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The Impact of Mass Shootings on Gun Policy

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Working Paper 16-126

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Abstract

There have been dozens of high-profile mass shootings in recent decades. This paper presents three main findings about the impact of mass shootings on gun policy. First, mass shootings evoke large policy responses. A single mass shooting leads to a 15% increase in the number of firearm bills introduced within a state in the year after a mass shooting. This effect increases with the number of fatalities. Second, mass shootings account for only 0.3% of all gun deaths, but have an outsized influence relative to other homicides. Our estimates suggest that the per-death impact of mass shootings on bills introduced is about 66 times as large as the impact of individual gun homicides in non-mass shooting incidents. Third, when looking at enacted laws, the impact of mass shootings depends on the party in power. A mass shooting increases the number of enacted laws that *loosen* gun restrictions by 75% in states with Republican-controlled legislatures. We find no significant effect of mass shootings on laws enacted when there is a Democrat-controlled legislature.

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1. Introduction

Recent decades have witnessed a series of high-profile mass shootings throughout the United States in towns ranging from Newtown, CT to Killeen, TX. While most homicides receive little attention from the general public, mass shooting incidents are extremely salient. Nonetheless, a common and frequently articulated view is that despite extensive discussion about mass shootings, they have little influence on policymaking.

Should we expect policymakers to propose new legislation in the wake of a mass shooting? Given that the vast majority of gun deaths do not result from mass shootings, it would be difficult to reconcile large responses to mass shootings with basic models of optimal policy aimed exclusively at reducing gun violence. However, mass shootings may have another effect – bringing attention to the issue of gun violence. Mass shootings potentially lead to policy changes by focusing attention on gun violence, even if they do not provide new information or change politicians' preferences (which are generally static and aligned with party preferences).

In this paper, we explore the impact of mass shootings on gun policy, constructing a dataset of all U.S. gun legislation and mass shootings over a period of twenty-five years (1989-2014) – combining data from a variety of media and government sources. We begin by looking at the extent of deaths resulting from mass shootings relative to other gun deaths. Overall, there are more than 30,000 gun related fatalities in the United States per year. Roughly 56% of these are suicides and 40% are homicides. The remaining 4% are accidents or incidents of undetermined intent. Mass shootings account for about 0.3% of all gun deaths.

Because mass shootings are salient and plausibly random occurrences, we are able to implement a difference-in-differences strategy around the timing of mass shootings to estimate their causal impact on gun regulation. Specifically, we compare gun laws before and after mass shootings, in states where mass shootings occur relative to all other states.

We then present three main findings about the impact of mass shootings on policy. First, mass shootings evoke large policy responses. A single mass shooting leads to an approximately 15% increase in the number of firearm bills introduced within a state in the year after a mass shooting. This effect is largest after shootings with the most fatalities – and holds for both Republican-controlled and Democrat-controlled legislatures.

Second, mass shootings account for only 0.3% of all gun deaths, but have an outsized influence relative to other homicides. Our estimates suggest that the per-death impact of mass shootings on bills introduced is about 66 times as large as the impact of gun homicides in non-mass shooting incidents.

Third, when looking at enacted laws, the impact of mass shootings depends on the party in power. A mass shooting increases the number of enacted laws that *loosen* gun restrictions by 75% in states with Republican-controlled legislatures. We find no significant effect of mass shootings on laws enacted when there is a Democrat-controlled legislature.

These findings contribute to the empirical literature that uses a political economy lens to explore the determinants of policymaking (Makowsky and Stratmann 2009, Bardhan and Mookherjee 2010). Our results demonstrate that salient events – such as mass shootings – can lead to significant policy responses. The data also suggest that policymakers may use mass shootings as an opportunity to propose bills that are

consistent with their ideology. This helps to shed light on the role of attention and salience in shaping policy and the moderating role of politics.

