Influence of Socioeconomic Factors and Gun Laws on the Frequency of Gun Violence in America: A Statewide Analysis from 2010-2018

by

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Abstract

Are gun laws effective in lowering the frequency of gun violence, and do socioeconomic factors affect this in any way? This paper analyzes the influences of both gun control provisions and socioeconomic factors on the frequency of intentional gun violence inflicted against others, measuring changes to each on a statewide basis over the 2010 to 2018 period. This paper uses two-way fixed effects models controlling for year and state in the study, and results show that most measurable socioeconomic conditions have little effect on the frequency of gun violence. As for gun laws, while some provisions are not effective in lowering the frequency of gun violence, overall, states with more gun control provisions in place see a lower frequency. However, not all types of laws lower the frequency equally.

I. Introduction

Gun violence in America remains a polarized issue over the past few decades. Proponents for stricter gun control measures argue that shooters would be prevented from acquiring a firearm if stricter measures had been in place, while pro-gun Americans argue stricter gun laws would not have prevented the shooter from getting their firearm in the first place, since only law-abiding citizens follow the law (Lesko, 2019, p. 13). The latter half of Americans view guns as a deterrant: if more people own a firearm, then potential shooters would think twice about starting a shooting, because then their own safety would be uncertain. On the other hand, some Americans do not view an increase in gun ownership levels as a deterrant, but instead as the direct cause of gun violence: since more Americans own a gun, that increases the likelihood of a shooting occurring (Kahan & Braman, 2003, p. 1292.). Gun violence by definition cannot occur without any guns present, so higher gun ownership rates would theoretically translate to higher levels of gun violence.

Emotions often run high shortly after any shooting takes place. Any shooting itself is an unfortunate tragedy, and people wonder if anything could have been done to prevent the shooting from occurring. High emotion levels thus make it difficult to enact meaningful policy changes to prevent future gun violence; additionally, policymakers do not agree on what should be changed in the first place. While weak gun laws might have enabled the shooter in successfully carrying out the shooting, the question is also raised on their motive and whether there were any warning signs. The shooter's prior living conditions are consistently seen to have some level of influence over them that led to their decision to start a shooting, since the socioeconomic factors of the state they resided in would have bettered or worsened their living conditions at home, as well as their mental state (Kwon et al., 1997, Swanson et al. (2015)). Therefore, while the strictness – or lack thereof – of gun laws are claimed to influence gun violence levels, state socioeconomic conditions also have some influence.

This paper examines the influence of both a state's gun laws and socioeconomic factors on the number of firearm murder cases each year per 100,000 people, on the specified time period of 2010-2018. This time period covers major shooting events and the rise of movements seeking to enact major policy changes, such as the Sandy Hook Elementary School shooting in 2012 and Ferguson unrest in 2014, for example, so their impact on later years in the study would be seen in the data. Data was obtained from various government agencies and independent research organizations, and a full list is

seen in Table 1 in section III of the paper. Only firearm-related murder cases are analyzed in this paper, so suicides caused by firearms are excluded from analysis.

This paper uses five different specifications of two-way fixed effects models to identify the causal effects of policy variables and socioeconomic factors on the frequency of gun violence, controlling for year and state. Focusing on a single year's worth of data would not accurately describe the impact each variable has on the frequency of gun violence, especially if gun laws and socioeconomic factors change frequently – or greatly – over the years. Because protests and other major unmeasurable factors occur during the measured period that might affect the frequency of gun violence, the models isolate this influence from the true effects of the factors on gun violence. Therefore, the models control for years in which gun violence is particularly bad because of outside influences; the same applies for states that are disproportionality experiencing this as well. The models overall show that socioeconomic factors do not affect the frequency of gun violence, although states with higher levels of per capita gallons of alcohol consumed see worsened levels. Contrary to intuitive thought, the two models that measured the firearm ownership rate find this variable to have no influence on the frequency of gun violence; the same result was found for police funding levels. Regarding gun law provisions, all three of the models find that states with stricter gun control laws see less firearm-related murder cases, although some laws are seen to be less effective than others.

II. Literature Review

In general, the existing literature primarily focuses on just one of two major factors thought to affect gun violence: socioeconomic factors and gun laws. Some papers do look at both socioeconomic factors and gun laws, but statistical analysis is only done on data collected for a single year. Papers that use panel data only observe either gun laws *or* socioeconomic factors; no existing paper has measured both of the categories over a given period of time to examine the influence of annual differences on the frequency of firearm murder cases. Shughart II & Lott (1999, p. 23) note this weakness in gun control research, writing,

> The vast majority of gun-control studies that examine time-series data present a comparison of the average murder rates before and after the change in laws; those that examine cross-sectional data compare murder rates across places with and without certain laws. Unfortunately, these studies make no attempt to relate fluctuations in crime rates to changing law-enforcement factors like arrest or conviction rates, prison-sentence lengths, or other obvious variables" (Shughart II & Lott, 1999).

Existing federal research efforts on gun violence has been very limited, due to a halt in research during the end of the 20th century because of lobbying done by the National Rifle Association (NRA). The NRA was efficient in lobbying members of Congress, with it outspending its closest opponent by a 6:1 ratio in 1986 (Langbein & Lotwis, 1990). The NRA then lobbied in support for the Dickey Amendment, and when passed in the 1996 United States omnibus spending bill, the amendment mandated that "none of the funds made available for injury prevention and control at the Centers for Disease Control and Prevention (CDC) may be used to advocate or promote gun control" (Bohannon, 2013). This amendment prevented the CDC from using funding on gun research, which stagnated federal research efforts until 2018, when the law was clarified by Congress to allow the usage of funding on gun research; gun violence research also dropped by 60% during the 1996-2018 time period (Underwood,

2013). Although the CDC was allowed to conduct research into gun violence in 2018, no funding was allocated specifically for this, until the 2020 fiscal year spending bill allocated $25 million to be split between the CDC and National Institutes of Health.

One of the biggest controversies surrounding gun violence in America is the impact of mental health. Research on the subject has consistently shown that mental health does *not* have as big of an impact as previously claimed, and epidemiologic studies show, "the facts showed that people with serious mental illnesses are, indeed, somewhat more likely to commit violent acts than people who are not mentally ill, but the large majority are not violent towards others" (Swanson et al., 2015). The authors note that papers which establish an association between mental health diagnoses and violence are misleading, because they use data which was obtained from clinical forensic studies; psychiatric patients who checked in for violent tendencies already were violent to begin with, thus creating a selection bias. Results also show that the belief of mental health affecting gun violence is spread by news organizations, and while people with mental health issues are primarily not ever violent towards others, Swanson et al. (2015) note a strong positive association between mental illness and risk of suicide. The literature thus shows that while mentally ill people are not violent towards other people, they are far more likely to be violent to themselves (Swanson et al., 2015, Kleck (1986)).

