D/R	2020 loss D/R
163 Wards (34% of city)	176	-7758	-2589	-10171	76%	96D / 4R	-44.1

As an example of the excess vote gains above the norm, consider the city wards of Wauwatosa. Every ward significantly out performs its history by adding on average 190 new Biden votes per ward, which is adding 16% more turnout vs 2016 for Biden alone. Biden takes on average 151% of the new vote in Wauwatosa. Specifically, Biden gains 4,564 new votes over 2016 against Trump’s 70 new votes, gaining 65 new voters for every 1 new Trump voters. This abnormal ratio stands at 98.5 D / 1.5R.

2016						2020 Gains							
Ward	Trump	Clinton	Other	Total	D/R	Trump	Biden	Other	Total	dD/R	Dem % of new vote		
City of Wauwatosa Ward 1	342	788	79	1209	2.3	10	147	-52	105	14.7	140%		
City of Wauwatosa Ward 2	323	792	81	1196	2.5	-25	214	-57	132	N/A	162%		
City of Wauwatosa Ward 3	391	784	138	1313	2.0	10	197	-113	94	19.7	210%		
City of Wauwatosa Ward 4	602	987	153	1742	1.6	-13	277	-106	158	N/A	175%		
City of Wauwatosa Ward 5	317	572	70	959	1.8	16	175	-49	142	10.9	123%		
City of Wauwatosa Ward 6	260	510	82	852	2.0	7	223	-55	175	31.9	127%		
City of Wauwatosa Ward 7	505	807	116	1428	1.6	4	211	-77	138	52.8	153%		
City of Wauwatosa Ward 8	298	336	40	674	1.1	-22	78	-31	25	N/A	312%		
City of Wauwatosa Ward 9	639	649	101	1389	1.0	-8	134	-67	59	N/A	227%		
City of Wauwatosa Ward 10	344	718	83	1145	2.1	35	291	-44	282	8.3	103%		
City of Wauwatosa Ward 11	359	803	86	1248	2.2	11	139	-59	91	12.6	153%		
City of Wauwatosa Ward 12	543	748	122	1413	1.4	-3	261	-85	173	N/A	151%		
City of Wauwatosa Ward 13	209	422	63	694	2.0	-34	116	-38	44	N/A	264%		
City of Wauwatosa Ward 14	354	806	121	1281	2.3	-21	213	-85	107	N/A	199%		
City of Wauwatosa Ward 15	318	921	139	1378	2.9	7	207	-102	112	29.6	185%		
City of Wauwatosa Ward 16	479	823	138	1440	1.7	10	233	-88	155	23.3	150%		
City of Wauwatosa Ward 17	501	615	99	1215	1.2	26	181	-65	142	7.0	127%		
City of Wauwatosa Ward 18	390	611	80	1081	1.6	-21	145	-67	57	N/A	254%		
City of Wauwatosa Ward 19	426	608	81	1115	1.4	29	228	-55	202	7.9	113%		
City of Wauwatosa Ward 20	635	741	105	1481	1.2	51	257	-68	240	5.0	107%		
City of Wauwatosa Ward 21	468	519	91	1078	1.1	-9	164	-63	92	N/A	178%		
City of Wauwatosa Ward 22	427	644	95	1166	1.5	57	215	-56	216	3.8	100%		
City of Wauwatosa Ward 23	522	526	95	1143	1.0	-3	142	-63	76	N/A	187%		
City of Wauwatosa Ward 24	382	586	80	1048	1.5	-44	116	-57	15	N/A	773%		
Ward	Trump	Clinton	Other	Total	D/R	Trump	Biden	Other	Total	dD/R	Dem % of new vote		
TOTAL	10034	16316	2338	28688	1.63	70	4564	-1602	3032	65.2	151%		
				2016 Dem/Rep	62D / 38R				Gain Dem/Rep	98.5D / 1.5R			

Estimating Excess Vote Gains

Unlike other cities which only had severe excesses in select precincts or townships – Milwaukee uniquely has entire thirds of the city swinging wildly up and down almost uniformly. Additionally, in spite of such movements, the distribution curves of gains are very normal – only maintaining large MEAN values, but nothing else extraordinary.