2. Background and Data

As described above, out of the roughly 30,000 annual gun deaths in the United States, fewer than 100 occur in mass shootings. For the purpose of this paper, we define a "mass shooting" as an incident in which 4 or more people, other than the perpetrator(s), are unlawfully killed with a firearm in a single, continuous incident that is not related to gangs, drugs, or other criminal activity. This definition closely matches the one used by Krouse and Richardson (2015) and the FBI's definition of "mass murder" as 4 or more murders "occurring during the same incident, with no distinctive time period between the murders… typically involv[ing] a single location" (Morton and Hilts 2008). We further restrict our analysis to cases where at least three of the fatalities were individuals unrelated to, and not romantically involved with, the shooter(s). We include spree murders – homicides at multiple locations without a significant pause between incidents – if they result in four or more deaths.

We assemble a list of mass shootings since 1989 from a variety of government and media sources because there is no single, comprehensive government database of mass murders. We extract all gun-related mass murders (four or more dead) that are not felony related from the FBI supplementary homicide reports (SHR). We then verify each incident in the SHR using media accounts; the SHR may contain errors in which separate homicides in a month are reported as a single incident, which is why it is necessary to verify the incidents with media coverage. Participation in the SHR program is voluntary and many

law enforcement agencies do not report detailed data to the FBI. We therefore supplement the FBI data with mass shootings gathered from media accounts or compiled by other researchers and journalists interested in the topic. We combine the SHR data with mass shootings collected by the Mass Shootings in America (MSA) project at Stanford University (Stanford Geospatial Center and Stanford Libraries 2015) and a list created by *USA Today* (2013). For each shooting, we determine the event location as well as the number of victim fatalities and injuries. We also classify shootings based on the relationship (if any) between the alleged shooter(s) and victims. Previous work on mass shootings (Duwe 2007; Krouse and Richardson 2015) distinguishes between public mass shootings that occur in places frequented by the public, felony-related murders, and familicide. We categorize shootings by whether they are public events or primarily related to domestic conflicts, and we focus on incidents in which at least three people not related or romantically involved with the shooter died. This restriction filters out family-killings in residences as well as family-related murders in public places.[1] Figure 1 shows the number of incidents and fatalities in mass shootings by year. The data show a slight upward trend in the number of incidents and fatalities over time, but both incidents and fatalities vary substantially from year to year.

2.2. Gun Legislation

State governments are the primary regulators of firearms. Federal laws establish a minimum level of gun control, which is then augmented to varying degrees by state and local policies. Federal government has limited commerce, the possession of guns by

[1] A 2006 shooting at a church in Louisiana is one example. A man killed his wife and in-laws while abducting her and their children from a church. Only the wife's family was present at the church during the shooting.

potentially dangerous individuals, and some types of firearms and ammunition. States decide a variety of gun policies ranging from who can purchase and possess a gun to what types of guns are allowed in different situations to how guns should be stored and what types of training should be undertaken by gun owners. Local ordinances can also restrict firearm possession and use, but state statutes enacted in the past few decades have limited the importance of local government in this arena by pre-empting local regulations.

We create a comprehensive dataset of gun legislation in all fifty states using the bill tracking reports service from LexisNexis, which includes all bills introduced in state legislatures since at least 1990 with a synopsis and timeline of each bill's progress. This allows us to determine whether bills pass the legislature and become law. We identify firearm bills by searching for the firearm-related terms "firearm", "handgun", "pistol", "revolver", "rifle", "shotgun", "long-gun", and "assault weapon." We identify 20,409 firearm bills and 3,199 laws between 1990 and 2014. In other words, there were 20,409 *proposals* introduced and 3,199 laws passed in the twenty-five year sample period across all fifty states. This includes laws that loosen or tighten gun restrictions, and many that do neither or both. We exclude resolutions, executive orders, and ballot initiatives from the analysis.[2]

To explore whether gun control is tightened or loosened after mass shootings, we hired eight people to manually code the summary of bills that became law. Coders were given instructions explaining how to code legislation, but were otherwise blind to the topic and design of the study. We presented bill summaries from LexisNexis to coders in randomly chosen groups of 50. Two people coded each summary, and no coder saw the

[2] Legislators in some states first submit ideas for bills in the form of a draft request or similar document. We exclude these from our analyses because they result in double counting some legislation. We instead focus only on actual bills.

same summary multiple times. For each summary, coders decided whether the bill was tightening (stricter gun control), loosening (weaker gun control), uncertain (insufficient information), both tightening and loosening, or neither tightening nor loosening (neutral). There were therefore five possible labels for bills: tighten, loosen, both, neutral, or uncertain. Appendix A shows example bill summaries and their expected labels.