The accessibility of guns has been seen time and time again to have a positive association with murder rates (LaFollette, 2000, Kamal & Burton (2018)). It is important to note that this result refers to the severity of gun violence – the number of people injured in a shooting – and *not* the number of cases where at least one person is injured by a gun. Kleck & McElrath (1991), however, provides an alternate explanation to this finding, writing that firearms "appear to inhibit attack, and in the case of an attack, [they] reduce the probability of injury; whereas, once an injury occurs, they appear to increase the probability of death." They thus argue that although firearms theoretically discourage people from committing violence, the risk of death increases after a gun is first used. Additionally, Kleck & Patterson (1993) finds that the banning of firearm possession for mentally ill people reduces homicide rates, although the homicide rates they used in their analysis included every type of weapon used, not just firearms. Swanson et al. (2015) made the same observations regarding mentally ill people in their study. Cook & Ludwig (2006) finds that gun ownership is positively associated with the lethality of criminal violence, but it has no effect on the frequency of crime. Similarly, Kleck (1986) finds that reducing the availability of guns will not affect the frequency of gun violence, because while ordinary law-abiding citizens will follow these new guidelines, criminals would not. Lesko (2019) supports these findings with data, saying that a Department of Justice report finds 56% of prison inmates got their guns illegally. Therefore, even if gun accessibility is attempted to be lowered, people intent on committing a crime would still have other ways of obtaining a gun. The literature thus observes that while it is impossible to see how many crimes are deterred by the presence of guns, higher levels of gun ownership are still associated with a greater number of people injured in firearm-involved attacks, although more gun ownership does not affect the frequency of incidents.

Regarding the effectiveness of gun control laws, the literature has mixed results. Kleck (1986) writes, "federal controls are less satisfactory, because traditionally there has been a very limited federal law enforcement apparatus in the area of ordinary crime. The Federal Bureau of Investigation (FBI) regards itself more as an investigatory than a law enforcement agency." Murray (1975) find that most gun control laws have no significant effect on total violence rates, although Kleck & Patterson (1993)'s study shows only some gun laws, such as bans on gun possession by criminals and mentally ill people,

purchase permit requirements for all firearms, and additional penalties for commiting a crime with a gun, were found to be influential in lowering homicide rates. Kleck (1986) and Kleck & Patterson (1993) show that while federal gun control laws are not as effective compared to state laws, state laws are not very effective, either. Kleck & Patterson (1993)'s reasoning behind gun laws being unlikely to affect violence is that people would probably just use another weapon instead to attack their victim; however, this is partially disproved by Geisel et al. (1969), as well as epidemiological research in the case of suicide, which said that "gun background checks and waiting periods significantly reduced suicide in the older population; these results, too, suggested that suicide is preventable by removing or restricting (or even delaying) access to lethal means" (Swanson et al., 2015). Shughart II & Lott (1999) finds that background checks and waiting periods have no effect on crime, although he does not look into suicides. Geisel et al. (1969) agrees on the usage of gun control decreasing suicide rates, but disagrees on the overall effectiveness of gun control legislation, saying, "gun control legislation is most effective in reducing the number of suicides and accidents by firearm, less effective in reducing the number of homicides and generally ineffective in reducing the number of other crimes." Luca et al. (2017) then had similar results in their study, saying that states with handgun waiting period laws in place see a 17% reduction in gun homicides. As mentioned before, however, criminals simply obtain their guns by illegal means if gun laws prevent them from obtaining firearms legally, so Kleck (1986) writes that in order for gun control to be effective, it must also have methods in dealing with criminals who do not obtain their firearms legally.

Other studies looked in particular at the impact of right-to-carry concealed firearm laws on gun violence. Duwe et al. (2002) finds that on average, the majority of states (91.9%) have zero mass shootings every year, where a "mass shooting" is categorized as there being four or more victims injured by the gunman. This study ultimately finds, "there is no evidence that the presence of an RTC law or the number of people with carry permits (as measured by the RTC time trend variable) reduces the number of people killed and injured during shooting attacks" (Duwe et al., 2002). However, Shughart II & Lott (1999, p. 260) contradicts these findings, observing that both violent crime rates and murder rates decreased over a 15-year period after states adopted right-to-carry laws. However, it is unclear what effect – if any – changing socioeconomic factors over this time period had on these results, as these papers did not include measurements for these factors in their studies.

The influence of socioeconomic factors on gun violence is clearer according to the literature. Swanson et al. (2015) found a positive association between worsened socioeconomic status and violence; the paper also noted socioeconomic factors were statistically predictive, regardless of whether the shooter in question had a mental illness or not. Kwon et al. (1997) finds that "gun control laws have a very mild effect on the number of gun related deaths, while socioeconomic variables such as a state's poverty level, unemployment rate and alcohol consumption, have significant impact on firearm related deaths." Regarding just homicides, Geisel et al. (1969) finds that the number of police employees in a state has a strong positive association with homicide rates; Chalfin & McCrary (2017) then duplicates these findings, while also noting a link between the economy and crime.

As for ways to stop gun violence, the literature provides some suggestions. In the papers that noted the influence of socioeconomic factors on gun violence, it stands to reason that improving living conditions in states with particularly low standards of living would reduce gun violence. Kwon et al. (1997) notes the large positive and statistically significant marginal effect of poverty rates on murders, so raising the standard of living statewide and reducing poverty rates should decrease firearm homi-

cides. Other ways include stricter punishments: Garoupa (2003) writes, "most studies corroborate the hypothesis that the probability of punishment, and to a lesser degree also the severity of punishment, has a deterrent effect on crime." Geisel et al. (1969) partially contradicts this finding, noting that a greater police presence is strongly associated with higher homicide rates, which shows that even if the probability of being arrested or killed by police is large, crime is not deterred. Garoupa (2003) voices that psychologists and criminologists frequently say criminals have 'limited' rationality; even if there is a heavy police presence to protect the public, because criminals do not have the level of rationality that normal people do, this would not dissuade them from committing the crime. The paper adds that many criminals have overconfidence or cognitive dissonance about their actions, leading the literature to come to no concensus on how to best stop crime and gun violence from occurring.

III. Data

The literature in general did not look at both major sets of variables, and the few papers that did only examined the variables' effects on gun violence in a single year. These papers thus do not capture the true effects of these variables on gun violence, since changes in the factors would not be measured. This paper resolves these issues by using data on both sets of variables over the mentioned nine-year time period. Panel data from 2010-2018 was collected from various government agencies and independent research databases for each of the measured variables. The number of firearm-related murder cases variable was rescaled by population to account for population changes over time and differences across states. Table 1 contains the name for each variable used in this study, the variable's description, and the source from where the data was obtained from. All of the variables measure numeric values, except for the gun law provision variables, which are all dummy variables.

Table 1: Variable Descriptions

Variable	Definition	Source
GunMurders	Total firearm-related murder cases in a state per 100,000 people per year.	FBI Criminal Justice Information Services (CJIS) provided firearm-related murder cases data for each state per year, and the United States Census Bureau provided state population data.
Poverty	Percent of people living below the state poverty threshold per year.	United States Census Bureau.
Alcohol	Per capita gallons of alcohol consumed per year for people aged 14+.	National Institute on Alcohol Abuse and Alcoholism.
HighSchool	State high school graduation rate percentage.	National Center for Education Statistics.
Police	State and local police expenditures, per capita USD value.	United States Census Bureau.
FirearmRate	State-level estimates of household firearm ownership percentage.	RAND Corporation.
Assault	State has a ban on sale of assault rifles (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
PermitConcealed	State requires a permit to carry concealed weapons (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
Universal	State requires universal background checks at point of purchase for all firearms (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
TotalLaws	Total number of state firearm law provisions out of all 134 measured provisions.	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
Violent	State prohibits firearm possession for people convicted of a violent misdemeanor (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
Records	State requires all sellers to keep and retain records of all firearm sales (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.

Table 1: Variable Descriptions

Variable	Definition	Source
Inspection	State requires at least one annual inspection of gun dealerships by the police or other law enforcement personnel (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
MayIssue	State provides authorities with discretion in deciding whether to grant a concealed carry permit, or the law bans all concealed weapons (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.
Waiting	State requires a waiting period on all firearm purchases from dealers (1=Yes, 0=No).	National Archive for Criminal Justice Data: State Firearm Law Database from 1991-2019.

