Do Higher Gun Sales Lead to Higher Rates of Gun Violence?

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Introduction

107 days; 147 mass shootings, yet zero policy change (Insider, 2023). In the past four months, the United States has experienced more mass shootings than there have been days in the year, with each one resulting in at least four people dead. Around 43% of Americans identify gun violence as "a very big problem", 24% believe it is a "moderately big problem", and only 6% do not regard gun violence as an issue (Pew Research, 2022). Gun violence has increased at alarming rates over the years, and without comprehensive policy changes, this growth is not going to fall any time soon. There are a plethora of factors that affect gun violence rates across the country, and they need to be identified in order to create policy recommendations that address these specific factors. In the following paper, we will use the data collected to analyze whether the frequency of mass shootings differs depending on how many guns are sold in the state with respect to that state's population. We will also look at gun laws, specifically the training required to purchase a gun, and how they affect the number of gun violence incidents in each state. There is great discourse surrounding gun control and what the government should do in response to this public safety crisis, so this paper's objective is to provide clear evidence to help shape gun related policy.

Data

We took our data from multiple different archives and created a dataset that had all the variables we were testing for all fifty states and the District of Columbia. The gun related incidents were taken from the Gun Violence Archive for the years of 2021. The data consisted of all gun related incidents regardless of the number of victims. The gun sales data was taken from the FBI's NICS Firearm Checks Database, which has an extensive record of each state's monthly firearm sales from November 1998 to March 2023. We used the Everytown for Gun Safety Support Fund to get the data for each state's policies for purchasing guns. There were a lot of different policies to analyze, but we wanted to focus on a single significant policy. We picked firearm training because we hypothesized states without any form of training requirement would have more gun violence incidents. Finally, the population data for each state was taken from the US Census Bureau's NST estimated 2021 dataset. We conducted two bivariate regressions; the first one regressed the correlation between firearm sales and gun violence incidents. In this regression, the independent variable is annual gun sales in the state, the dependent variable is the number of gun violence incidents, and the confounding variable is the population density of the state. We included population in our regressions because we hypothesized that population would determine the number of gun sales; sales increase as the population increases and there will be more incidents in a state with a higher population. In our second bivariate regression, we switched our independent variable for whether states had a firearm training requirement before purchase. The dataset for this variable was categorical, so we re-coded states that did not have the requirement as 0 and states that did have the requirement as 1. In this regression, we also added the state population variable because we wanted to control for the effects of more populated states on frequency of gun related incidents. Finally, we put all the variables together in one model because we wanted to be wary of any omitted variable bias in our model. We did not want to overlook any significant factors that affect the frequency of gun related incidents as it could lead to an overestimation or underestimation of the variables being studied.

Table 1: Continuous Variable Summary Statistics

Variable	Observations	N Missing	Mean	Std. Deviation	Min	Max
Firearm Sales	51	0	369812.75	343051.37	33	1624677
Training	51	0	0.20	0.40	0	1
Population	51	0	6507720.49	7397954.69	578803	39237836
Incidents	51	0	1110.12	1141.69	23	5060

Methods

$$incidents_i = \beta_0 + \beta_1 * sales_i + \beta_2 * training_i + \beta_3 * population_i$$

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Comparing the equations above and combining them together for the first regression model, our B1 coefficient in the second regression should tell us how sales affects the number of incidents in a state, holding all population constant, and our B2 coefficient in the third regression tells us how training affects the rate of incidents in a state, holding population constant. We chose to combine the models because we wanted to make sure no omitted variable was affecting our regression without our knowledge when comparing the first two equations on each other. We wanted to make sure that the sales and training didn't have any other confounding variables that we had forgotten to add into our regression that was affecting our two regressions.

In order to run such a regression, we needed to include gun sales as the independent variable for the second equation, with incidents being the primary dependent variable. We also wanted to see if training could affect incidents, so we ran the third regression where training is the independent variable and incidents is our primary dependent variable. Sales represents the amount of gun sales in a given state. Population represents the amount of people in a state. Training represents whether a state requires firearm training before purchasing the weapon, and as it was categorical, we switched the data to a 0 and 1 identification system (no training vs. training). In both regressions we held the population the same, and ran a third (the first one in the order) regression to reduce omitted variable bias. .

Results

As stated previously, we were interested in determining the effect that our primary independent variable, B1 * Sales, had on gun related incidents when population was held constant. After scaling the results to match every 100,000 sales, the coefficient was equal to roughly 1 10^-8 , meaning there was a slight increase in gun related incidents. After performing a two-tailed T-test at a = 0.05 and 48 degrees of freedom, the result was not statistically significant as the t-statistic of 0.02 was less than the critical value at 2.01. As a result, we reject the null hypothesis that stated B1 * Sales is equal to zero and we fail to reject the alternative hypothesis.

We wanted to add an additional independent variable, B2 * Training, to our methods to see if training requirements had any impact on gun related incidents. For every 100,000 training requirements, the amount of gun related incidents decreased on average by 0.44%, holding population constant. To find if this was a statistically significant value, we performed a two-tailed T-test at a = 0.1 and 48 degrees of freedom resulting in a t-statistic of 0.000019. Since the t-statistic is less than the critical of 2.01, the value is not statistically significant. As a result, we reject the null hypothesis of B2 * Training being equal to zero, failing to reject the alternative hypothesis.

Take into account that our results are not necessarily reflective of any confounding variables and do not take into account differences among states. In any instance, however, we found that population was not a significant indicator in the determination of gun related incidents.

Table 2: Regression Results

	Dependent variable:		
	incidents		
	(1)	(2)	(3)
Sales	0.001	0.001^{**}	
	(0.001)	(0.0005)	
Training	−275.283		-440.043^{*}
	(248.674)		(231.207)
Population	0.0001^{***}	0.0001^{***}	0.0001^{***}
	(0.00002)	(0.00002)	(0.00001)
Constant	235.147	163.473	362.400^{***}
	(147.648)	(133.005)	(127.576)
Observations	51	51	51
R^2	0.704	0.696	0.687
Adjusted R^2	0.685	0.683	0.674
Residual Std. Error	640.984 (df = 47)	642.488 (df = 48)	652.022 (df = 48)
F Statistic	37.208^{***} (df = 3; 47)	54.942^{***} (df = 2; 48)	52.650^{***} (df = 2; 48)
Note:			*p<0.1; **p<0.05; ***p<0.01

Conclusion

During our research, our primary focus was to examine the correlation between gun sales, adjusted for population, and the frequency of mass shootings across states. We also explored the current training requirements for purchasing firearms and their impact on gun violence within each state. Our regression analysis revealed statistically insignificant findings, meaning that the evidence in our data is not strong enough to support the impact of gun sales or training requirement laws.

That being said, our investigation demonstrated a small association between gun sales, training and a reduction in gun violence incidents. Though there is a small effect, the finding still underscores the importance of implementing training for all individuals seeking to purchase firearms in every state. We suggest policymakers refer to Japan's existing training program as a potential model for development. Notably, according to the Chicago Tribune, in 2015, the United States recorded 13,000 nonsuicide gun deaths, while Japan reported only one, highlighting the effectiveness of a comprehensive training program.

In light of these results, we further recommend that gun owners be required to complete the training program every two years to maintain their license. This periodic retraining ensures ongoing competence and responsible ownership. By adopting these policies, states can take proactive measures to mitigate gun violence and prioritize public safety.

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