STAND YOUR GROUND LAWS

AND HOW THEY RELATE TO HOMICIDES, VIOLENT CRIME, AND POLITICAL INDICATORS

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FOR SPEA V-370, WITH MIR USMAN

MAY 2, 2019

INTRODUCTION

The Second Amendment of the United States Constitution is considered by many Americans to be a sacred right: the right to bear arms. This ability was originally given by the founding fathers in order to safeguard against the tyranny of government, but also gives average citizens the ability to protect themselves in an immediate crisis. In the mid-2000s, several states and lobbying organizations, such as the National Rifle Association (NRA) and American Legislative Exchange Council (ALEC) moved to enact "**stand your ground laws**"; essentially laws that establish a right by a person to defend themselves or others against perceived threats, regardless of whether safely removing themselves from the situation is possible.

This concept can find its roots dating back to the Castle Doctrine, an English common law from the 1600s, which allowed people to defend themselves in their own homes. This law began to expand around the time of the American civil war, where the definition of "home" began to broaden. After a major lobbying effort in the beginning of the 21st Century, the first stand-your-ground law was passed in 2005 in the State of Florida. Today, 29 States have some form of a stand-your-ground law, offering near legal immunity to any individual who takes advantage of it. (Colarossi, 2019)

As more and more states ratify stand-your-ground laws, (referred to for the duration of the report as SYG laws) it is important to know its effects on people living within those States. More specifically, **it is important to know if these laws are having an effect on homicide rates**. This is important to know because the entire point of these laws is to deter crime on a larger scale, some specific examples of which are examined in this study as well. If crimes are not in fact being deterred, but the homicide rate maintains itself despite SYG laws, we will be able to see the true effectiveness of these laws.

Unfortunately, the Dicky Amendment blocks the Center for Disease Control (CDC) from doing similar types of research. Hopefully this study can be used in the future by policy analysts, law makers, and others in order to get an accurate idea of how effective these laws are after a decade of being in effect.

LITERATURE REVIEW

This is not the first study to question gun laws and their effects on crime levels and, more specifically, homicide rates. In order to prepare for this study, three previous studies and their research questions, variables, data used, and conclusions they came to were reviewed.

The first piece of research examined is "The Impact of State Firearm Laws on Homicide and Suicide Deaths in the USA, 1991–2016: a Panel Study", a study that was led by Boston University Professor Michael Siegel. The objective of Siegel's research was to examine the relationship between state firearm laws and overall homicide and suicide rates of every State over a 26 year period. The first problem that the research team ran into was that there was no central database that tracked gun laws in states (the independent variable) over the years, and so the team created the first database on gun laws by reading through every states' laws. Data collected on homicide and suicide rates (the dependent variables), as well as the control variables (race, poverty, etc.), were collected from public databases such as the Census. Using a differences-in-differences approach, the research team ran a fixed effects, multivariable regression model in order to analyze the data. While the study found no significant effects of the laws on suicide rates, it did find several correlations between a few gun laws and firearm homicide rates. The first was universal background checks, which decreased firearm homicides by 14.9%. The second was violent misdemeanor laws, which decreased firearm homicides by 18.1%. The third was "shall issue" laws, which saw an increase of firearm homicide rates by 9.0%. The study concluded by saying that it is important to keep in mind that it did non study non-firearm homicides and that while there are apparent correlations, future work should be done to indicate whether there is an actual causation. It also found that stand-your-ground laws did not have a correlation with firearm homicide rates. (Siegel, 2019),

The second piece of literature examined is "An Examination of the Effects of Concealed Weapons Laws and Assault Weapons Bans on State-Level Murder Rates", by Mark Gius. The purpose of Gius' study was to examine the effect of individual states' laws regarding assault style weapons and the ability to have concealed firearms (the independent variables) on state-level gun-related murder rates (the dependent variable) from 1980 to 2009. Data on homicide rates were acquired through the *Supplementary Homicide Reports* issued by the Department of Justice and State Laws were taken from several resources (including, but not limited to, the Legal Community Against Violence, the National Rifle Association, and the United States Bureau of Alcohol, Tobacco, Firearms, and Explosives), while all other state relevant data was taken from Censuses. In order to determine if concealed weapons laws and assault weapons bans had statistically-significant effects on gun-related murder rates, a fixed effects model that controls for both state-level and year effects was used; dummy variables were used to denote if States had relevant

assault weapon or concealed carry laws. The results of the study showed that states with more restrictive concealed carry laws had gun-related murder rates that were 10.0% higher; the results also showed that during the years that the federal ban on assault rifles was in effect (1994 to 2004), gun-related murder rates were 19.3% higher. Gius concluded his findings by saying that further research would be warranted to decide if this was due to an actual causation. (Gius, 2013)

The third study examined was "Homicide and Suicide Rates Associated with Implementation of the Brady Handgun Violence Prevention Act", conducted by Jens Ludwig and Philip Cook. The objective of the study was to determine if the implementation of the Brady Act (the independent variable) in 1994 could be associated with a reduction in both homicide and suicide rates (the dependent variables) in each State by examining data from 1985 to 1997. Data on homicide, gun-related homicide, suicide, and gun-related suicide rates (per 100,000 people) were all collected from the vital statistics census of deaths of US residents from the National Center for Health Statistics for the period of 1985 to 1997 and were calculated separately by year for each State; all data that was collected and calculated was for adults 21 years of age and older. Prior to the implementation of the Brady Act, 18 States and the District of Columbia already had state background checks and waiting periods for guns, and so were used as the control group; the Brady Act required 32 States to implement these rules in order to purchase a firearm, becoming the treatment group.