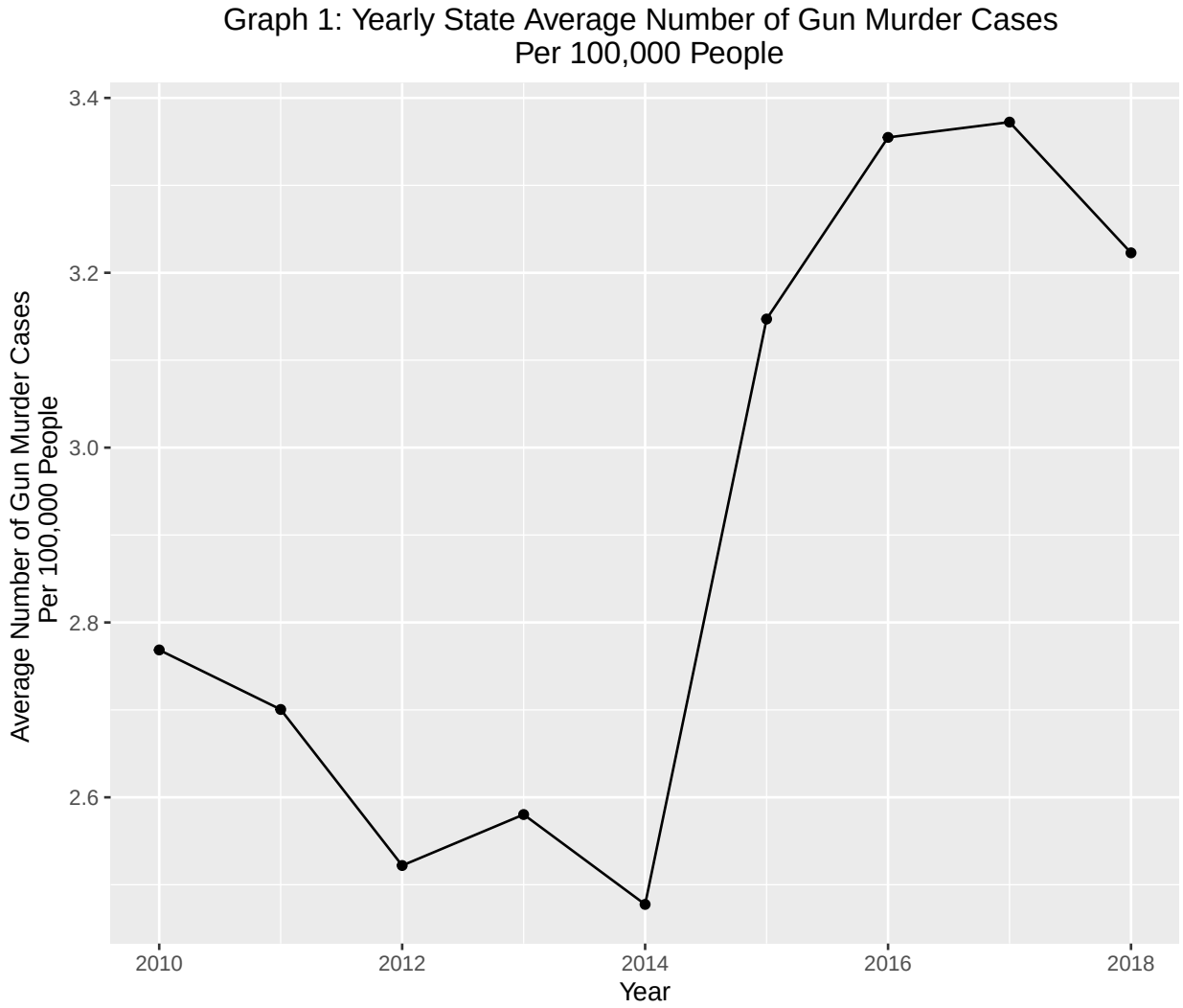
Since the Dickey Amendment prevented the CDC from conducting research into gun violence, no available government data exists on gun ownership rates across the country. To deal with this, a common proxy used in the literature to measure gun ownership rates is the number of firearm-caused suicides, due to suicides making up over half (61%) of all firearm-related murders (Duggan et al., 2011, Swanson et al. (2015)). Therefore, studies that use gun ownership estimates in their analyses might not have accurate results, due to the lack of available accurate data. This paper instead uses RAND Corporation data from fifty-one nationally representative surveys that inquired into gun ownership, using predictive models that combine these results with data on "firearm suicides, hunting licenses, subscriptions to Guns & Ammo magazine, and background checks," in order to calculate estimates on firearm ownership rates (Schell et al., 2020). It is plausible that firearm-involved suicides and gun magazine subscriptions measure both legal and illegal gun ownership, although hunting licenses and background checks would only proxy legally owned guns. There is thus a limitation here, in that the data obtained from RAND might not provide an accurate estimate for both legal and illegally owned firearms.

Table 2 contains summary statistics for all of the variables. It should be noted that the state and local police expenditures for 2018 were not yet available at the time of writing, and gun ownership estimates for 2017 and 2018 were not available from RAND Corporation. Firearm-related murder cases data for Florida was unavailable for all the years measured in this paper.