To cross-validate (and incentivize) the bill coding, we coded a small fraction of bills ourselves as a baseline comparison point. For this process, we blinded ourselves from any information about when or where the bill was proposed. We then used our scores to assess the quality of coders. Specifically, each group of 50 bills given to a coder contained five bills that we had also coded (they did not know which bills were and weren't coded, and did not have access to any of our assessments of whether a bill was looser or tighter). Coders were paid up to a 50% bonus based on the extent to which their coding matched ours (which we simply told them was a "gold standard" of known codes).

Across all five categories, coders agreed with each other 52% of the time (the agreement rate would be 20% by chance) and agreed with the gold standard 71% of the time. Coders performed worst on the neutral category, and best on the tighten-only and loosen-only categories; when a bill tightens gun control (according to the gold standard), coders agree on tightening 67% of the time, and when a bill loosens gun control, coders agree on loosening 60% of the time.

Most importantly for the purposes of our analysis: when coders agree with each other on tightening, they also agree with our coding 93% of the time; when coders agree on loosening, they are consistent with our scores 91% of the time. When analyzing the direction of policy change, we leverage this high degree of reliability by restricting our

analysis to bills on which coders agreed that the law was designed to tighten or loosen gun control. Because states can pass either, none, or both types of laws in a year, our dependent variable is the count of laws in each direction.

2.3. Control Variables

While our empirical strategy allows us to control for all time invariant factors that may affect gun legislation, we also add time varying controls. These include economic and demographic factors such as unemployment, divorce rates, and the rates of military service. We also control for institutional differences between legislatures. First, we control for the number of lawmakers as a measure of legislature size. Larger legislatures consider more bills. Second, we create a dummy for legislatures that held a regular session in a given year because not all legislatures meet annually. Third, we control for whether bills in each year carryover into subsequent sessions; some chambers allow for carryover while others kill all unpassed bills at the end of each session. Fourth, we control for years in which bills were restricted to specific topics; seven states restrict the scope of legislation (e.g. appropriations only) in specific years. Fifth, we control for the political party in power and political "trifectas" (i.e. when one party controls both chambers and governorship). Table 1 contains summary statistics for all variables used in the analyses.

3. The Impact of Mass Shootings on Gun Policy

3.1 Identification Strategy

We implement a difference-in-differences strategy that compares gun laws before and after mass shootings, in states where mass shootings occur relative to all other states.

Our dependent variables are counts of bills or enacted laws at the state-year level. We study the effect of mass shootings using Poisson regressions with conditional mean:

$$\mathbf{E}\left[y_{s,t}\middle|\alpha_s, \lambda_t, Shoot_{s,t-1}, X_{s,t}\right] = \exp\left(\alpha_s + \lambda_t + \beta' Shoot_{s,t-1} + \gamma' X_{s,t}\right)$$

where $y_{s,t}$ is a count of bills introduced or laws enacted in state s and year t; α_s and λ_t are state and year fixed effects; $Shoot_{s,t-1}$ is a vector of shooting-related variables such as an indicator and the fatality count for each mass shooting, and $X_{s,t}$ is a vector of time-varying political, economic, and demographic factors. We estimate the parameters via maximum likelihood by conditioning on the sum of $y_{s,t}$ within states and including year indicators.

3.2 The Effect of Mass Shootings on Gun Bill Introductions

Table 2 shows that a mass shooting leads to a 15% increase in firearm bills introduced. For the average state, this amounts to an additional 2.5 firearm bills introduced in the year following a mass shooting. Mass shootings with more deaths lead to larger effects. On average, each additional death in a mass shooting leads to a 2.5% increase in the number of gun bills introduced. This result holds both for Republican-controlled and Democrat-controlled legislatures.[3]

3.3 Comparing Mass Shootings and Non-Mass Shootings

Table 3 shows that fatalities resulting from mass shootings lead to much larger increases in gun bill introductions than gun homicides in non-mass shooting incidents. Specifically, it would take approximately *66 people dying in individual gun homicide incidents* to have as much impact on bills introduced as each person who dies in a mass shooting. Our estimates imply that, on average, a *single* mass shooting has as much impact

[3] Results on bills proposed broken down by political affiliation are available upon request.

on the number of bills proposed as would a 240% increase in the number of gun homicides in a state. Given the average number of gun homicides per year is roughly 260 per state, this would be equivalent to an additional 370 homicides per state year.