To even guess what a predictable result might be in normal circumstances requires seemingly unwinding the entire city uniformly. The only way to maintain a sound mathematical distribution that is true per ward to their history is to quite literally divide all Biden votes by 1.5 to even come close to a reasonable turnout seen by other heavy Democrat cities. The actual 2020 vote total summary follows:

	2020 Registered	Total Votes	Biden Votes	Trump Votes	D/R
	551311	460300	317251	134355	2.36
<i>Turnout</i>	83%	share	69%	29%	

A “prediction” requiring good distributions with a target of 65% turnout would again, require something bold like “divide Biden votes by 1.5 across all wards”. Even this result mis-matches on the final D/R ratio vs 2016, which was 2.29, but the same kind of excess is seen even in that election. Thus, the best prediction we can generate of an expected 2020 election in Milwaukee that doesn’t have precincts with anomalous voting would look like the following, stripping roughly 105,750 votes off the total.

Total Predicted 2020	Registered	Total Votes	Biden Votes	Trump Votes	D/R	Excess Votes
	551311	354550	211501	134355	1.57	105,750
<i>turnout</i>	64%	share	60%	38%		

Milwaukee 2020 Election Voting Analysis

S. Stanley Young, PhD, FASA, FAAAS: *Revision 11-29-20*

I was given the data summary for each of Milwaukee's 478 wards. This data was manually extracted into an Excel document from this [official file](#) — which is the latest tabulation of the 2020 presidential election votes.

Additionally we were given an Excel file of the Milwaukee 2016 Presidential election votes. This was an [official file](#) tabulated as of 11-9-20.

I did six different analyses of this data. Please see the summary at the end...

Item 1 —

Two data sets giving vote totals for the Wards of the city of Milwaukee for 2016 and 2020 were combined into one data. The first few rows of that data set are given,

RowID	Ward	Biden2020	Trump2020	Clinton2016	Trump2016
1	City of Milwaukee Ward 1	974	190	932	222
2	City of Milwaukee Ward 2	323	28	361	30
3	City of Milwaukee Ward 3	718	146	762	177

There are 478 Wards in the city. Two differences are computed, Biden2020-Trump2020 and Clinton2016-Trump2016. I then computed a difference of difference, how much better did Biden do versus Trump2020 than Clinton versus Trump2016. Contrast = (Biden-Trump2020) – (Clinton-Trump2016).

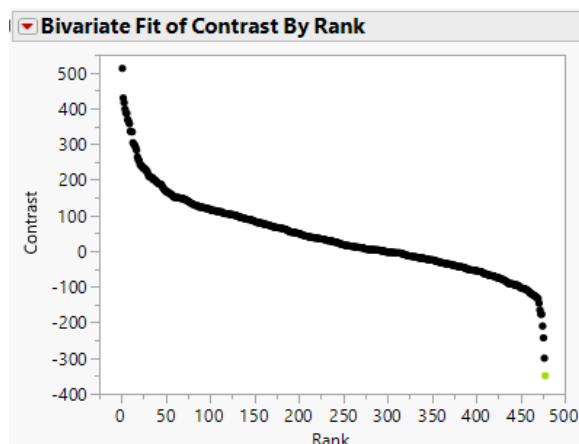
Item 2 —

There is general consistency of voting patterns from 2016 to 2020.

Correlations				
	Biden2020	Trump2020	Clinton2016	Trump2016
Biden2020	1.0000	0.5223	0.9575	0.5280
Trump2020	0.5223	1.0000	0.3815	0.9913
Clinton2016	0.9575	0.3815	1.0000	0.3911
Trump2016	0.5280	0.9913	0.3911	1.0000

Note the high correlation between Biden2020 and Clinton2016, 0.9575, but the **higher** correlation between Trump2020 and Trump2016, 0.9913.

Item 3 —

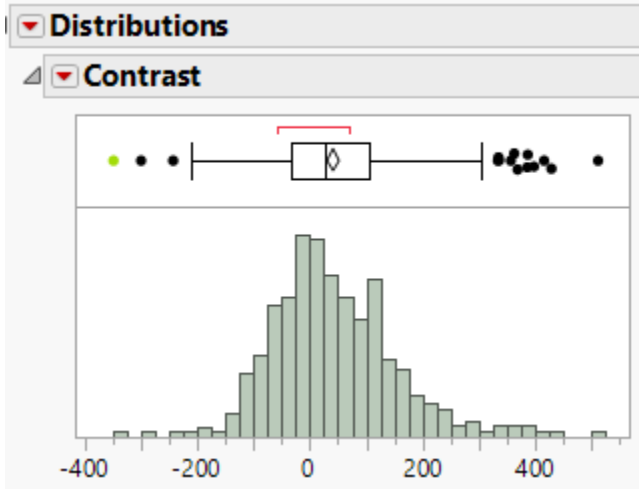


The values for the variable Contrast were ranked from largest to smallest and plotted against the integers, 1, 2, 3,..