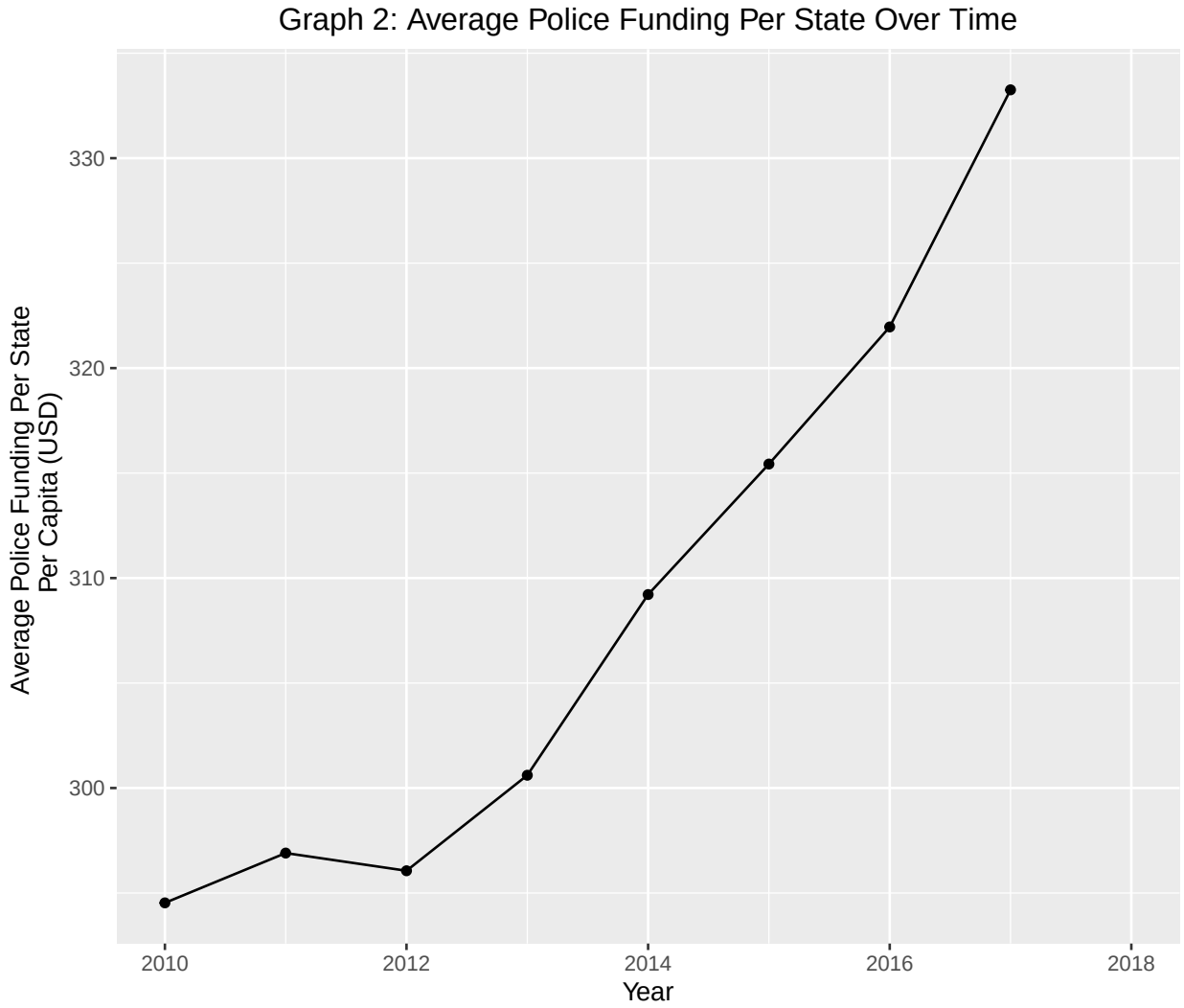
Table 2: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
GunMurders	448	2.906	2.371	0.021	1.223	3.819	17.915
Poverty	459	0.144	0.032	0.073	0.117	0.168	0.242
Alcohol	459	2.484	0.561	1.344	2.140	2.736	4.762
HighSchool	452	0.818	0.064	0.578	0.782	0.870	0.914
Police	408	308.495	111.392	159.000	242.000	342.750	954.000
FirearmRate	350	0.386	0.139	0.034	0.335	0.483	0.658
Assault	450	0.113	0.317	0.000	0.000	0.000	1.000
PermitConcealed	450	0.869	0.338	0.000	1.000	1.000	1.000
Universal	450	0.127	0.333	0.000	0.000	0.000	1.000
TotalLaws	450	26.218	25.715	1.000	9.000	31.000	109.000
Violent	450	0.071	0.257	0.000	0.000	0.000	1.000
Records	450	0.102	0.303	0.000	0.000	0.000	1.000
Inspection	450	0.040	0.196	0.000	0.000	0.000	1.000
MayIssue	450	0.198	0.399	0.000	0.000	0.000	1.000
Waiting	450	0.082	0.275	0.000	0.000	0.000	1.000

As has unfortunately become more and more commonplace, gun violence has increasingly been on the rise in America since 2015, with new cases showing up in the media on a near daily basis. Even when accounting for population growth, the average number of gun murder cases is still high when compared to what it used to be between 2010 and 2014. Graph 1 shows these changes throughout the decade.

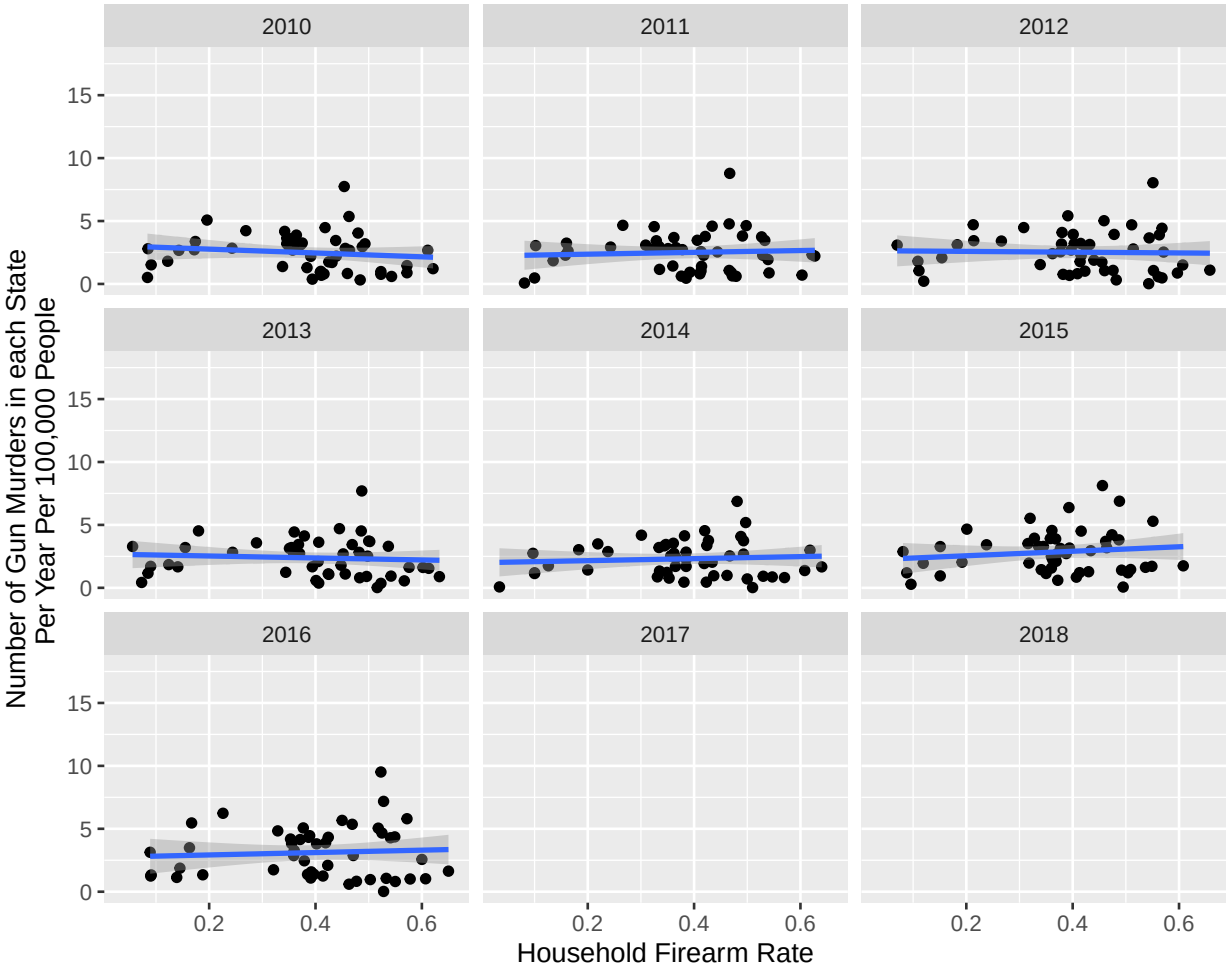


Average police funding statewide has been increasing throughout the decade as well, as seen in Graph 2. However, the relationship between police funding and firearm-related murder cases is not clear, since the curves do not appear to be exactly correlated to one another. From the literature, Geisel et al. (1969) noted that while a greater police presence is strongly associated with higher homicide rates, just the opposite is likely: states with higher levels of gun violence would see higher police funding levels to curb the violence.



As mentioned in the literature review, gun ownership rates are positively associated with the severity of gun violence but have no effect on the frequency. Graph 3 matches these results by showing that the ownership rate has no association with the frequency of gun violence on a yearly basis.