3.4 The Role of Political Party on Laws Enacted

As mentioned previously, the two major political parties in the United States differ dramatically in their stances on how restrictive gun policy should be, with the Republican Party favoring fewer gun restrictions.[4] To look at the impact of political parties on gun policy, we restrict our analysis to enacted laws, all of which were coded for whether they loosened or tightened gun restrictions (see data description for more details).

Table 4 shows the effect of mass shootings interacted with Democrat and Republican control of state government (divided government, in which the legislature is not controlled by a single party, is the omitted group). The results show that Democrats and Republicans respond differently to mass shootings.

When there is a Republican-controlled legislature, mass shootings lead to more firearm laws that loosen gun control. A mass shooting in the previous year increases the number of enacted laws that loosen gun restrictions by 75% in states with Republican-controlled legislatures. When there is a Democrat-controlled legislature, mass shootings lead to a statistically insignificant reduction in laws that loosen gun control. We find no significant effects of mass shootings on laws that tighten gun restrictions, but the estimates are imprecise. Summing across all legislatures (Republican, Democrat, and split), there is roughly a 10% increase in laws enacted after a mass shooting, but this estimate is imprecise and statistically insignificant (Appendix B).

[4] See, for example, https://www.gop.com/platform/ and https://www.democrats.org/party-platform.

3.5 Robustness Checks

In this section, we present three sets of robustness checks. First, we provide support for the exogeneity of mass shootings. Second, we show that our main results are robust to the inclusion of state-specific time trends. Third, we perform a falsification exercise in which we use randomly generated placebo shootings instead of actual shootings; we show there are no effects using the placebo shootings, providing support for our identification strategy.

3.5.1 Determinants of Mass Shootings

Our ability to identify the causal impact of mass shootings on policy rests on the assumption that they are plausibly exogenous to other factors that would drive gun control in a given year. Given the erratic nature of mass shootings, this is a plausible assumption. Nonetheless, one might be concerned that both mass shootings and gun policy are being driven by a third variable. To provide support for our assumption and interpretation, we regress an indicator for whether a mass shooting occurs on economic, demographic, and policy variables.

Consistent with the assumption that mass shootings are exogenous with respect to potential confounds, the results in Appendix C show that, out of 32 variables we consider, only unemployment is significantly associated with a higher probability of mass shootings. Because higher unemployment is also associated with a reduction in gun bill introductions (Table 2), the potential bias of this would work in the opposite direction of our finding – making it unlikely that this is driving our results. To further support our interpretation, we control for unemployment in all models. Importantly, bills introduced, laws enacted, and major gun policies do not predict future mass shootings (Appendix C).

3.5.2 State-Specific Time Trends

Another potential concern is that states have differential trends in mass shootings, and that these trends correlate with gun regulations, which would violate the parallel trends assumption. As a robustness check, we run our main specifications with state-specific trends. Appendix D shows the results of re-estimating the models in Tables 2 and 3 with state specific time trends. The inclusion of state specific trends does not change our main results from Tables 2 and 3. We are unable to estimate models with state specific trends for our analyses of tightening and loosening laws because the likelihood function is discontinuous when including the additional parameters due to some states having very few laws that we can identify as tightening or loosening. We can, however, conduct a placebo analysis to address any residual concerns.

3.5.3 Placebo Tests

As a final robustness check, we perform a falsification exercise based on the insights of Bertrand, Duflo, and Mullainathan (2004) and Donald and Lang (2007). Specifically, we randomly assign placebo mass shootings to state-years in which no actual shooting occurred with probability equal to each state's frequency of shootings, and randomly draw a fatality count from the empirical distribution of fatalities. Appendix E shows percentiles of the test statistic based on 1,000 repetitions of this procedure and our actual test statistics from Tables 2 and 4. The results suggest our tests do not over-reject the null hypothesis that mass shootings have no effect on gun policy.