The study focused on using an equation that was estimated via weighted least squares, which corrected for heteroscedasticity in the stochastic term by pre-multiplying the dependent and explanatory variables by the square root of the State's population; standard errors from data sources were used to adjust for the non-independence of observations from the same State. The results found that there was no significant difference in the homicide or firearm homicide rates in the 32 treatment States after the implementation of the Brady Act. The study did note that it was possible that the Brady Act may have had a negative association with homicide rates in both the treatment and control states by reducing the flow of guns from treatment state gun dealers into secondary gun markets, though they were unable to conclude this based on their own research. The study also states that although the Brady Act might not have helped stop crime, it helped solve crime since all firearm purchases were strictly recorded. (Ludwig, 2000)

The final study we examined was "From a Duty to Retreat to Stand Your Ground: The Race and Gender Politics of Do-It-Yourself-Defense", which was a 2015 study done by Caroline White. The goal of the article was to figure out if stand your ground laws (the independent variable) disproportionately affected homicide rates of minority groups (the dependent variable). The study took into consideration the erosion of the duty to retreat

since the post-Reconstruction era, when post-war political and economic turmoil and enfranchisement of African American men that ultimately led to the shifting of the legal definition of a man's "castle" that has today led to the empowering of armed citizens to justify their perceptions of a "reasonable threat". One of the main sources for data for the study was a United Nations report submitted in 2013 titled "Dream Defenders, National Association for the Advancement of Colored People, & Community Justice Project of Florida Legal Services. The study also independently went through the various state laws regarding SYG laws, as well as white-on-black homicides. The study ultimately concluded that states with SYG laws saw overall homicide rates increase from 7% overall to 9% overall. Even more shockingly, the study found that white-on-black homicides are significantly more likely to be determined as justifiable in states with stand-your-ground laws than in states without such laws. Similar statistics can be found in a 2017 case study for Florida ("Association between Enactment of a 'Stand Your Ground- Self-defense Law and Unlawful Homicides in Florida", by David Humphreys, Antonio Gasparrini, and Douglas Wiebe). This study specifically found that monthly homicide rates increased by 31.6% after the law was enacted, though it was not able to distinguish between "justifiable" and "unlawful" homicides. These combined studies highlight the issues surrounding Stand-your-ground laws and their effects on overall homicides, as well as their effects on African-Americans. (White, 2015)

Although previous research suggests that laws that restricted gun ownership in some way did not affect homicide rates, we are hoping to find the opposite: does giving more freedom to use your gun lower the homicide rate? So far previous literature has suggested some conflicting information, which makes our study even more important. This research examines similar external factors as the previous research, such as poverty rate, race, other types of crime, etc. One significant difference is that this study's data does not distinguish between gun-related and non-gun-related homicides, something that all of the previous research looks at. This study also does not look at effects on suicide (whether gun-related or other), as it is not relevant to SYG laws.

HYPOTHESIS

The relationship between Stand Your Ground Law and homicides is important for policy makers to understand because the findings can be used to improve public safety. Given that a homicide is any unnatural death caused by another, we hypothesize that the SYG will have an inverse effect on homicides. We understand that the SYG law will lead to victims of violent crimes being more likely to act in defense using a firearm, and possibly murder or injury an assailant. However, this increase in homicides will be outweighed by a decrease in violent crimes, robberies, and burglaries which will overall decrease the amount of homicides. Our hypothesis is:

$$H0: B_1 = 0$$

$$H1: B_1 < 0$$

In layman's terms, we believe the presence of SYG law will decrease the number of homicides.

DATA

Variable	Type	Key Information
Homicides	Continuous	Homicide rate per 100,000 individuals
Stand Your Ground	Dummy Variable, discreet	Whether or not the state has a *Stand Your Ground Law*
Adjusted Total Violent Crime	Continuous	The total violent crime in a state, adjusted to population
Adjusted Robberies	Continuous	The total robberies in a state, adjusted to population
Adjusted Burglaries	Continuous	The total burglaries in a state, adjusted to population
Education Percent	Continuous	Percent of individuals who possess a high school diploma or equivalent
Percent in Poverty	Continuous	Percent of individuals in a

		state that live in poverty
Member of Confederacy	Dummy Variable, discreet	Whether a state was a part of the confederacy, union, or neutral/not applicable
Voted Trump	Dummy Variable, discreet	Whether a state voted for Trump or Clinton in the 2016 national US election

In order to support our hypothesis we have put together a regression model to assess the homicide rate. The key variable in question is how the SYG laws impact our dependent variable, homicide rate per 100,000, and the seven covariates that we believe are relevant to the relationship between homicide rate and the Stand Your Ground law. To collect our data we used the Uniform Crime Report, Shoot First: Stand Your Grounds Laws and Their Effect on Violent Crimes and the Criminal Justice System, U.S. Census Bureau, U.S. Parks, CNN, and the Kaiser Family Foundation to find the data on all of our variables.

The Uniform Crime Report (UCR) is a program directed by the FBI with the goal of obtaining reliable data on a wide range of crimes. *Shoot First* is a report on the effects of the SYG law on crime and contains the information on when a state adopted am SYG law. The U.S. Census Bureau is a governmental agency that is responsible for providing information on the American population. The U.S. Parks department provided data on which states were a part of the Union and the Confederacy during the civil war. CNN provided information pertaining to the 2016 U.S. election results, and the Kaiser Family Foundation is a non-profit organization that focuses on issues regarding healthcare for all Americans.

HOMICIDE RATE

Homicide rate per 100,000 people is our dependent variable, and has been collected for all 50 states and the District of Columbia from 1995 to 2006. The data was collected from the Uniform Crime Report based on a sample of 100,000 people which gave us a continuous variable for every year and state. The UCR operates on a voluntarily submitted data, so this variable is a sample of the population of homicide rates.

STAND YOUR GROUND LAW

Our most key independent variable is a dummy variable on the Stand Your Ground. We collected the data from the appendix of Shoot First: Stand Your Grounds Laws and Their Effect on Violent Crimes and the Criminal Justice System. This appendix shows when the 29 states with a SYG law adopted the law, so we can conclude that the states not listed and all states before the 2005, where the appendix timeframe have no such law and will be represented by a 0 in the regression model, and for the states with the Stand Your Ground

law a 1 will be used. The expectation is that homicide rates will have a negative relationship with SYG laws.

TOTAL VIOLENT CRIME

The second independent variable is total violent crime. We used the Uniform Crime Report to find data on all 50 states and the District of Columbia from 1995- 2016. The data found will give us a discrete variable for the total of violent crimes reported to the UCR. This is a sample of all violent crimes because the UCR operates on a voluntarily submitted data, so this variable is a sample of the population of all violent crimes. Our expectation is that the total violent crime will have a positive relationship with homicides.

ROBBERIES

Our third independent variable is on the total number of robberies, and we collected this data from the Uniform Crime Report. The UCR defines a robbery has the taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear. We collected data for all 50 states and the District of Columbia from 1995-2016, and the data found will represent this variable has a discrete variable. Again due to the UCR operating on volunteer basis this data is a sample of the whole population of robberies. We predict that robberies will have a positive relationship with homicide rates.

