

Firearm Laws and Gun-Related Homicides

MS&E 125 Final Project

1 Introduction

The purpose of this project is to explore the relationship between firearm laws and gun-related homicides in the United States.

2 Current Literature

Prior literature has found that the loosening of concealed carry restrictions is associated with an increase in homicide rates while universal background checks and domestic violence laws are associated with decreases in homicide rates (Rosengart et al. (2005), Siegel et al. (2019)). Other literature has found no statistically significant association between firearm laws and homicide rates (Edwards et al. (2018), Ludwig and Cook (2000)). We set out to examine associations between categories of firearm law, specifically considering the association with different sub-groups of homicides, split by gender, age, and firearm type.

3 Data

State firearm law data spans the years 1991 to 2018 and were obtained from Siegel’s State Firearm Database (“State-by-State Firearm Law Data State Firearm Laws” 2020). These data are 133 separate state-level firearm laws compiled from 1991 to 2018 as logical variables: 1 if a restrictive law is in place in a given state and year and 0 if one is not. We grouped these 133 laws into 14 larger categories with a logical OR, representing whether a state has passed any one of the provisions within a given broader category. This allows us to compare similar laws across states and times. We create additional variables, pass and repeal for the number of laws passed or repealed in a given state and year. This differs from our other variables which are logical and denote if a law is in place or not.

Firearm homicide deaths are obtained at the state level from 1981 to 2018 from the CDC split by age, gender, and firearm type (Disease Control, Prevention, and Others (2010)).

For socioeconomic covariates, we use similar sources to the prior literature. First, we include state-level poverty rates from the Census (using data available from 1980 – 2018) (“United States Census Bureau. Historical Poverty Tables: People and Families - 1959 to 2017,” n.d.)). We include gallons of ethanol consumption per capita over the age of 21, unemployment statistics, educational attainment (bachelor’s degree or higher) Bode (2017), gini coefficient for income inequality, divorce rates, hunting licenses and race data (Haughwout and Slater (n.d.), (“Bureau of Labor Statistics. Local Area Unemployment Statistics,” n.d.), Mark W. Frank (n.d.), Wolfers (2006), (“USFWS- WSFR Historical License Data,” n.d.), Disease Control, Prevention, and Others (2010)).

4 Overview of data

This figure, obtained from the firearm law report, details what each category of grouped gun laws entails (Jane McClenathan, Molly Pahn, Michael Siegel (n.d.)).

Dealer Regulations: Establish rules for anyone in the business of selling, lending, or trading firearms.

Buyer Regulations: Laws that gun purchasers must obey in order to obtain a firearm.

Prohibitions for High-Risk Gun Possession: Prevent individuals with a history of crime, substance use, or mental health issues from possessing firearms.

Background Checks: Establish requirements and procedures for firearm dealers to perform background checks on prospective firearm purchasers.

Ammunition Regulations: Establish rules for anyone in the business of buying or selling firearm ammunition.

Possession Regulations: Establish age limitations for firearm possession, conditions under which possession is allowed, and places where gun carrying is permitted.

Concealed Carry Permitting: Outline the process that individuals must undergo to obtain a concealed carry permit in their state.

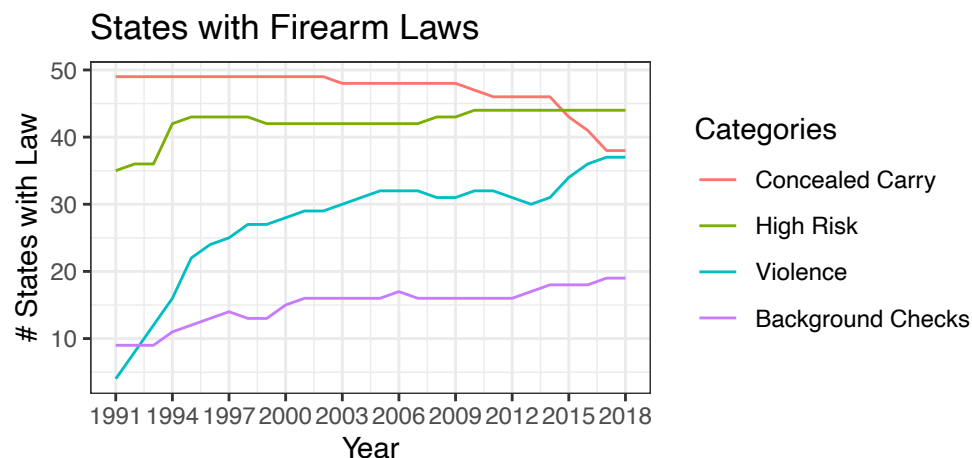
Assault Weapons and Large-Capacity Ammunition Magazines: Outline state bans on the purchase and/or possession of assault weapons and large capacity ammunition magazines.