Many of the values fall on a relatively straight line and indicate changes from 2016 to 2020 were +/- 100 votes.

Item 4 —

A frequency histogram is given for the variable Contrast.



Several comments.

1. The distribution centers a bit above zero.
2. We expect a bell-shaped histogram and we see two things.
 - a. There are more large observations on the right of the histogram.
 - b. The right side of the histogram has a shoulder. It is too high.
3. The figure has the look of “loading the tail”, voter fraud.

4. The outlier plot above the histogram has 11 or so high outliers and three low outliers.

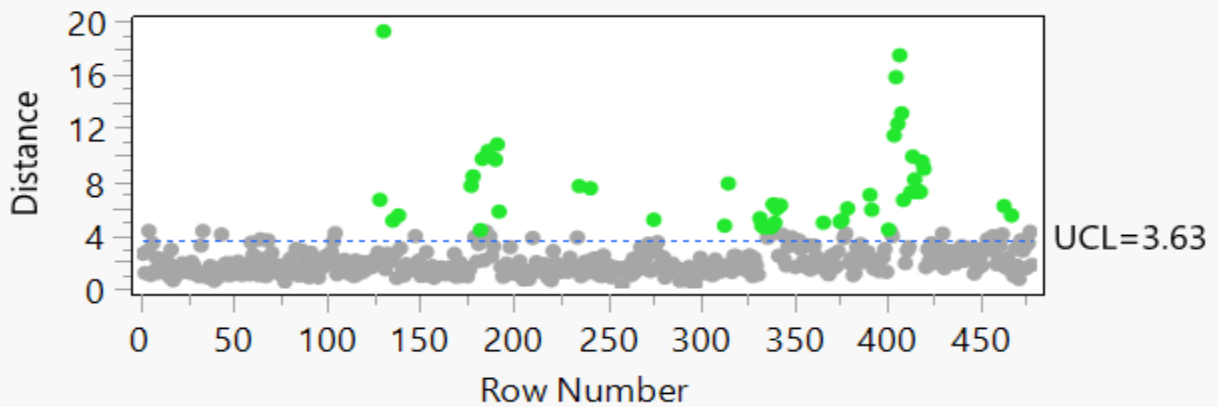
5. Other problematic observations are in the right shoulder.

Item 5 —

Techniques for detecting outliers for multivariate data were applied to the four vote count variables. The computations were done in SAS JMP 15.2.

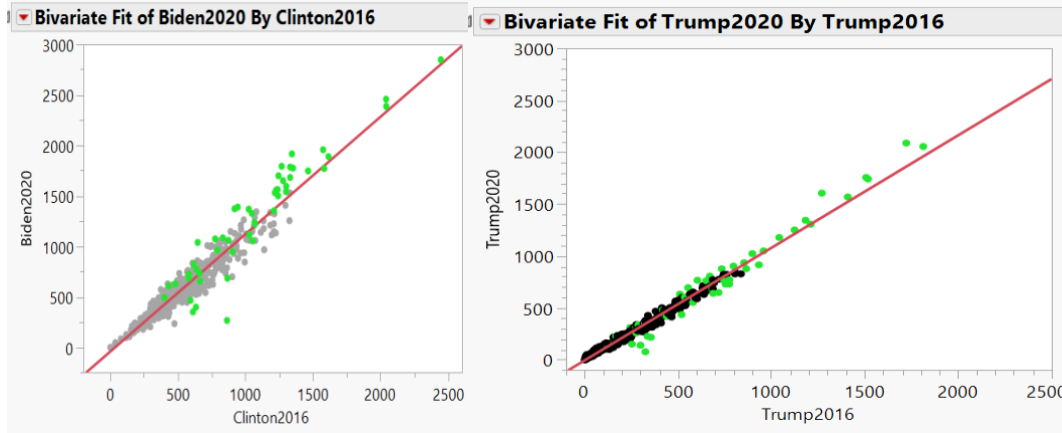
Outlier Analysis

Mahalanobis Distances



$\alpha = 0.01$

Points above the blue dashed line are potential outliers. Those points are marked in the two figures, Biden vs Clinton and Trump2020 vs Trump2016.