4. Discussion

Mass shootings account for a small fraction of gun deaths in the United States, but have a significant impact on gun policy. More gun laws are proposed in the year following a mass shooting, a result which holds for both Republican- and Democrat-controlled legislatures. Notably, mass shootings have much larger effects on policy, per fatality, than ordinary gun homicides. However, we also find evidence that Democrat- and Republican-controlled legislatures differ significantly when it comes to enacting gun laws. Republicans are more likely to loosen gun laws in the year after a mass shooting. The effect for Democrats, which tends toward less loosening of gun restrictions after a mass shooting, is statistically insignificant.

Our results are consistent with qualitative research that has hypothesized the possibility of mass shootings precipitating change. For example, Godwin and Schroedel (1998) argue that the Stockton schoolyard massacre in 1989 led to the enactment of California's assault weapons ban. We find empirical evidence that sporadic events such as mass shootings can lead to major policy changes. This raises the question of other factors that might drive policy, and conditions under which we might expect such effects. For example, might extreme weather events in a single state influence its environmental policy? Might we expect a greater impact of random events in some policy contexts (e.g., the effect of a terrorist attack) than in others (e.g., the effect of an Ebola outbreak)? In the context of gun legislation itself, might mass shootings have a greater impact if they occur at a time when few other events are competing for media attention, or during elections, when public attention is more focused on such issues (e.g., Bouton, Conconi, and Pino 2015)?

Our findings raise a number of additional questions, and suggest several directions for future research. First, our estimates focus on the impact on policy within the state in which each shooting took place. Some mass shootings get national media attention and potentially affect policy nationwide, which would not be identified by our fixed effects model. One direction for future research is to develop strategies to identify national responses. With respect to our findings, this suggests that the total impact of mass shootings on gun policy may be even larger than our estimates.

Second, future research might further explore the role of salience in shaping policy by examining the conditions under which events are more or less influential. For example, some types of events (e.g., school shootings) may have larger effects than others, something we could not test given the relative infrequency of such events. Salience might also vary based on whether the event occurs during an election cycle. Finally, the role of interest groups who try to promote their preferred policies in the aftermath of such events deserves further exploration.

Third, there is a large literature on the impact of gun policies on crime (Duggan 2001, Ludwig and Cook 2000, Ludwig and Cook 2003, Abrams 2012), which has yielded mixed results. The relationship we find between mass shootings and gun policy raises the possibility of using mass shootings as an instrumental variable to study the impact of gun laws on gun deaths. In our sample, mass shootings are not a sufficiently strong instrument to estimate the effects of gun policy on gun deaths, due to their relative infrequency. Appendix F presents results of this analysis. This leaves open the possibility of using salient and plausibly random events to instrument for policy changes in future research.

Our findings suggest that while much attention has been rightfully devoted to understanding the impact of policy, there is a lot to be learned from exploring the determinants of policy change as well. We find that even random and infrequent events that account for a relatively small portion of total societal harm in a domain might nonetheless be crucial levers for policy consideration and change. This does not imply that politicians and policy makers are over-reacting; it may be that on issues where there is usually political deadlock, salient events create opportunities for change that has been sought all along. Whether these changes reflect appropriate responses to the problem remains an open question.