Child Access Prevention: Establish rules for firearm safety locks and hold gun owners criminally liable for negligent gun storage.

Gun Trafficking: Prohibit the sale of firearms with the intent to re-sell them, ban straw purchases, or require gun technology that helps trace firearms or ensure that a gun can be operated only by its owner.

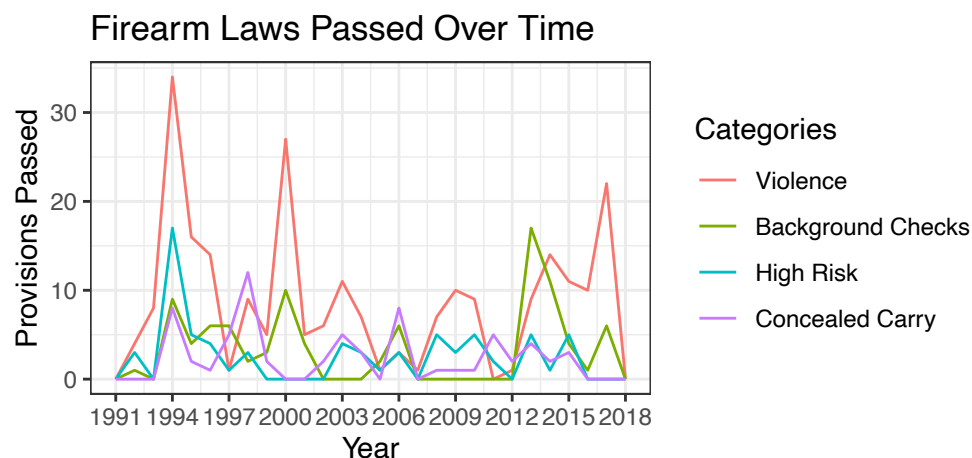
Domestic Violence: Establish conditions under which individuals convicted of domestic violence-related offenses are prohibited from possessing firearms.

Given the scope of the project, we decided to narrow our analysis to the four most common categories of law addressed in the prior literature we reviewed: concealed carry, high-risk regulation, domestic violence and background checks.



In 1991, the most common gun laws among states were restrictions of concealed carry and those deemed high-risk from possessing firearms.

By 2018, there has been a downward trend in the restrictiveness of concealed carry and a rise in the number of states having restrictions on possession for those who have been convicted of domestic violence offenses as well as background checks. The number of states high-risk regulations has remained pretty constant in recent years.