BURGLARIES

The fourth variable is on the total number of burglaries which differs from robberies because a burglary is the unlawful entry into a building with the intent to commit a felony or theft. In order to find the data we used the Uniform Crime Report to give us data on all 50 states and the District of Columbia from 1995-2016. The data we found gives us discrete variables to be used in our regression model. This data was collected from the UCR, so the data represents only a sample of all burglaries committed. Our expectation is that burglaries will positively relate to homicide rates.

EDUCATION PERCENTAGE

Our fifth variable is based on the education percentage in each state. The “education percentage” represents the percentage of people in each state that have received a high school diploma, GED, or equivalent. Data covering education percentages per state primarily came from the U.S. Census. Our expectation is that education percentages will have a negative relationship with homicide rates. The more educated the area, the less homicides we predict.

POVERTY

The sixth variable is the percentage of the state's population who live below the poverty line. The data was retrieved from U.S. Census and has given us data on all fifty states and the District of Columbia from 1995-2016. This variable is independent, and we predict that due to the disparity of wealth and necessary resources to have a comfortable life, that communities with lower income will have higher instances of crime and gun violence.

CONFEDERACY

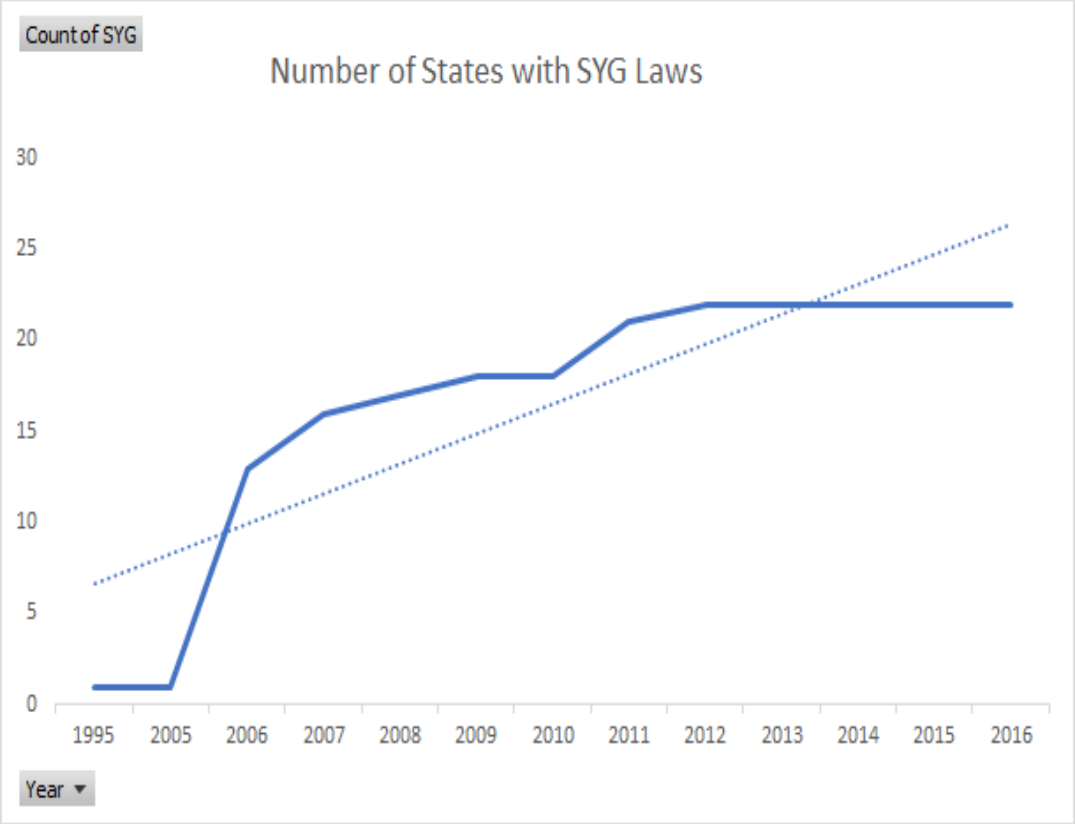
The seventh variable that we examined was whether a state was a part of the Confederacy or Union during the civil war, data derived from US National Parks Service. In order to calculate this, a dummy variable was used 1 represented states that were a part of the Confederacy, 2 represented states that were a part of the Union, and a 0 was used for border states and states not established by 1861. Our expectation is that states that used to belong to the Confederacy will have a positive relationship with homicide rates.