Graph 3: Household Firearm Ownership on Number of State Gun Murder Cases Per Year



IV. Empirical Model

The two-way fixed effect model used by this paper is defined by the following equation, which estimates a fixed effect for both states and years:

$$\hat{Y}_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 x_{it} + ... + \beta_n x_{it} + \alpha_i + \theta_t + \epsilon_{it}$$

In this formula, the subscript i refers to the specific state a case occurs in, t refers to the year, and n refers to the maximum number of explanatory variables in this paper. Thus $n = 14$. $\hat{Y}_{it}$ refers to the dependent variable of the study, which is the number of firearm-related murder cases per 100,000 people in a given state and year. α_i measures the states fixed effect, which absorbs unobserved factors that are constant over time but differ by state. θ_t represents the year fixed effect, which measures differences over time in unobserved factors that do not change across states. The last term, ϵ_{it}, measures the error.

Five empirical models were constructed to test the influence of socioeconomic factors and gun control laws on gun violence. The first two models measure the influence of socioeconomic factors

and gun laws *separately*, as commonly done in the literature review. The second model is a Directed Acrylic Graph (DAG) model, which isolates causality from the correlations between the independent variables. We thus control for the minimum number of variables that the model suggested, ignoring the variables that the model deemed to have no causal relationship with the dependent variable. The fourth model measures the effects of all the variables on gun violence, so both socioeconomic factors and gun laws are included together in this model. Because TotalLaws is correlated with all of the gun control provisions (see Table 5 in section VIII), the variable was omitted in the fifth model. It should be noted that all of the models are likely affected by endogeneity, as other unmeasured factors can influence a state's standard of living and level of gun control, such as drug use and political party in control of the state government. The regression table for all the models is seen in Table 3.

Table 3: Fixed Effects Models Regression Table

	Dependent variable:				
			GunMurders		
	Socioeconomic	Gun Control Laws	DAG	All Variables	Total Laws Omitted
	(1)	(2)	(3)	(4)	(5)
Poverty	0.030 (0.063)			0.046 (0.062)	0.037 (0.063)
Alcohol	0.890 (0.559)		0.900* (0.472)	1.235** (0.580)	0.892 (0.563)
HighSchool	0.799 (1.372)			1.224 (1.359)	1.242 (1.369)
Police	0.001 (0.003)			0.003 (0.003)	0.003 (0.003)
FirearmRate	−0.020 (0.014)			−0.021 (0.014)	−0.018 (0.014)
TotalLaws		−0.062*** (0.016)	−0.059*** (0.013)	−0.050** (0.022)	
Assault		0.585 (0.421)	0.515 (0.420)	−0.049 (0.431)	−0.223 (0.427)
PermitConcealed		0.428** (0.167)		0.459** (0.227)	0.263 (0.211)
Violent		−0.584 (0.386)		−0.694* (0.403)	−1.172*** (0.344)
Records		−0.358 (0.335)		−0.251 (0.383)	−0.106 (0.381)
Inspection		5.979*** (1.474)		3.789* (2.037)	−0.270 (0.913)
MayIssue		0.162 (0.255)		0.249 (0.247)	0.205 (0.248)
Universal		0.838*** (0.277)	0.698*** (0.231)	0.466 (0.374)	−0.176 (0.240)
Waiting		−3.499*** (1.143)	1.748*** (0.492)	−3.294** (1.557)	−0.123 (0.631)
Constant	−1.820 (2.197)	0.224 (0.295)	−1.022 (0.933)	−3.539 (2.225)	−3.187 (2.235)
Observations	335	440	440	335	335
R^2	0.917	0.914	0.912	0.923	0.922
Adjusted R^2	0.899	0.899	0.898	0.904	0.903
Residual Std. Error	0.528 (df = 275)	0.563 (df = 376)	0.567 (df = 379)	0.515 (df = 268)	0.519 (df = 269)
F Statistic	51.477*** (df = 59; 275)	63.130*** (df = 63; 376)	65.334*** (df = 60; 379)	48.667*** (df = 66; 268)	48.626*** (df = 65; 269)
Note:					*p<0.1; **p<0.05; ***p<0.01

The first number listed for each explanatory variable refers to the β coefficient mentioned earlier, and the number to the right is the standard error. Coefficients with asterisks are statistically significant; the greater the number of asterisks, the smaller the p-value. The state and year fixed effect values were omitted to focus on just the socioeconomic factors and gun laws coefficients.

To examine the effectiveness of doing a two-way fixed effect analysis on the variables, the above models are replicated in Table 4 but do not control for both year and state. The first three multivariate

models omit both year and states, the fourth model controls just for year, and then the fifth model controls just for states.

Table 4: Additional Models Regression Table

	Dependent variable:				
			GunMurders		
	Socioeconomic	Gun Control Laws	All Variables	All Variables (Year FE)	All Variables (States FE)
	(1)	(2)	(3)	(4)	(5)
Poverty	0.260*** (0.034)		0.277*** (0.034)	0.287*** (0.034)	−0.174*** (0.048)
Alcohol	−0.287 (0.177)		−0.391** (0.170)	−0.329** (0.167)	1.173** (0.564)
HighSchool	2.650 (1.610)		4.043** (1.587)	3.016* (1.751)	1.582 (1.228)
Police	0.008*** (0.001)		0.012*** (0.002)	0.011*** (0.002)	0.008*** (0.002)
FirearmRate	0.003 (0.007)		−0.032*** (0.011)	−0.033*** (0.011)	−0.002 (0.012)
TotalLaws		−0.015* (0.008)	−0.011 (0.008)	−0.011 (0.008)	−0.035 (0.023)
Assault		0.898* (0.537)	−1.232** (0.501)	−1.131** (0.491)	−0.189 (0.455)
PermitConcealed		0.708*** (0.261)	0.863*** (0.293)	0.929*** (0.287)	0.166 (0.233)
Violent		0.071 (0.483)	1.222*** (0.447)	1.204*** (0.444)	−0.895** (0.423)
Records		1.347*** (0.465)	1.978*** (0.461)	1.996*** (0.451)	−0.121 (0.401)
Inspection		−1.285** (0.529)	−0.616 (0.473)	−0.643 (0.464)	1.243 (2.024)
MayIssue		0.048 (0.402)	−0.003 (0.366)	0.068 (0.371)	0.331 (0.257)
Universal		−0.881** (0.358)	−1.329*** (0.367)	−1.442*** (0.367)	0.124 (0.389)
Waiting		−0.380 (0.542)	−2.655*** (0.523)	−2.622*** (0.512)	−1.946 (1.615)
Constant	−4.973** (1.956)	2.417*** (0.231)	−6.356*** (1.945)	−5.585*** (2.030)	−1.607 (1.994)
Observations	335	440	335	335	335
R^2	0.242	0.069	0.367	0.408	0.911
Adjusted R^2	0.231	0.050	0.340	0.370	0.892
Residual Std. Error	1.458 (df = 329)	1.728 (df = 430)	1.351 (df = 320)	1.320 (df = 314)	0.546 (df = 274)
F Statistic	21.060*** (df = 5; 329)	3.560*** (df = 9; 430)	13.268*** (df = 14; 320)	10.807*** (df = 20; 314)	47.029*** (df = 60; 274)

Note: *p<0.1; **p<0.05; ***p<0.01

V. Results and Implications

Examining the R^2 value, a significant increase occurs when the state fixed effect is included in a model. Including the state fixed effect allows for differences across states to be measured, which otherwise was being absorbed by the explanatory variables in the multivariate models. Likely all of the explanatory variables in the multivariate models are therefore being affected by endogeneity, so the coefficients for the variables should be interpreted more as correlations, and less as having a causal effect on the frequency of gun violence. The models in Table 4 thus do not fit the data well when compared to the models in Table 3.