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Figures

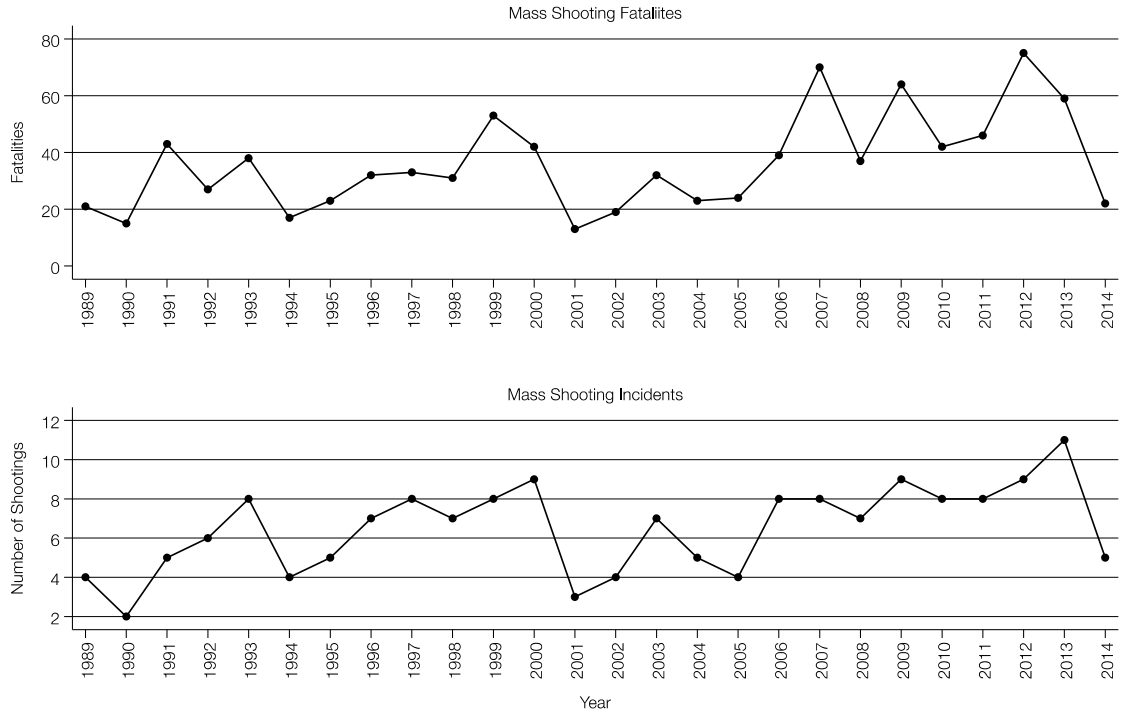

Figure 1 Mass shooting incidents and fatalities by year, 1989-2014. The upper panel of the figure shows the number of fatalities in mass shootings in the 50 states in which at least 3 people not related or romantically connected to the shooter were killed. The bottom panel shows the number of these incidents. Washington, D.C. is not included in the sample.

Tables

Table 1: Summary Statistics

	mean	sd	p5	p10	p50	p90	p95	N
Legislation								
Bills Introduced	16.33	22.04	0	1	10	38	53	1,250
Laws Enacted	2.56	3.35	0	0	1	6	9	1,250
Tightening Laws	0.70	1.29	0	0	0	2	3	1,250
Loosening Laws	0.25	0.62	0	0	0	1	1	1,250
Gun Violence								
Mass Shooting	0.12	0.32	0	0	0	1	1	1,250
Fatalities	0.72	2.40	0	0	0	4	5	1,250
Gun Homicide Rate	3.76	2.55	0.72	0.98	3.42	7.40	8.65	1,250
Political Controls								
Democratic Legislature	0.42	0.49	0	0	0	1	1	1,250
Republican Legislature	0.34	0.47	0	0	0	1	1	1,250
Democratic Trifecta	0.23	0.42	0	0	0	1	1	1,250
Republican Trifecta	0.24	0.43	0	0	0	1	1	1,250
Republican Governor	0.53	0.50	0	0	1	1	1	1,200
Institutional Controls								
Regular Session	0.94	0.24	0	1	1	1	1	1,250
Bill Carryover	0.27	0.44	0	0	0	1	1	1,250
Limited Leg. Topic	0.06	0.24	0	0	0	0	1	1,250
Legislature Size	148	59.3	62	82.5	144	200	236	1,250
Demographic Controls								
Elderly (65+) %	12.9	2.0	9.8	10.7	13.1	15.2	15.7	1,250
Under 25 %	35.1	2.7	31.4	32.2	34.8	38.0	39.5	1,250
Black %	10.3	9.5	0.6	0.8	7.4	26.4	30.1	1,250
Hispanic %	8.3	9.2	0.8	1.2	5.1	20.3	29.9	1,250
Unemployment %	5.7	1.9	3.1	3.5	5.4	8.1	9.3	1,250
Income per capita	19.1	3.3	14.1	15.0	18.7	23.3	25.8	1,250
High School %	85.2	5.2	75.7	78.4	86.1	91.2	92.0	1,250
Veteran %	11.8	2.4	7.9	8.8	11.8	15.0	16.1	1,250
Divorced %	11.8	1.8	8.9	9.5	11.8	14.1	14.7	1,250