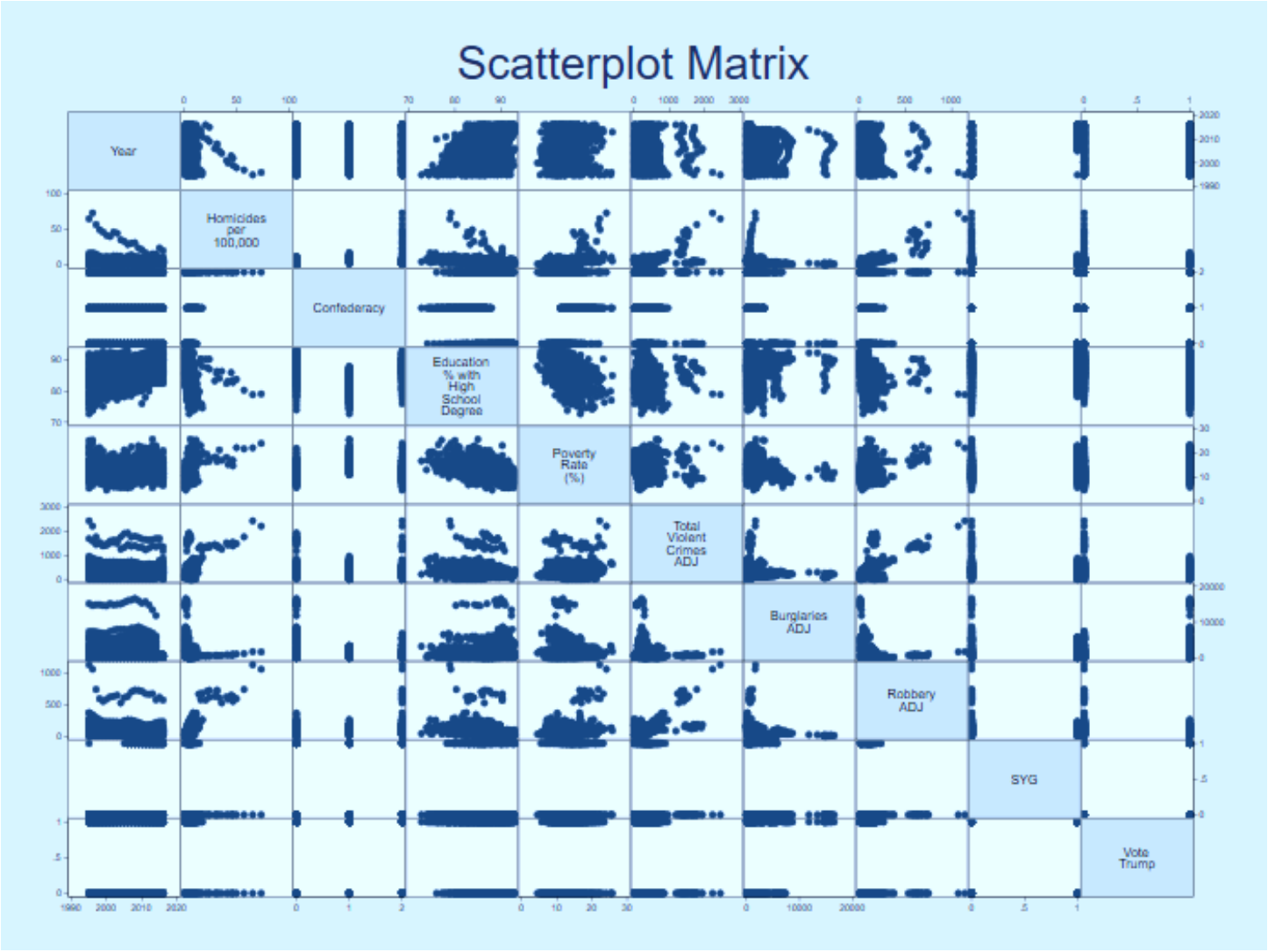
VOTED TRUMP

The eighth variable used was whether or not a state voted for Donald Trump in the 2016 US national election. Data was retrieved from CNN and their coverage of the 2016 election. A dummy variable was used to evaluate this. If a state's electoral votes went to Donald Trump, it was represented by a 1 and if a state's electoral votes went to Hillary Clinton, then it was represented by a 0. Due to the stark differences in beliefs, we suspect that states that voted for Trump will positive relationships with homicide rates.

ANALYSIS

In 2005, Florida became the first of many to create SYG protections for its citizens. The graph below illustrates the growth of the SYG laws as they gained popularity in the United States. Between 2005 and 2006 15 states enacted SYG laws, partially explained by lobbying done for the National Rifle Association and the American Legislative Exchange Council. These groups resurrected 2nd Amendment concerns and pushed a "Stand Your Ground" rhetoric that appealed to many legislators constituents. And by 2012, over 20 states had an SYG law in place.

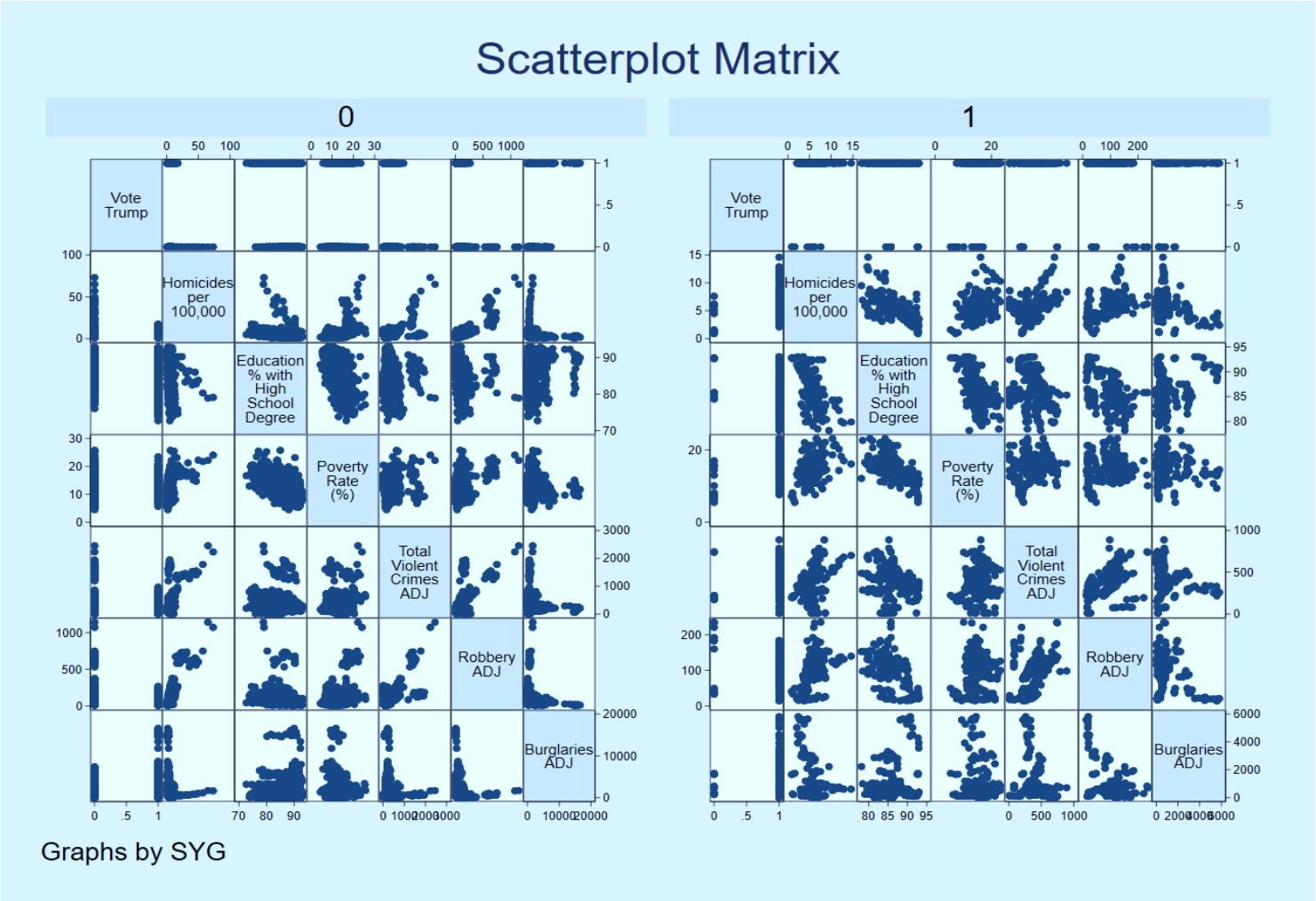




TRENDS IN SCATTERPLOT MATRIX

From our scatterplot matrix, we noticed the following patterns:

- Total Violent Crime, which we expected would have a positive, linear correlation with burglaries, robberies, and homicides (as all of which would be considered a component of violent crime) has a lot more scatter and variability than we would expect
- States with SYG laws appear to have fewer incidents of burglaries per 100,000 people
- States which voted for Trump had a higher poverty percentage, states that did not had fewer burglaries per 100,000 people
- Whether or not a state has SYG laws in place doesn't appear to affect any of our variables in a meaningful way
- Over time, more states had higher percentages of the population with high school degrees, and homicides per 100,000 people seems to have also decreased over time



- When we separate the data based on our chief dummy variable (SYG law, 0 = negative, 1= affirmative, we see a more clearly positive, linear relationship between total violent crimes, and burglaries, robberies, and homicides. This relationship persists regardless of whether the state has SYG laws, however it is strongest and most linear in states without SYG laws. This could be a consequence of more accidental homicides / manslaughter and how those crimes are recorded when they're considered crimes, and not simply self-defense. Another possible explanation is that the states without a SYG precedent in place are states that feel no need for one as they have fewer incidents of violent crime.

- We can see more clearly that states with SYG laws had a higher proportion vote for Donald Trump. As a common characterization of the Trump voter is one who values small government, individual rights, and the preservation of traditional American values – this makes sense.

- States that do have SYG laws have a stronger correlation between percentage with a high school education and poverty (negative correlation).

FINAL REGRESSION MODEL AND TABLE

HOMICIDEPER100, 000=6.06(VOTETRUMP+.03(ROBBERYADJ)+STATECOEF(STN)+ERRORI

It's apparent in the new regression table below that most of the independent variables are not significant. The only independent variables that were significant were whether or not the state voted from Trump (votetrump) and number of robberies per 100,000 people (robberyadj), with magnitudes of 6.06 and .03, respectively. Other than those two variables, no years were significant, and only some states were: Arkansas (3.19), Arizona (5.93), Colorado (1.73), D.C. (18.35), Idaho (-4.30), Illinois (10.03), Mississippi (3.15) Michigan (-4.36), North Dakota (-5.92), Nevada (-5.08), New Mexico (5.94), South Dakota (-4.92), Utah (-5.70), and Virginia (-3.26).

These numbers seem to make sense. We assume that a state that voted for Trump in the 2016 elections is a more divided state that would value ones right to protect themselves from big government. Not to forget, a majority of states voted for Trump, so it is not surprising to see that it is significant. The number of robberies also is logical, as it can be assumed that robberies involve weapons and an immediate threat on the person; potentially this could be extended to SYG laws because the person being robbed might have "defended" themselves and faced their attackers. Robberies involve a confrontation – they happen within the domicile, the bank, etc. They're going to be more frequently reported, and more accurately reported, as opposed to burglaries, which can go unnoticed, and inefficiently reported. As far as the individual states go, it makes sense that traditionally more violent cities (D.C. and Chicago) would push their states to have higher coefficients (18.35 and 10.03, respectively). Finally, of the fourteen states that were statistically significant, only three of them had SYG laws, implying that maybe these laws do in fact make a difference in lowering homicide rates.

After running this regression we can **accept our null hypothesis** because the Stand Your Ground law has a potential of having zero effect on the homicide rate.