Every single model that included TotalLaws has a negative coefficient estimate for the variable; this suggests that for every additional gun control provision a state has in place, the number of firearm-related murder cases per 100,000 people would decrease by the value of the coefficient. These results thus provide robust evidence that states with more gun control provisions in place have less firearm-related murder cases. The same applies to states that require waiting periods for all firearm purchases from dealers, as nearly every model (aside from the DAG model) has a negative coefficient value for

this dummy variable. Every model also shows that states which require a permit to carry concealed weapons tend to see heightened frequency levels of gun violence, but results are not consistent for states that require gun dealerships to be inspected at least once a year. The models have similar results for the variable measuring whether states have universal background checks in place, but the two-way fixed effect model including every variable, and the two-way fixed effect model that omits TotalLaws, both have the coefficient not being statistically significant.

The DAG model in Table 3 finds that states with higher levels of per capita gallons of alcohol consumed tend to see a greater frequency of gun violence. Like the model measuring just gun control provisions in Table 3, the DAG model finds that increasing the number of gun control provisions in a state tends to lower the frequency, and that states with universal background checks tend to have more firearm related murder cases per 100,000 people.

Regarding the last two models in Table 3, the results are fairly constant between them even when TotalLaws is dropped in the last model. The only differences are that per capita alcohol consumption, mandatory inspection laws, and mandatory waiting periods are no longer statistically significant in the model that omits TotalLaws; however, all the other results remain constant. The model measuring all of the variables also overall matches the results of the first three models, although there are some discrepancies with the Universal and Violent variables. Matching intuition, states that prohibit firearm possession for people convicted of a violent misdemeanor and states that require mandatory waiting periods for all firearm purchases see less cases of gun violence, although universal background checks are seen to have no effect on this.

Matching the results from the literature review and of Graph 3, there is no relationship between the household firearm ownership rate and the number of firearm-related murder cases when controlled for state population, since none of the models in Table 3 that included the FirearmRate variable calculated a statistically significant effect of the variable on the frequency of gun violence. The negative coefficient for the estimates in every model additionally suggests that the number of cases tends to drop by the value of the coefficient as gun ownership rates increase by 1%, although the effect is extremely small since the estimate is nearly zero. The insignificance of the variable thus shows that gun ownership levels tend to have no effect on the frequency of gun violence.

Another counterintuitive observation is the statistically insignificant effects of many of the socioeconomic factors on the frequency of cases. The coefficient estimate for poverty levels has a positive value, suggesting that raising poverty levels by 1% tends to raise the number of cases by that estimate, although the insignificance of the estimate proves that the effect of this is very small. The same result is found with the high school graduation rate. One surprising observation is the near-zero influence of per capita police funding on the frequency of gun violence. Raising police funding would mean a heavier police presence, which theoretically should deter crime, but the models do not support this. Rather, the models support the limited rationality argument proposed in the literature, which claims that criminals would not be deterred by heightened police levels. It should be noted that every model in Table 4 has police funding being statistically significant and positive.

Policy implications of these findings are to increase the number of gun control provisions in a state, as all three of the models measuring this variable found a statistically significant decrease in firearm-related murder cases for states that had more gun control provisions in place. Although some of the variables have no statistically significant effect on the frequency, overall, the models support the argument that gun control laws are effective in curbing it. It is counterintuitive, however, that some

gun control provisions are associated with more cases, especially with the gun laws and DAG models finding states with universal background checks seeing more cases than states that do not have this provision. Due to these findings, and the fact that the model measuring every variable does not find a statistically significant coefficient estimate for universal background checks, universal background checks are ineffective in lowering the frequency of gun violence in America. Likewise, the findings do not support states in requiring permits to carry concealed weapons; neither do the findings support states having assault weapon sales bans. However, the models do support states in requiring mandatory waiting periods for all firearm purchases, as two of the models found a statistically significant decrease in gun violence; the only exception to this is the DAG model. Another implication is for states to prohibit firearm possession for people convicted of a violent misdemeanor; while the gun laws model found this variable to have no effect on gun violence, the fourth and fifth models found a significant drop in cases for states that had this provision in place. The results thus support states in enacting this provision, as the models predict this provision to *not* being associated with an increase in cases. Lastly, the models do not support states in requiring all gun dealerships be inspected by law enforcement at least once a year, although this finding does not make intuitive sense. It could be that the high levels of gun violence encouraged states to enact policy requiring gun dealerships to be inspected, and *not* that this policy itself is what is causing the gun violence. No recommendations are made regarding this provision.

VI. Conclusion

Like the background research, this paper arrives at no clear ways of stopping gun violence from occurring in America, only ways of mitigating it through the suggestion of states enacting more gun control provisions. Socioeconomic factors are seen (aside from alcohol consumption) to have no influence on the frequency of gun violence, although gun control provisions can lower the frequency. However, it does not make intuitive sense for certain provisions to be positively associated with the number of cases; it is unrealistic that enacting a policy would cause more gun violence. Therefore, it can be surmised that the true cause of gun violence lies elsewhere. Other papers arrived at similar conclusions, with some arguing that there might not be a rational cause of gun violence due to the irrational behavior of the criminal causing the violence (Garoupa, 2003). In that case, all that can be done is to keep guns out of the hands of criminals and only in the hands of law-abiding citizens, so this paper supports Kleck (1986)'s claim that gun control should have methods in dealing with criminals who obtained their guns illegally. No suggestions are made on this front, due to myriad of ways for people to illegally obtain a firearm.

There exist a few weaknesses regarding the methods used in this paper. The first weakness is that it only examined the frequency of gun violence on a statewide level, not at a city or town level. Some cities have their own gun control provisions in place, but because the state itself does not have this provision in place, then the city's provision is ignored in this study. The effectiveness of gun control provisions at the city level was thus ignored in this paper. Likewise, the same applies for socioeconomic conditions. Socioeconomic conditions differ among cities and towns, so while the statewide numbers in this paper are the averages of these values, the differences were ignored in favor of looking at the issue of gun violence using a statewide approach. Limitations for this approach are that insufficient data is available for all the variables at the city level, although the government does collect statewide data on a yearly basis; additionally, it would have been impossible to get firearm ownership estimates for every city and town in America. Another weakness is that all of the yearly data was collected at

a fixed moment in time; the gun control provisions, for example, were only viewed at one point in a year. Therefore, if a state does not have a provision in place at the time of observation, and then it does enact a policy change soon after, the original policy would still be reflected in the data for that given year. Although the data reflects changes on a yearly basis, this might not be fast enough in some cases.

Future areas of expansion are thus to attempt to study the influences of socioeconomic factors and gun control provisions on gun control over time *at the city level* in America, with data that is updated to reflect changes on factors more frequently than on a yearly basis. Another method is to study gun violence by looking not just at the frequency of firearm-related murder cases, but the *severity* of them as well. While any one case occurring is bad, some cases are worse than others; the 2017 Las Vegas mass shooting saw over 400 people being wounded by the gunman. This paper did not examine whether socioeconomic factors and gun laws affected the severity of shootings over time, although some policy changes (e.g. U.S. Department of Justice's regulation banning the sale of bump stocks at the end of 2018) intuitively might decrease the severity (Public Affairs, 2018). The findings from the literature review support that gun ownership is positively associated with the severity of gun violence, although these studies were not done over time on a statewide level measuring both socioeconomic factors and gun control provisions.