Note that the outlier points in the Biden2020 figure are mostly above the regression line. These points would tilt the line upward, consistent with the slope of 1.16. The same points are marked in the Trump figure and mostly are near the regression line. Points above the regression line indicate added votes.

Item 6 —

Some Wards are selected as worthy of examination. These Wards are statistical outliers. They do not match the overall pattern of the data.

RowID	Ward	Biden2020	Trump2020	Clinton2016	Trump2016	Contrast	
183	City of Milwaukee ...	1918	482	1343	419	512	The most extreme outlier, observation 183, generated 512 more votes for Biden than would expected based on 2016, Clinton versus Trump2016.
177	City of Milwaukee ...	1787	352	1330	324	429	
415	V. Shorewood War...	2460	435	2040	431	416	
235	City of Milwaukee ...	1391	339	942	288	398	
178	City of Milwaukee ...	1374	312	919	244	387	
186	City of Milwaukee ...	1795	696	1267	554	386	
416	V. Shorewood War...	2389	419	2041	440	369	
340	V. Fox Point Ward...	1533	641	1217	688	363	
333	V. Brown Deer Wa...	1684	772	1330	775	357	
414	V. Shorewood War...	2851	606	2445	536	336	

These ten Wards represent a vote gain for Biden of 3,953 votes. Additional outliers and Wards in the shoulder of the histogram indicate additional Biden votes. Of course, these are statistical inferences. Alternatively, Biden might be a more attractive candidate than Clinton.

Summary —

1. There is general consistency of voting patterns from 2016 to 2020. However, those patterns are more consistent for Trump than for Biden.
2. The slope of the 2020 vs 2016 results can be used to evaluate the consistency of voting patterns. The slope for Biden is 1.16 whereas for Trump it is 1.08, Item 5. Trump is more consistent with the expectation that people are expected to vote similar to the way they vote in the past.
3. An outlier detection analysis was computed. The outliers in the Biden figure were generally above the regression line and in the higher count Wards. These points would increase the counts for Biden. The same point in the Trump figure were close to the regression line.
4. Ten Wards were identified as multivariate outliers. These Wards alone represent a $3,953\pm$ gain in votes for Biden versus the expectation based on consistent voting from 2016 to 2020. Many other outliers appear to be in the shoulder of the distribution.

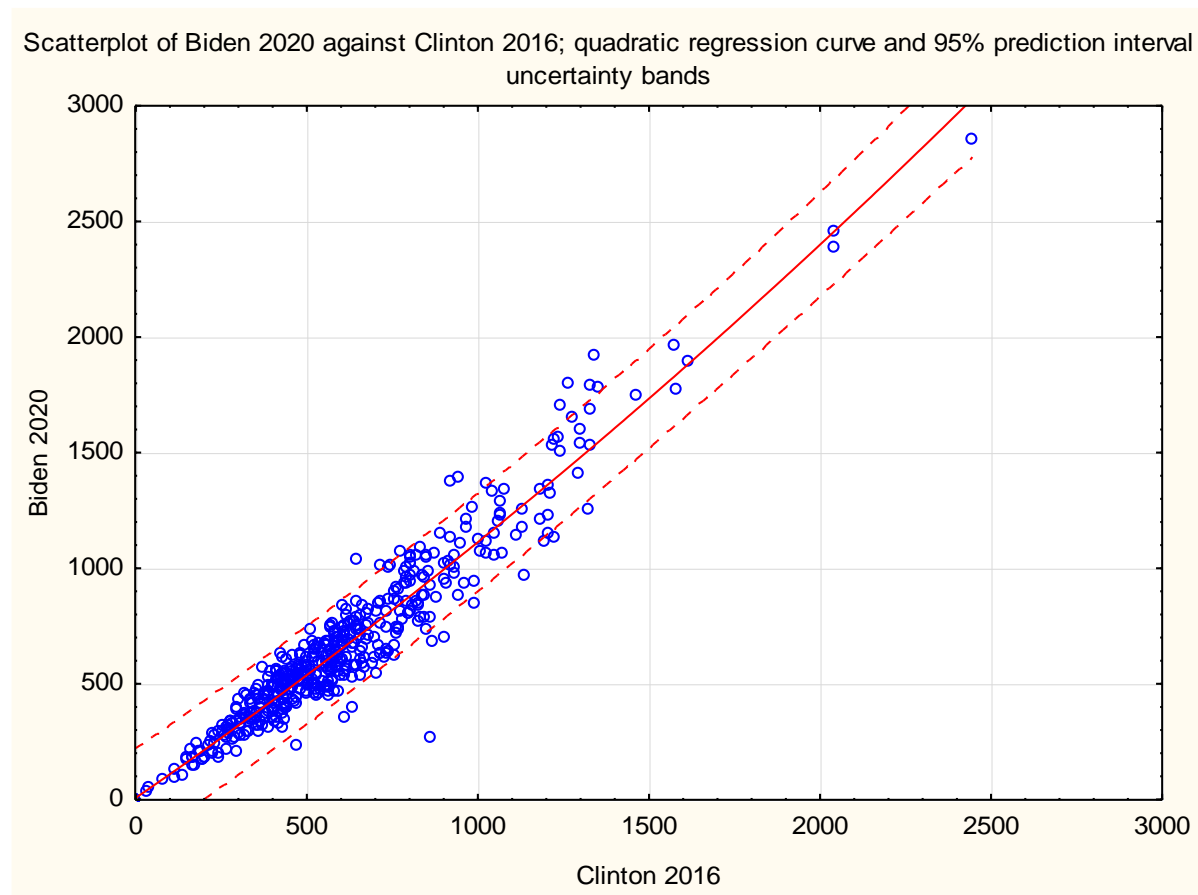
From: [Dr. Louis Anthony Cox, jr.](#)