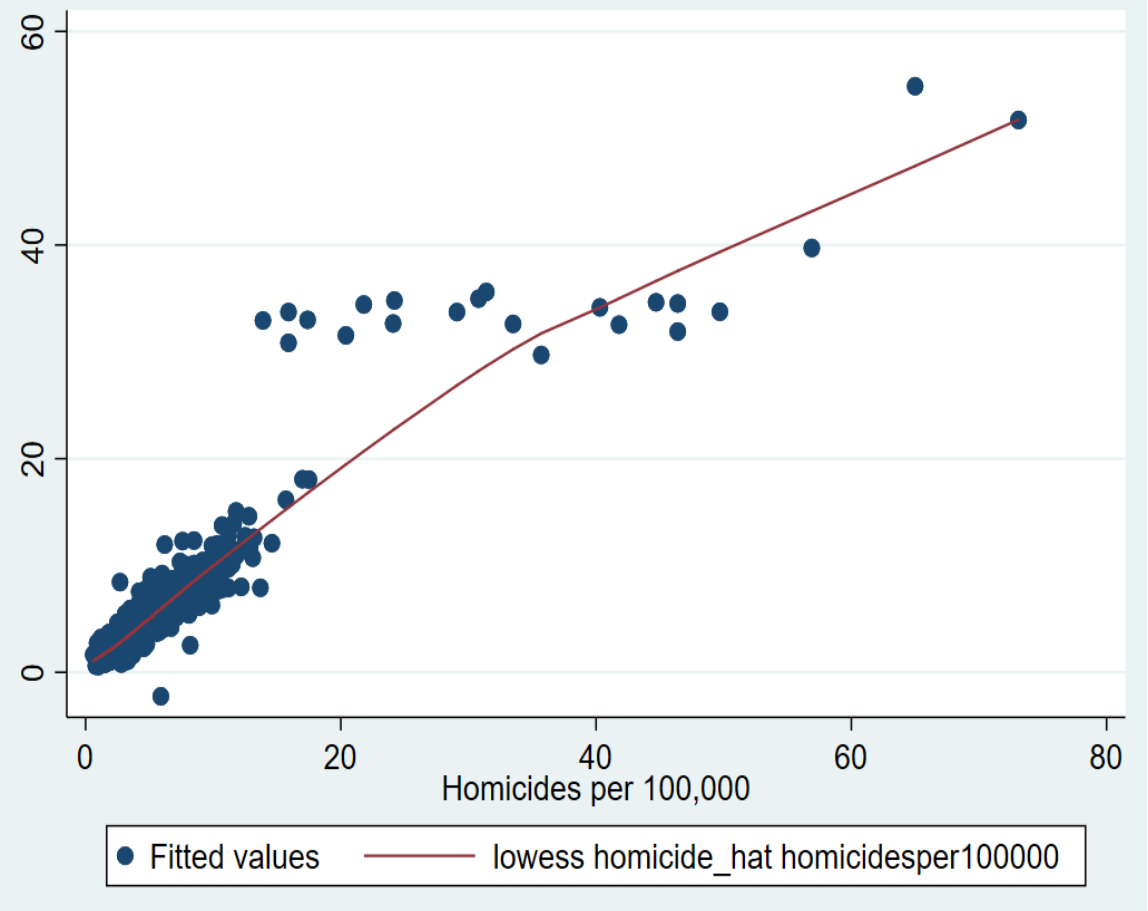
```
. reg homicidesper100000 syg confederacy votetrump EDU povertyrate totalviolentcrimesadj robberyadj b
> urglariesadj i.stn i.year, vce(cluster stn)
note: 48.stn omitted because of collinearity
note: 50.stn omitted because of collinearity

Linear regression                               Number of obs     =      1,122
                                                F(26, 50)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.8611
                                                Root MSE          =     2.1018

                                   (Std. Err. adjusted for 51 clusters in stn)
------------------------------------------------------------------------------
             |               Robust
homicidesp~0 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         syg |    .130642   .6596542     0.20   0.844    -1.194312    1.455596
  confederacy |     -4.964   3.263733    -1.52   0.135     -11.5194    1.591401
   votetrump |     6.05829   1.255272     4.83   0.000     3.537003    8.579578
         EDU |   -.1042583   .1778784    -0.59   0.560    -.4615375    .2530209
  povertyrate |    .0292571    .091168     0.32   0.750    -.1538592    .2123734
totalviolen~j |    .0059548   .0054171     1.10   0.277    -.0049256    .0168353
  robberyadj |    .0272541   .0054089     5.04   0.000       .01639    .0381182
burglariesadj |     .000123   .0000946     1.30   0.200     -.000067     .000313
              |
          stn |
           AL |    .6156812   1.032151     0.60   0.554    -1.457456    2.688818
           AR |    3.186401   1.017414     3.13   0.003     1.142865    5.229938
           AZ |    5.926908   2.011514     2.95   0.005     1.886665    9.967152
           CA |    11.54874    6.15363     1.88   0.066    -.8111899    23.90867
           CO |    1.763744   .3756379     4.70   0.000     1.009253    2.518235
           CT |    8.863835   5.916044     1.50   0.140    -3.018889    20.74656
           DC |    18.33362   2.947597     6.22   0.000      12.4132    24.25404
           DE |   -8.287364   7.285126    -1.14   0.261    -22.91997    6.345243
           FL |    .7709506   1.890541     0.41   0.685    -3.026313    4.568215
           GA |   -.3037656   .5918705    -0.51   0.610    -1.492572    .8850412
           HI |   -.7997733   .5122776    -1.56   0.125    -1.828713    .2291666
           IA |    4.124176   5.610183     0.74   0.466    -7.144207    15.39256
```

ID	-4.30115	1.046958	-4.11	0.000	-6.404026	-2.198274
IL	10.02885	4.881237	2.05	0.045	.2245978	19.8331
IN	5.434803	4.127903	1.32	0.194	-2.856334	13.72594
KS	5.451396	4.663879	1.17	0.248	-3.91628	14.81907
KY	-4.684382	3.118845	-1.50	0.139	-10.94877	1.580004
LA	3.328466	2.291727	1.45	0.153	-1.274603	7.931535
MA	7.851015	5.521367	1.42	0.161	-3.238976	18.94101
MD	-.049057	1.869067	-0.03	0.979	-3.803189	3.705075
ME	11.22187	7.21431	1.56	0.126	-3.268499	25.71224
MI	4.988853	3.648622	1.37	0.178	-2.339619	12.31733
MN	.1673091	.8532754	0.20	0.845	-1.546545	1.881163
MO	-4.372246	2.69366	-1.62	0.111	-9.782622	1.03813
MS	3.148249	.6264482	5.03	0.000	1.889991	4.406508
MT	-4.335177	1.498424	-2.89	0.006	-7.344849	-1.325504
NC	.0389202	.4052715	0.10	0.924	-.7750916	.8529319
ND	-5.918033	1.749486	-3.38	0.001	-9.431979	-2.404086
NE	-5.08289	.991928	-5.12	0.000	-7.075236	-3.090544
NH	10.80458	7.727075	1.40	0.168	-4.715702	26.32487
NJ	9.154666	6.210382	1.47	0.147	-3.319255	21.62859
NM	5.943244	.6528863	9.10	0.000	4.631883	7.254605
NV	11.71697	5.932989	1.97	0.054	-.1997901	23.63373
NY	7.275931	4.478062	1.62	0.110	-1.718522	16.27038
OH	3.580569	4.809794	0.74	0.460	-6.080186	13.24132
OK	-4.613016	3.413427	-1.35	0.183	-11.46909	2.243054
OR	9.874593	6.328983	1.56	0.125	-2.837544	22.58673
PA	4.220349	4.411134	0.96	0.343	-4.639675	13.08037
RI	9.340208	5.34886	1.75	0.087	-1.403293	20.08371
SC	-.5180398	1.784279	-0.29	0.773	-4.101869	3.065789
SD	-4.918069	1.547535	-3.18	0.003	-8.026385	-1.809754
TN	-1.464177	1.710329	-0.86	0.396	-4.899474	1.97112
TX	-1.45935	1.193234	-1.22	0.227	-3.856031	.9373307
UT	-5.695786	.8373807	-6.80	0.000	-7.377715	-4.013858
VA	-3.261648	1.248017	-2.61	0.012	-5.768364	-.7549319
VT	11.92863	7.66933	1.56	0.126	-3.475675	27.33293
WA	0	(omitted)				
WI	4.739274	5.760496	0.82	0.415	-6.831022	16.30957
WV	0	(omitted)				
WY	-3.883049	.5954826	-6.52	0.000	-5.079111	-2.686987
year						
1996	.0335094	.4169278	0.08	0.936	-.8039147	.8709336
1997	-.2253173	.5168528	-0.44	0.665	-1.263447	.8128121
1998	-.0734692	.8271816	-0.09	0.930	-1.734912	1.587974
1999	-.0637584	1.075861	-0.06	0.953	-2.224689	2.097172