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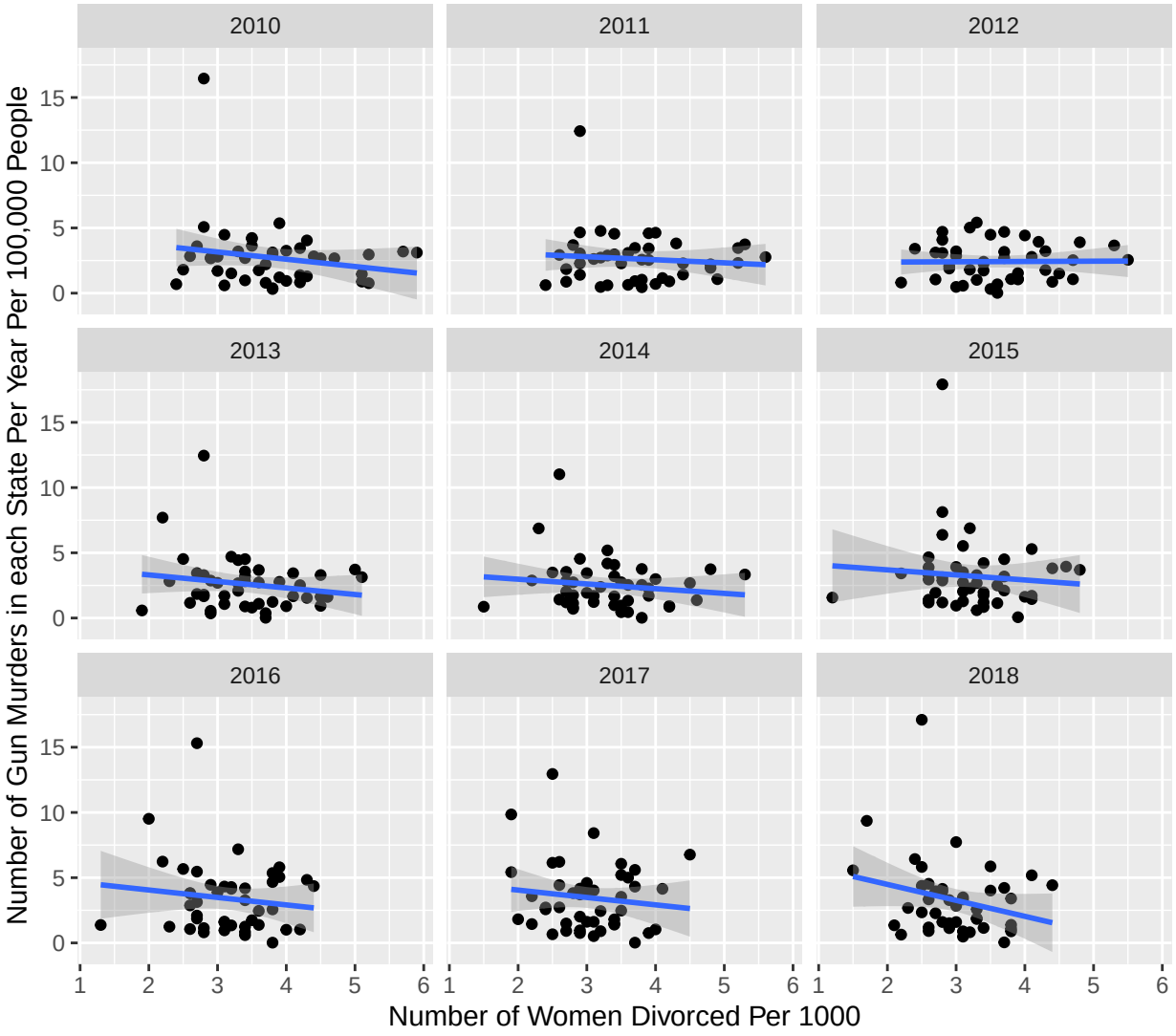
VIII. Appendix