Re: Milwaukee Wards 2020 Presidential Election Data Analysis

Date: 11-10-2020

Figure 1 shows that ward-level counts of votes for Clinton in 2016 strongly predict ward-level counts for Biden in 2020. The relationship between them is nearly linear (Pearson's correlation = 0.957)

Figure 1. Simple nonlinear (quadratic) regression of Biden 2020 votes vs. Clinton 2016 votes for 478 wards in Milwaukee data set



However, there is considerable vertical scatter around the regression curve. Some outliers (e.g., about 5% of data points falling outside the prediction interval bands) might be expected by chance, but this leaves open the question of whether there is any pattern in the outliers.

Table 1 shows the results of an exploratory simple linear regression (SLR) analysis (uncorrected for heteroskedasticity or other departures from the usual SLR modeling assumptions) that highlights wards with observed 2020 Biden counts significantly different from what would be expected based on Clinton 2016 counts. This analysis identifies six wards with relatively large deviations (“residuals”) from expected values. Five of these six were in the direction of more votes for Biden than expected based on the Clinton 2016 counts and the SLR model. These included 2 of the 10 largest wards (183 and 186).

Table 1. Analysis of residuals for Biden 2020 votes (showing the top and bottom of the complete table) identifies 6 extreme outliers (“+3s” or “-3s”): Wards 183, 186, 178, 235, 241, and 130. The 5 largest of these six outliers are in the direction of more Biden votes than expected based on SLR predictions.

						Raw Residual (Milwaukee.sta) Dependent variable: Biden 2020		
Raw Residuals						Observed Value	Predicted Value	Residual
Case	-3s	.	.	0	.	.	+3s	
183	*	1918.000
186	*	1795.000
178	*	1374.000
235	*	1391.000
241	*	1040.000
130	*	267.000

Table 2. Analysis of residuals for Trump (showing the top and bottom of the complete table) identifies 9 extreme outliers (“+3s” or “-3s”). Six of these nine outliers (the 3 above and the 3 below the double line) are in the direction of fewer Trump votes than expected based on SLR predictions.

						Raw Residual (Milwaukee.sta) Dependent variable: Trump 2020		
Raw Residuals						Observed Value	Predicted Value	Residual
Case	-3s	.	.	0	.	.	+3s	
405	*	1607.000
407	*	2090.000
406	*	1758.000
315	*	436.000
463	*	649.000
128	*	227.000
190	*	218.000
191	*	141.000
130	*	78.000

Table 2 shows analogous results for Trump data, using Trump vote counts in 2016 as predictors of Trump vote counts in 2020. (This is a strong predictive relationship, with a regression R^2 of 0.99 and adjusted R^2 of 0.98.) For the Trump counts, there are 9 outliers, of which six are in the direction of fewer Trump votes than expected based on SLR modeling.