year						
1996	.0335094	.4169278	0.08	0.936	-.8039147	.8709336
1997	-.2253173	.5168528	-0.44	0.665	-1.263447	.8128121
1998	-.0734692	.8271816	-0.09	0.930	-1.734912	1.587974
1999	-.0637584	1.075861	-0.06	0.953	-2.224689	2.097172
2000	-.5124879	1.186441	-0.43	0.668	-2.895525	1.870549
2001	-.6436425	1.004043	-0.64	0.524	-2.660323	1.373038
2002	-.5176939	1.122364	-0.46	0.647	-2.772028	1.73664
2003	-.351174	1.203232	-0.29	0.772	-2.767937	2.065589
2004	-.4325136	1.205376	-0.36	0.721	-2.853583	1.988556
2005	-.575109	1.037815	-0.55	0.582	-2.659621	1.509403
2006	-.7792532	.8205248	-0.95	0.347	-2.427326	.8688194
2007	-.8050322	.7206038	-1.12	0.269	-2.252408	.6423431
2008	-.9823387	.757497	-1.30	0.201	-2.503816	.5391388
2009	-1.219739	.7008925	-1.74	0.088	-2.627523	.1880452
2010	-1.182029	.7053467	-1.68	0.100	-2.598759	.2347015
2011	-.942088	.7571745	-1.24	0.219	-2.462918	.5787418
2012	-1.020457	.7915544	-1.29	0.203	-2.610341	.569427
2013	-.9764918	.9119796	-1.07	0.289	-2.808257	.8552731
2014	-.8761409	.9885906	-0.89	0.380	-2.861784	1.109502
2015	-.4218203	1.106201	-0.38	0.705	-2.64369	1.80005
2016	-.0138606	1.197229	-0.01	0.991	-2.418566	2.390844
_cons	8.149216	12.60789	0.65	0.521	-17.17447	33.4729

DIAGNOSTICS

LINEAR IN PARAMETER



In order to test the first Gauss-Mark assumption of linearity we plotted our dependent variable, homicides per 100,000, as a linear function of our independent variables. Based on the graph our model appears to be linear in parameters. We observe an upward sloping linear line.

ZERO CONDITIONAL MEAN

In order to test for the third Gaus-Marx assumption we plotted the residuals for the above regression against the SYG variable. The horizontal line lays perfectly across the zero Y axis, so we can conclude that the conditional mean is zero. This test also allows us to determine there are no omitted variables.

MULTICOLLINEARITY

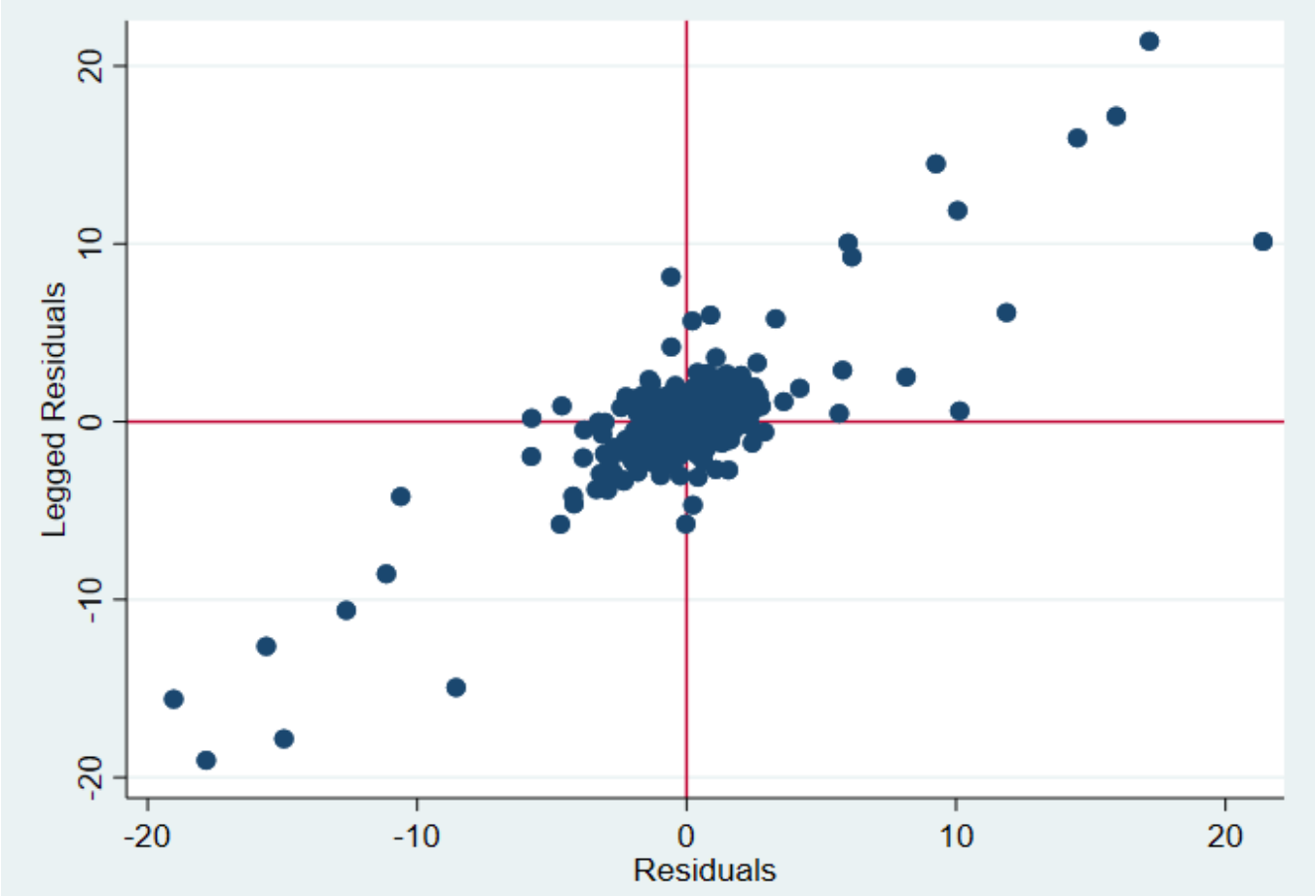
In order to assess the third Gauss-Marx assumption we tested our model for multicollinearity. When interpreting the VIF table (located in the Appendix), there are some variables that are concerning. The variable **confederacy** and **votetrump** had higher VIF values than most. This could be linked to the similar beliefs in the Southern States with the Confederacy. More conservatives reside in the South with different cultural values than those held on the West Coast, East Coast, Midwest, and New England. Due to the higher VIF values, we can link a redundancy with those two variables, and conclude our model has multicollinearity, and in a perfect regression model we would omit the confederacy variable because it is not significant.