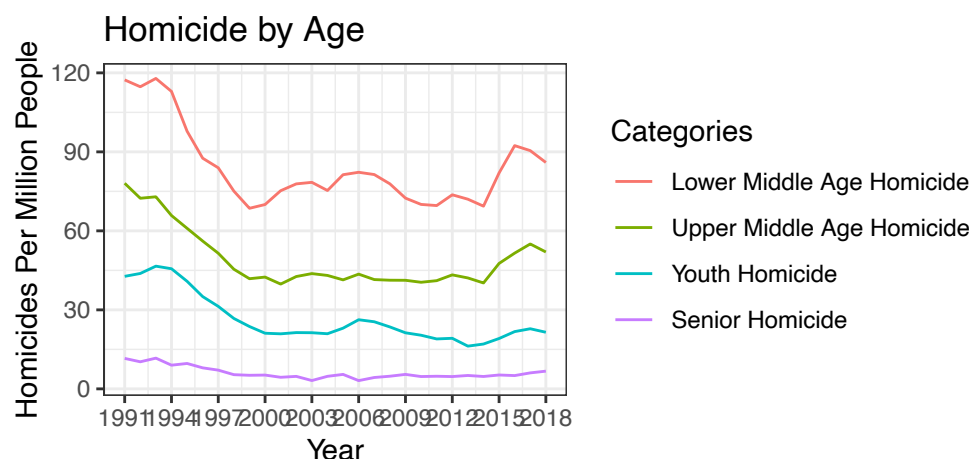


Provisions related to domestic violence have been passed the most¹ provision category in the past thirty years. Additionally, there are three visible spikes related to background check provisions, the first of which is likely in response to the Brady Handgun Violence Prevention Act, which went into effect in 1994. The law made background checks a requirement for gun purchases from licensed dealers. The other two spikes occur in 2006 and 2013.

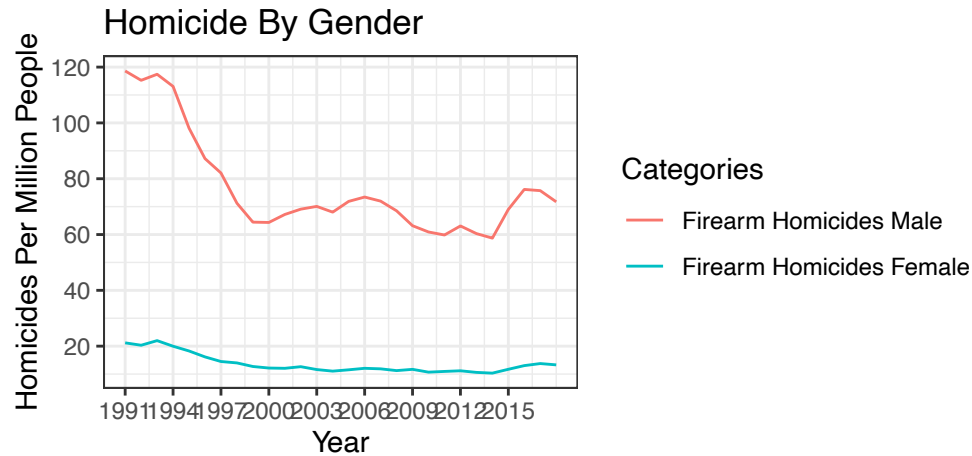
5 Firearm Homicide Trends

5.1 Gun Homicides By Group

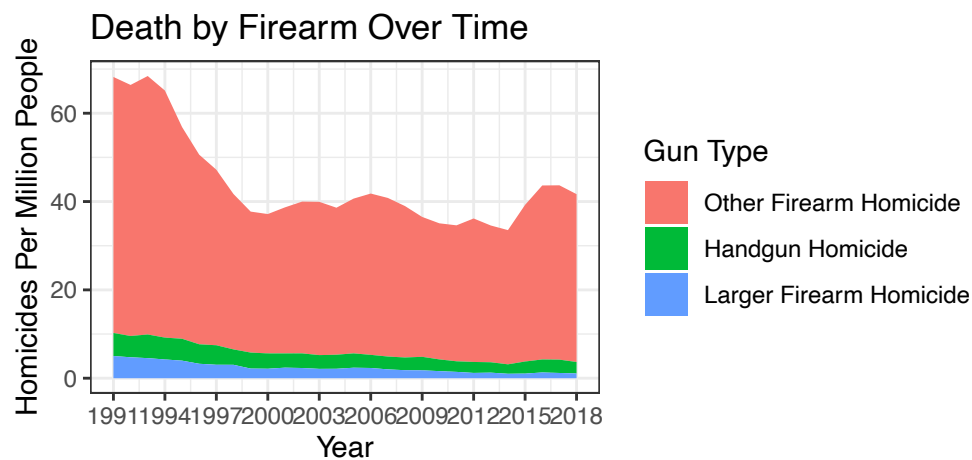
We then decided to look at trends in homicides by age group. This graph compares homicide death rates within the US between 1991-2018. We can see that those of lower middle age, 20 through 44, have the greatest homicide rate, followed by those 45-64, and then youth aged 1-19, and finally the smallest rate in the senior bracket, 65+. This order of age brackets by homicide rate has remained constant since 1991. Additionally, all groups follow similar trends, with a downward shift in homicides in the early 1990s followed by a stabilization around the 2000s and a slight increase starting in 2012.