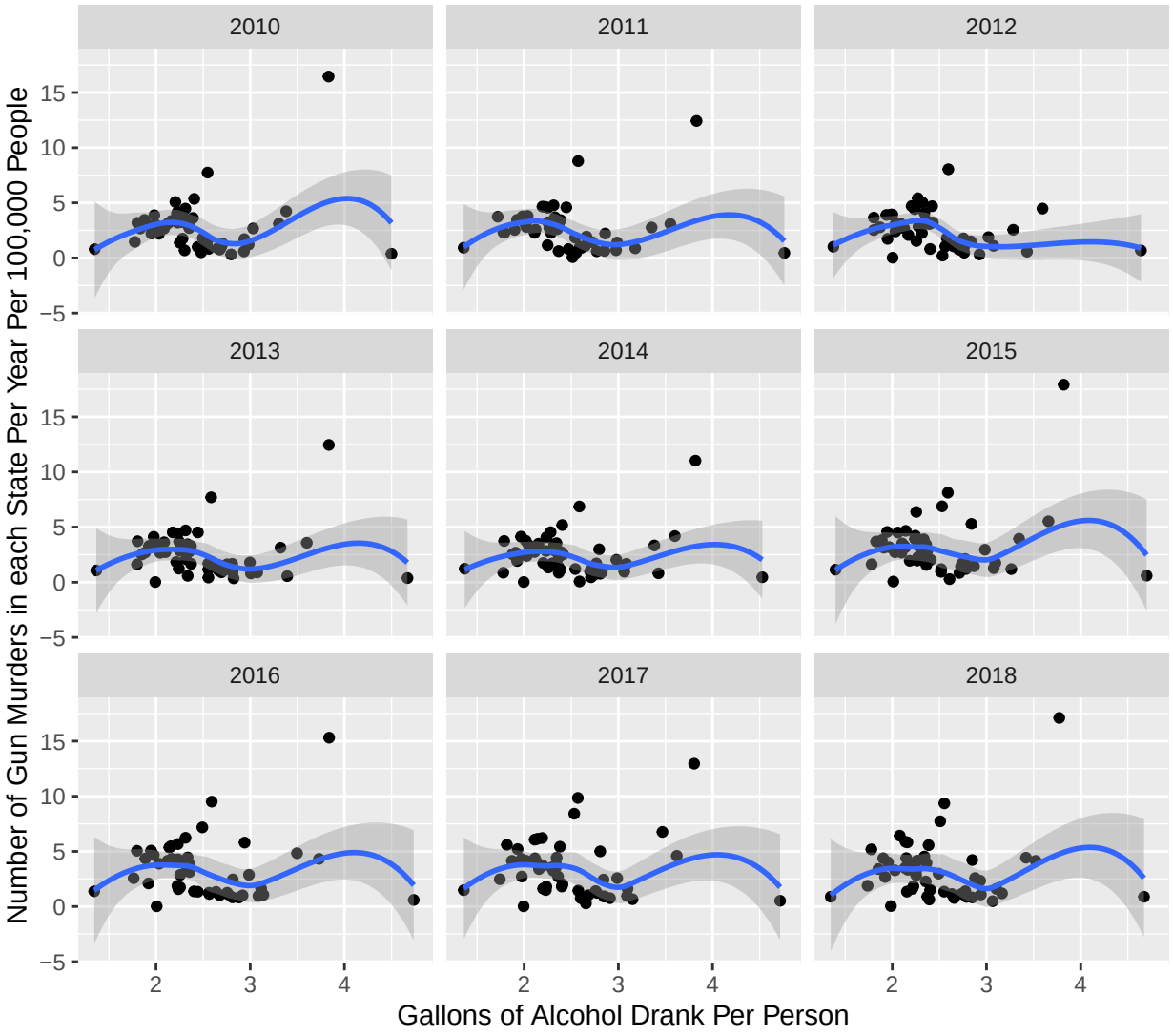
Table 5: Correlation Statistics

	Poverty	Alcohol	HighSchool	Police	FirearmRate	Assault	PermitConcealed	Universal	TotalLaws	Violent	Records	Inspection	MayIssue	Waiting
Poverty	1.0000000	-0.4308702	-0.4102324	-0.3094609	0.2839222	-0.2292397	0.1117195	-0.1382216	-0.3168913	-0.2143956	-0.1104121	-0.1216991	-0.2962835	-0.0778764
Alcohol	-0.4308702	1.0000000	0.0150660	0.2779727	0.0604175	-0.0847911	-0.1130816	0.0675286	-0.0637412	-0.0516236	0.0606935	0.0297759	0.0277688	-0.0153671
HighSchool	-0.4102324	0.0150660	1.0000000	-0.2509690	-0.0262258	0.1179807	0.0516034	-0.0536085	0.1389303	0.0629249	0.0285674	0.0369066	0.0770535	-0.0120369
Police	-0.3094609	0.2779727	-0.2509690	1.0000000	-0.4365989	0.4644415	-0.2273465	0.3375279	0.4536057	0.2513231	0.3180856	0.1670342	0.4691444	0.2790332
FirearmRate	0.2839222	0.0604175	-0.0262258	-0.4365989	1.0000000	-0.6268189	-0.2786904	-0.4159997	-0.8268174	-0.4494753	-0.4217940	-0.4097816	-0.7474586	-0.4972776
Assault	-0.2292397	-0.0847911	0.1179807	0.4644415	-0.6268189	1.0000000	0.1207408	0.4002646	0.7766536	0.4417829	0.3114526	0.2510226	0.7010529	0.1280077
PermitConcealed	0.1117195	-0.1130816	0.0516034	-0.2273465	-0.2786904	0.1207408	1.0000000	0.1189873	0.2740519	0.0924632	0.1118198	0.0695384	0.1722279	0.1005038
Universal	-0.1382216	0.0675286	-0.0536085	0.3375279	-0.4159997	0.4002646	0.1189873	1.0000000	0.4852426	0.3037212	0.7221766	0.2558030	0.4845323	0.3697118
TotalLaws	-0.3168913	-0.0637412	0.1389303	0.4536057	-0.8268174	0.7766536	0.2740519	0.4852426	1.0000000	0.5942045	0.5192185	0.3781537	0.8064318	0.5326556
Violent	-0.2143956	-0.0516236	0.0629249	0.2513231	-0.4494753	0.4417829	0.0924632	0.3037212	0.5942045	1.0000000	0.3297097	-0.0565817	0.5368656	0.5025911
Records	-0.1104121	0.0606935	0.0285674	0.3180856	-0.4217940	0.3114526	0.1118198	0.7221766	0.5192185	0.3297097	1.0000000	0.2767261	0.5047735	0.6493764
Inspection	-0.1216991	0.0297759	0.0369066	0.1670342	-0.4097816	0.2510226	0.0695384	0.2558030	0.3781537	-0.0565817	0.2767261	1.0000000	0.4037582	0.3151982
MayIssue	-0.2962835	0.0277688	0.0770535	0.4691444	-0.7474586	0.7010529	0.1722279	0.4845323	0.8064318	0.5368656	0.5047735	0.4037582	1.0000000	0.4784262
Waiting	-0.0778764	-0.0153671	-0.0120369	0.2790332	-0.4972776	0.1280077	0.1005038	0.3697118	0.5326556	0.5025911	0.6493764	0.3151982	0.4784262	1.0000000

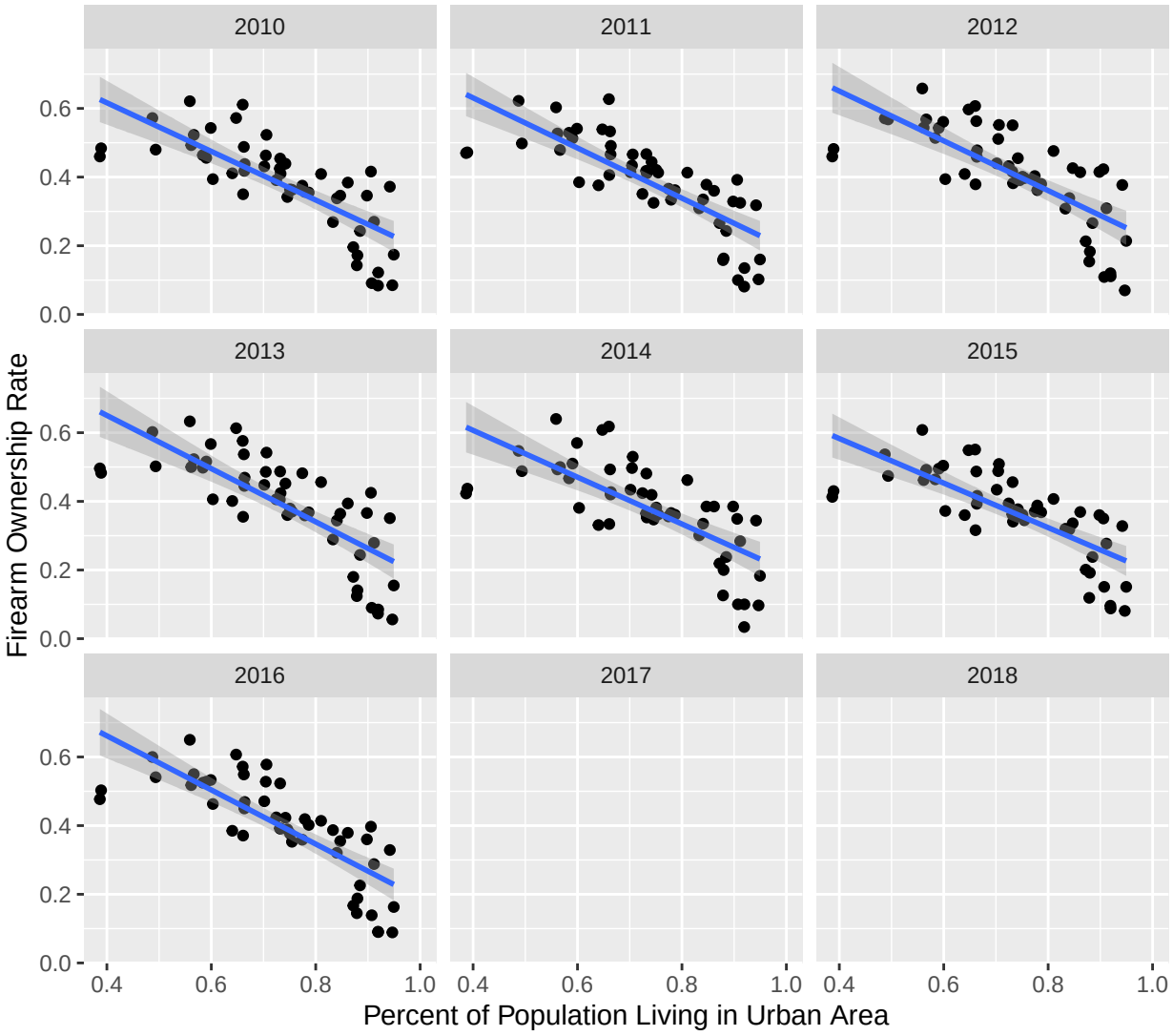
Graph 4: Divorce Rate on Gun Murders



Graph 5: Alcohol Consumption on Gun Violence



Graph 6: Living in an Urban Area on Gun Ownership



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