HETEROSCEDASTICITY

In order to test for the fourth Gauss-Marx assumption we ran the Breusch-Pagan test for heteroscedasticity (Appendix 1). The null hypothesis in this test is that the variables have a constant variance, and because the P-value is below the 5% benchmark we reject the null hypothesis. In conclusion there is some form of heteroscedasticity in our model, which means our estimators do not have a minimum variance and are not efficient.

AUTOCORRELATION

In order to assess the validity of the fifth and final Gauss-Marx assumption of autocorrelation we plotted the residuals against the lagged values. That is the residuals in time period t versus their value in period t-1. From this plot we can conclude that there is a positive autocorrelation because of the slope. This means that our model does not have minimum variance and is not efficient.



CONCLUSION

The clearest weakness in our project that can be identified is the source of the crime data. This report required information from the Unified Crime Reporting Program (UCR). While this program is the best estimate of the crime that occurs throughout the United States, its faults must be recognized. The UCR collects voluntary data from police precincts across the country. The data in the program can vary often and is not always accurate. Communities classify some crimes differently, which also negatively affects the accuracy of the reporting.

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APPENDIX 1: TABLES

High VIF test

```
. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
         syg |      2.44    0.409162
 confederacy |    143.37    0.006975
   votetrump |     28.03    0.035671
         EDU |     10.22    0.097885
 povertyrate |      5.79    0.172854
totalviole~j |     18.01    0.055527
  robberyadj |     23.43    0.042675
burglaries~j |     10.42    0.095955
         stn |
           2 |      2.27    0.440312
           3 |      2.30    0.434215
           4 |      2.49    0.401291
           5 |     14.77    0.067721
           6 |      2.00    0.499366
           7 |     16.23    0.061611
           8 |     23.71    0.042178
           9 |      7.13    0.140231
          10 |      3.18    0.314398
          11 |      2.42    0.413672
          12 |      2.85    0.351301
          13 |     11.41    0.087627
          14 |      2.29    0.436214
          15 |     15.31    0.065333
          16 |     10.14    0.098664
          17 |     11.20    0.089308
          18 |      3.56    0.281233
          19 |      2.59    0.386555
          20 |     15.65    0.063909
          21 |      2.69    0.372348
          22 |     15.59    0.064153
          23 |     10.73    0.093162
          24 |      2.06    0.485279
          25 |      2.71    0.369659
          26 |      2.22    0.450345
          27 |      2.72    0.367000
          28 |      2.33    0.429114
          29 |      8.04    0.124452
          30 |      2.16    0.463926
          31 |     17.83    0.056074
          32 |     16.57    0.060363
          33 |      4.13    0.242242
          34 |     16.09    0.062163
          35 |     14.23    0.070287
          36 |     11.19    0.089400
          37 |      2.98    0.335210
          38 |     15.50    0.064496
          39 |     11.00    0.090905
          40 |     13.43    0.074444
          41 |      2.61    0.383628
          42 |      2.86    0.350252
          43 |      2.63    0.379627
          44 |      2.40    0.416227
          45 |      3.62    0.276120
          46 |      2.39    0.418165
          47 |     16.72    0.059821
          49 |     11.91    0.083994
          51 |      2.69    0.371800
        year |
        1996 |      1.92    0.522113
        1997 |      1.94    0.515445
        1998 |      2.03    0.491499
        1999 |      2.14    0.467359
        2000 |      2.26    0.441693
        2001 |      2.19    0.457114
        2002 |      2.20    0.455427
        2003 |      2.27    0.441466
        2004 |      2.35    0.425125
        2005 |      2.35    0.426157
        2006 |      2.40    0.416143
        2007 |      2.28    0.437743
        2008 |      2.33    0.428865
        2009 |      2.45    0.408676
        2010 |      2.54    0.393823
        2011 |      2.72    0.367753
        2012 |      2.86    0.349932
        2013 |      3.07    0.325482
        2014 |      3.11    0.321974
        2015 |      3.20    0.312657
        2016 |      3.20    0.312756
-------------+----------------------
    Mean VIF |      8.66
```

Breusch-Pagan test

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heter
> oskedasticity
         Ho: Constant variance
         Variables: fitted values of
                    homicidesper100000

         chi2(1)      = 11900.27
         Prob > chi2  =   0.0000
```

APPENDIX 2: STATA COMMANDS

- use "C:\Users\alelogan\Downloads\STATA_FINAL.dta"
- rename var12 Obs
- encode state, gen(stn)
- reg homicidesper100000 syg confederacy votetrump EDU povertyrate totalviolentcrimesadj robberyadj burglariesadj i.stn i.year
- predict homicidesper100000_hat
- twoway scatter homicidesper100000_hat homicidesper100000 || lowess homicidesper100000_hat homicidesper100000
- predict resid, res
- twoway scatter resid syg || lowess resid syg, m
- estat vif
- estat hettest
- tsset Obs
- predict res, res
- gen lag_res=l.res
- twoway scatter lag_res res, yline(0) xline(0) ytitle(Legged Residuals)
- reg resid lag_res i.stn i.year
- reg homicidesper100000 syg confederacy votetrump EDU povertyrate totalviolentcrimesadj robberyadj burglariesadj i.stn i.year, vce(cluster stn)