¹Whether a law was passed or repealed was calculated using a lag, subtracting, and then considering a positive result a pass and a negative a repeal.



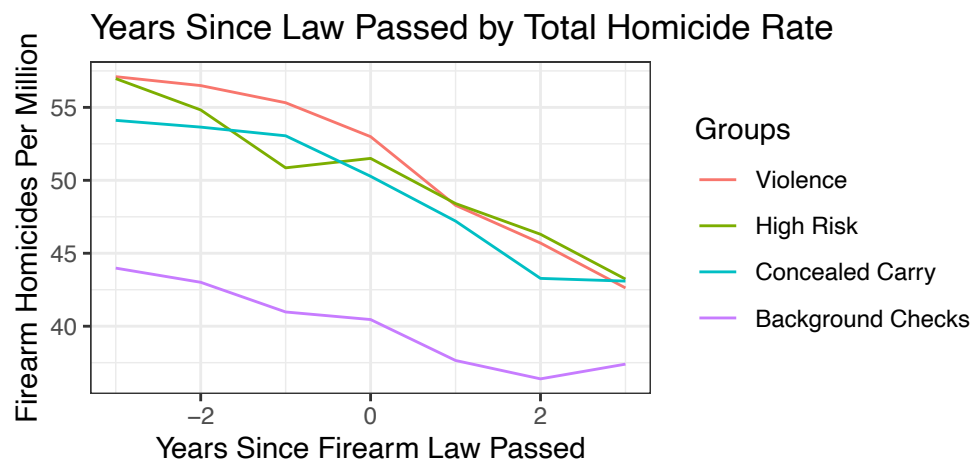
When comparing homicides by gender, male homicide trends make up the clear majority. Research suggest this may partially be due to the perception of men as the protectors of the household and gun marketing strategies towards men as that means of protection according to The Gender Policy Report (“Addressing Gun Violence by Reimagining Masculinity and Protection” 2020).



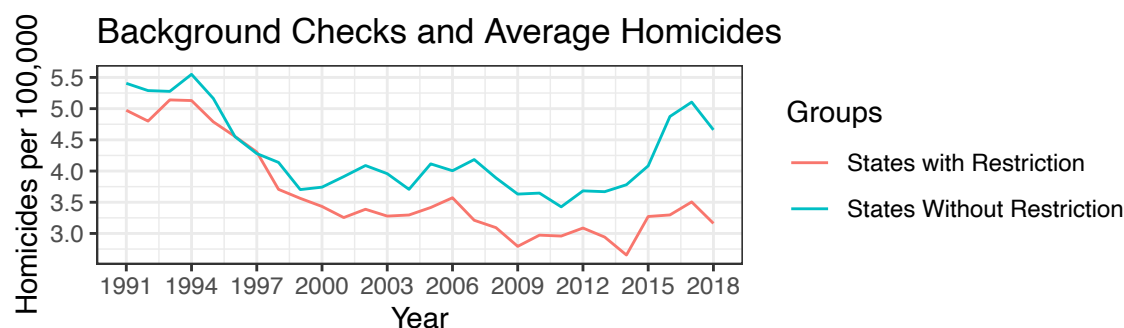
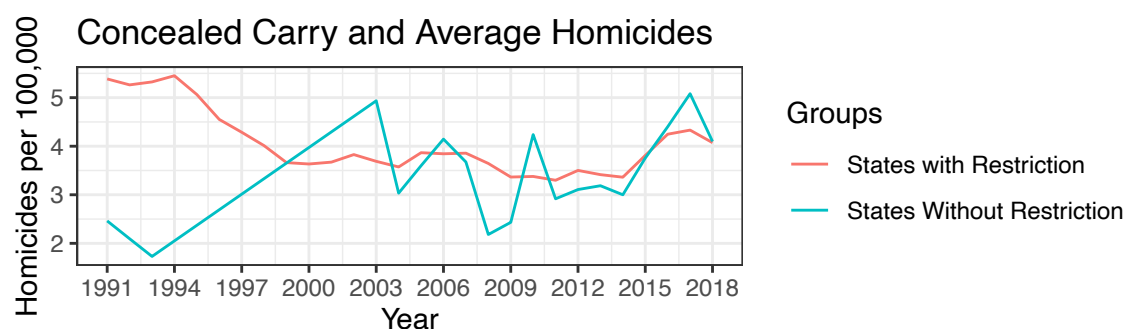
We observe that the vast majority of deaths by firearm type are under other or unspecified firearm. Other firearm includes instances in which the type of firearm involved in the death was not specified as well as all other firearms excluding shotguns, rifles, and handguns (shotguns and rifles are included in the larger firearm category). In future work, this could be further examined in relation to handgun-specific provisions and longgun-specific provisions. As the largest category, the trend of “other or unspecified firearms” closely matches that of total firearm homicides. We speculate that often after an instance of homicide, the gun type is not often known or specified, making analysis by gun-type difficult.