Based on this analysis, and acknowledging that additional modeling (e.g., with non-parametric methods or transformed variables) might be useful, I reach the following interim conclusions:

- It appears that wards 183, 186, 178, 235, and 241 have anomalously high Biden counts;
- Ward 130 has anomalously low vote counts for both Trump and Biden;
- For Biden, the outliers were overwhelmingly (in 5 of 5 cases, excluding ward 130) in the direction of more-than-expected Biden votes. This includes two of the largest wards, 183 and 186, for which sampling variability is expected to be less important than in small wards.
- For Trump, the outliers were in both directions (with 5 of 8, excluding ward 130, in the direction of fewer-than-expected votes for Trump).

Milwaukee 2020 Election Voter Analysis:

Dr. Matt Briggs, 11-11-20

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Additionally we were given an Excel file of the Milwaukee 2016 Presidential election votes. This was an [official file](#) tabulated as of 11-9-20.

Below I have two plots of the Milwaukee data. **Figure 1** shows the histogram, for 2020 and 2016, of minority candidate totals to total votes across all wards.

2020 is dramatically different than 2016: more votes went to D & R than minority candidates. A natural break point seemed to be a vote fraction of about 0.001.

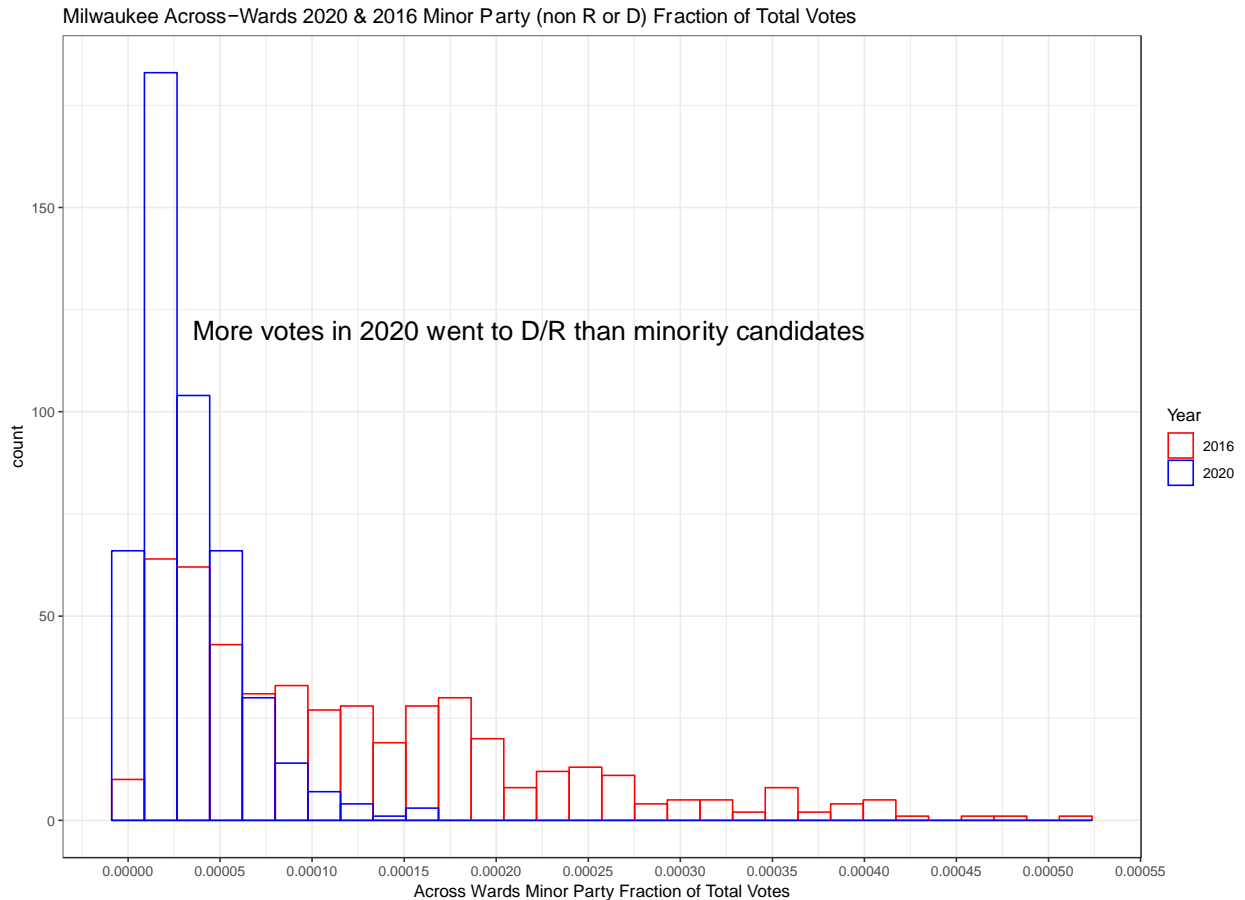


Figure 1

Figure 2 again compares 2020 to 2016, and looks at just those times when the minority vote fraction was < 0.0001 . It plots the histograms of (Trump vs Democrat) votes, where Democrat = Biden or Hillary.

There are some unusual wards where Biden did much better than Hillary over Trump. A natural point was $(\text{Trump} - \text{Biden}) < 1200$.

I annotate the graph with just those wards for both 2020 and 2016.

For instance, in V. Shorewood Wards 1,2,3,4 Biden gained 2,245 votes over Trump, whereas in 2016 Hillary was only up by 70 votes over Trump.

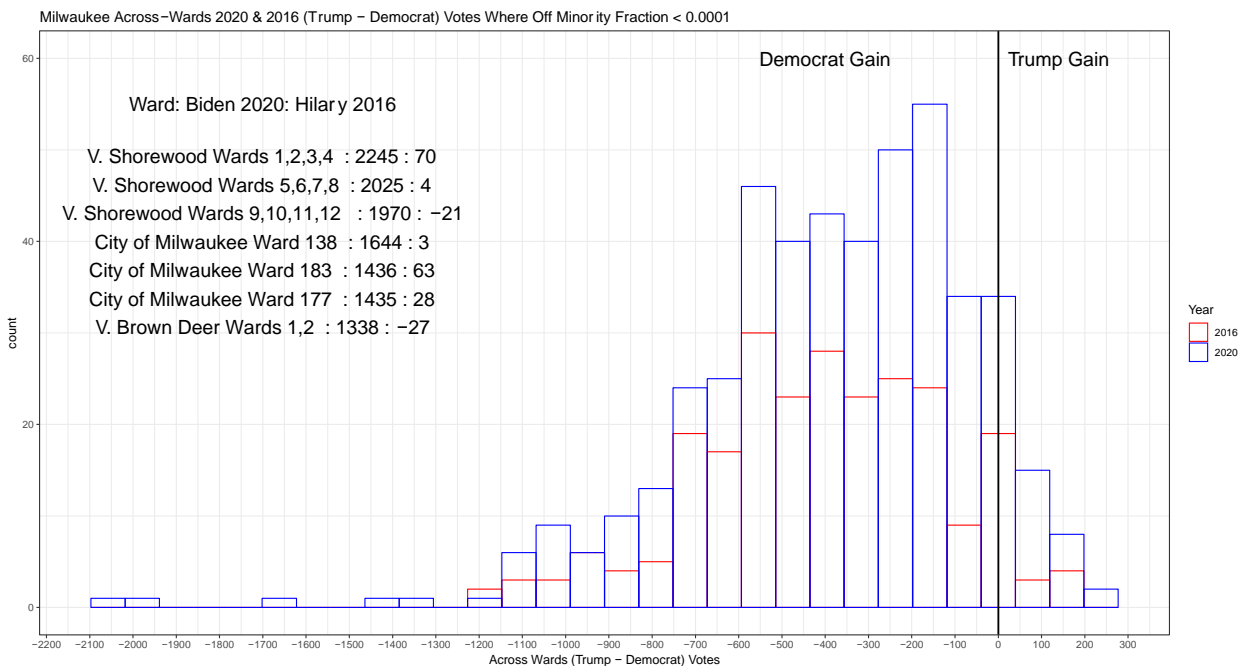


Figure 2

Recommendation: Based on the data, some attention be paid to the following wards since the statistical behavior is unusual there. The total advantage to Biden across these wards was 12,093 votes.

- V. Shorewood Wards 1,2,3,4
- V. Shorewood Wards 5,6,7,8
- V. Shorewood Wards 9,10,11,12
- City of Milwaukee Ward 138
- City of Milwaukee Ward 183
- City of Milwaukee Ward 177
- V. Brown Deer Wards 1,2