6 Analysis

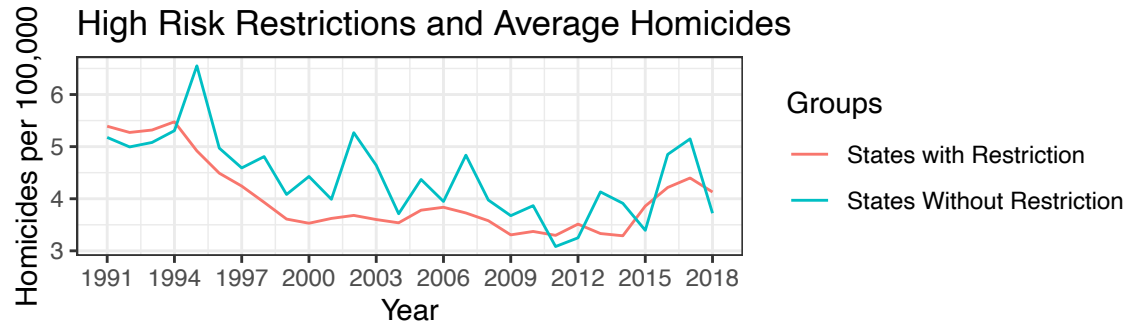
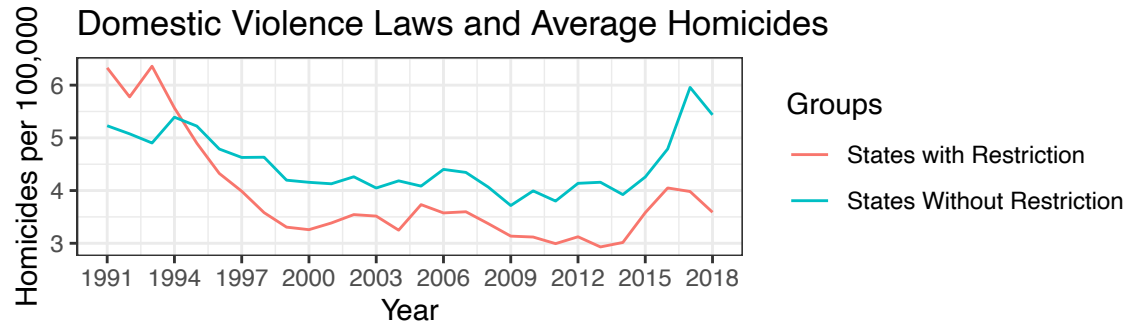
6.1 Laws Passed and Homicides



The graph above represents the average state death rate for the total population in the three years preceding a law being passed and the three years following. This provides us a first look at the broad change in deaths associated with the passing of a law which we will examine with a regression later. We see that, on average, the death rate seems to decrease in the three years following the passage of at least one provision in all the categories considered.



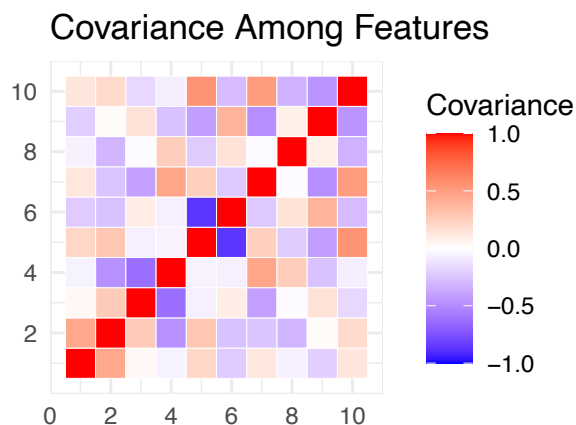
In the first graph, homicide rates in states with concealed carry restrictions were on average twice as high as in states without the law in 1991. This is likely because, as shown in a prior graph, there were very few states that had concealed carry laws in place in the early 90s, so this difference might reflect the very small sample size rather than a meaningful association with the law in place. Homicide rates between states with and without background checks are very similar, but diverged in recent years: in 2018, states without background checks had an average homicide rate of a little more than 3 people per 100,000 as opposed to over 4.5 per 100,000 in states without background checks. This is interesting to note given that 5 states passed their first background check law between 2012 and 2018.



It appears that starting in 1996, average homicides in states with domestic violence law are on average slightly higher than in those states without it, a trend that reverses over time. Further, states with high-risk restrictions have slightly lower homicide rates, on average, than those without.

6.2 Covariance Matrix 1991-2018

Consider the following covariance matrix for our covariates. We see that percent of people unemployed and the percent of people in poverty are strongly positively correlated. For this reason, we decide to only use one of them in the regressions in the following step. The covariates that are strongly negatively correlated are the percent of the population with a bachelor's and divorce rate. None of the other covariates have notable strong correlations besides our two race-related covariates.



Row.Column.Index	Feature
1	Percent_Unemployed
2	Poverty_Percent

Row.Column.Index	Feature
3	Divorce_Rate
4	Percent_Population_With_Bachelors
5	AA_and_Black_Population_Perc
6	White_Population_Perc
7	Population_density
8	Gallons_ethanol_per_capita_over_21
9	License_Holders_Per_Capita
10	Female_Population_Perc

We run a fixed-effects OLS regression with our covariates and our four categories of law for different categories of homicide deaths: male, female, handgun, larger firearm, youth and lower middle aged persons (ages 30 to 44). We chose to exclude other firearms since such trends would closely resemble that of the total in addition to upper middle aged and senior deaths because those are less prevalent and youth homicides are understudied.

	<i>Dependent variable:</i>					
	Male (1)	Female (2)	Handgun (3)	Larger Firearm (4)	Youth (5)	Middle-Age (6)
High Risk	-0.77**	-0.05	0.20	-0.09**	-0.33*	-0.63*
Background Checks	-0.46*	-0.12**	0.02	0.04	0.04	-0.63**
Concealed Carry	0.44	0.08	0.36	0.003	0.78***	1.05**
Violence	0.46***	0.11**	0.40***	0.07***	0.26**	0.19
Poverty Percent	0.10***	0.02**	0.03**	-0.001	0.02	0.13***
Gallons of alcohol consumed	3.24***	0.60***	-0.38	-0.04	1.63***	3.07***
Divorce Rate	0.03	0.10***	0.14**	0.02	-0.07	0.09
Pc College or More	-0.65	1.97*	3.70*	1.05*	-1.24	1.62
AA and Black Population Percent	0.62***	0.06	0.22**	-0.02	0.04	0.88***
White Population Percent	0.40***	-0.02	-0.21***	-0.07***	0.08	0.57***
Pop density	0.01***	-0.003**	-0.001	0.0002	0.005	0.02***
License Holders Per Capita	-0.29	1.15**	3.07*	-0.93	-2.87	4.18**
Female Population Percent	-0.78*	-0.06	0.26	-0.09	-0.04	-0.43
Constant	1.03	3.80	-3.77	11.69***	-4.29	-37.98
Observations	990	806	415	559	749	962

Note:

*p<0.1; **p<0.05; ***p<0.01

Our results align with prior literature for high-risk laws and background checks in that passing of those laws is associated with a decrease in homicide rates across gender groups. They also align with concealed carry outcomes that an increase in concealed carry restrictions are associated with increases in homicide rates. Since our dataset is encoded by restrictiveness, we can consider the passing of a law allowing for concealed carry to be going from a 1 to a 0. Therefore, we can interpret the concealed carry coefficient for males as having a concealed carry restriction is associated with a .44 increase in the male homicide death rate. Further, across all categories, the passing of at least one provision in the domestic violence category is associated with an increase in homicide rates. For the violence category, this is the opposite of findings in prior literature.

7 State-Level

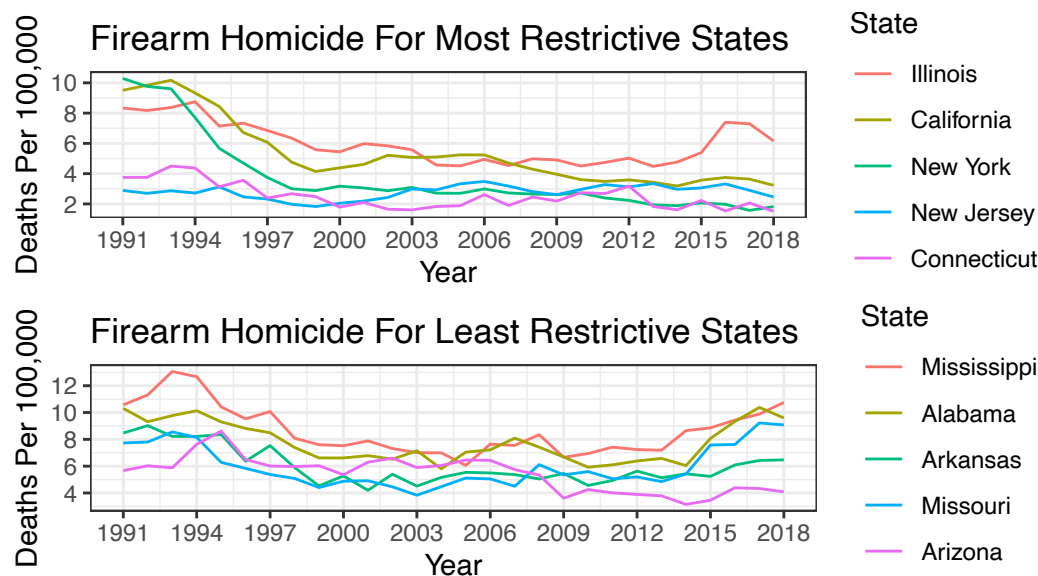
Table 2: Firearms Across States 1991-2018

	Firearm Laws Passed	Firearm Laws Repealed	Avg Gun Homicide	Avg Youth Homicide	Avg % in Poverty	Avg Thousands of Gallons Alcohol Consumed
AK	1	8	4	5	10%	32
AL	8	13	8	4	16%	22
AR	6	10	6	3	17%	20
AZ	5	9	5	3	16%	28
CA	51	1	5	4	15%	26
CO	26	5	3	2	10%	30
CT	62	0	3	2	9%	26
DE	29	1	4	5	10%	35
FL	6	3	5	3	14%	29
GA	5	11	6	3	15%	24
IA	7	1	1	1	10%	24
ID	3	6	1	3	12%	28
IL	28	5	6	5	12%	27
IN	8	6	4	3	12%	23
KS	6	15	3	2	12%	21
KY	3	4	4	2	16%	20
LA	7	4	11	6	19%	29
MA	45	0	2	1	11%	28
MD	49	2	7	4	9%	24
MI	5	8	5	3	12%	25
MN	28	2	1	1	9%	28
MO	4	18	6	4	13%	26
MS	2	8	9	4	20%	25
NC	21	10	5	3	14%	23
NE	7	3	2	2	10%	26
NJ	29	0	3	2	9%	26
NM	6	6	5	3	20%	27
NV	18	5	5	3	12%	41
NY	42	2	4	2	15%	23
OH	6	8	4	2	13%	23
OK	4	5	5	2	15%	21
OR	21	0	2	1	12%	28
PA	22	3	4	3	11%	24
SC	3	12	6	3	15%	27
TN	21	17	6	3	15%	22
TX	11	6	5	3	16%	26
UT	9	8	1	2	9%	16
VA	6	5	4	2	10%	23
WA	36	3	2	1	11%	26
WI	13	6	2	2	10%	33
WV	15	8	3	2	17%	19

Note: ^a Red signifies the top 10% in the column, while blue signifies the bottom 10%

Combining the law data above on a state level and restrictiveness rankings from the Gifford Law Center, we decided to look at five of the states with the most restrictive and least restrictive guns laws in order to get a better sense of the relationship of the gun laws and other covariates (“Giffords Law Center’s Annual Gun Law Scorecard” 2020). In Louisiana, the highest average gun homicide rate, average youth homicide rate, and second highest poverty percentage exists. Despite this, they have very little gun legislation in place.

Mississippi has one of the highest poverty percentages and gun homicide rates, but passed just two firearm laws, one of the lowest passed of any state. Connecticut passed the most firearm laws (62) and has one of the lowest average gun homicide rate and youth homicide rate in addition to having one of the lowest poverty rates of any state (9%).



Less restrictive states track our overall findings of more firearm homicides over time, on average. Some more restrictive states see decreases in death rates over time.

8 Conclusion

We find that high-risk laws and background checks are associated with decreases in homicide across genders while restrictions on concealed carry are associated with increases in homicide rates.

There are six states with no high-risk law in place: Idaho, Indiana, Louisiana, Montana, New Hampshire, and Vermont. Given the relationship between these laws and homicide rates, we recommend further investigating the potential effectiveness of provisions within this category in these six states. Further, 31 states have no background check laws in place in our dataset which is surprising considering the plethora of research, of which ours adds to, which shows their relationship with reduced homicide and suicide rates. Beyond this, we recognize that the effectiveness of laws is an extraordinarily complex and difficult topic to study and implementation of such laws may not be possible in certain states due to the political landscape, even if they may be effective for the cause of reducing homicide rates.

While our results were in the same direction across genders, when considering the relationship with handguns and larger firearms, it seems that none of the laws were associated with decreased death rates (except for high-risk and larger firearm death rates). This may be in part due to how the provisions relating to larger firearms and handguns are often lumped in with all the other provisions in a given category. In this light, by just considering the binary 1 of at least one law passed versus 0 if no law passed within a given category may not allow us to observe the true relationship between such categories of law and specific gun types. For the categories stratified on age, all those match our larger trends except youth for background checks.

9 Future Work

From a methodological point of view, there are several avenues of future work to pursue, primarily regarding law category definitions. The associations we found between laws and homicide rates could be understated

because we defined an overall category binary, whereas looking at individual laws being passed would likely yield more obvious granular results. By this we mean that in our work, a state is considered treated at the first passage of a relevant law, but the first law could be relatively lax, whereas a later (and more stringent) law passage would not be observed. However, using a more granular level of law categories would allow for fewer comparisons across states. Future work could find a robust mechanism to consider specific provisions rather than broad law categories.

Since we have merely run a basic regression and preliminarily analyzed the data, future research might consider other forms of regression analysis such as a negative binomial or poisson in addition to robust causal mechanisms to analyze the relationship between gun laws and homicides. Future work could also further consider the effectiveness of violence laws, given our results were significant and opposite to prior literature.

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