Note: Observations are state-years. *Bills Introduced* is the number of bills introduced in the legislature; *Laws Enacted* is the number of bills that became law. *Tightening* and *Loosening Laws* are numbers of enacted laws that tightened and loosened gun control respectively. *Mass Shooting* is an indicator for state-years with a mass shooting in which 3+ people not romantically involved with or related to the shooter(s) were killed. *Fatalities* is the total number of deaths in mass shootings in a state-year. *Democratic* and *Republican Legislature* are indicators for party control of the state legislature; *Democratic* and *Republican Trifecta* are indicators for party control of state government (legislative and executive branch). *Republican Governor* is an indicator for Republican governors. *Regular Session* indicates whether the legislature convened a regular (as opposed to special) session to consider bills; some state legislatures only meet every other year. *Bill Carryover* is proportion of chambers in which bills are eligible for carryover to the next session. *Limited Leg. Topic* is an indicator for legislative sessions during which bills are limited to specific topics (e.g. appropriations). *Legislature Size* is the number of lawmakers serving in the state legislature. *Income per capita* is measured in thousands of 1987 U.S. dollars; other demographic variables are percentages.

Table 2: The Effect of Mass Shootings on Gun Bill Introductions

Dependent variable: number of firearm-related bills introduced in the state legislature.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mass Shooting	0.154*	0.087	0.155**	0.148***	0.004	-0.103	-0.005	-0.023
	(0.088)	(0.074)	(0.065)	(0.056)	(0.089)	(0.063)	(0.078)	(0.077)
Fatalities					0.023	0.028***	0.024***	0.026***
					(0.016)	(0.008)	(0.009)	(0.009)
Dem. Legislature				-0.182*				-0.176*
				(0.096)				(0.098)
Rep. Legislature				0.159**				0.172***
				(0.073)				(0.066)
Dem. Trifecta				0.088				0.082
				(0.093)				(0.089)
Rep. Trifecta				-0.168				-0.183*
				(0.116)				(0.109)
Rep. Governor				0.059				0.067
				(0.089)				(0.083)
Institutional Controls	No	No	Yes	Yes	No	No	Yes	Yes
Demographic Controls	No	No	No	Yes	No	No	No	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
N	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). See note to Table 1 for variable definitions.

Table 3: Comparing Mass Shootings and Non-Mass Shootings

Dependent variable: number of firearm-related bills introduced in the state legislature.

	(1)	**(2)**	**(3)**	**(4)**
Mass Shooting Fatalities / 100,000	1.678***	1.332***	1.303***	1.316***
	(0.428)	(0.240)	(0.223)	(0.199)
Ordinary Gun Homicides / 100,000	-0.007	0.017	0.014	0.020
	(0.024)	(0.032)	(0.032)	(0.033)
Political Controls	No	No	No	Yes
Institutional Controls	No	No	Yes	Yes
Demographic Controls	No	No	No	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
N	1,250	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). *Mass Shooting Fatalities / 100,000* is the number of deaths in mass shootings per 100,000 state residents. *Ordinary Gun Homicides / 100,000* is the number of gun homicides not in mass shootings per 100,000 state residents. Control variables are defined as in Table 1.

Table 4: Mass Shootings and Enacted Laws

Dependent variable: number of firearm-related laws enacted (i.e. bills that became law).

	Tightening Laws		*Loosening Laws*	
	(1)	**(2)**	**(3)**	**(4)**
Mass Shooting	-0.012		0.252	
	(0.099)		(0.186)	
Rep. Leg. × Shooting		0.005		0.747***
		(0.234)		(0.256)
Dem. Leg. × Shooting		0.067		-0.245
		(0.135)		(0.411)
Split Leg. × Shooting		-0.229		0.169
		(0.256)		(0.338)
Dem. Legislature	-0.105	-0.159	-0.349	-0.279
	(0.179)	(0.198)	(0.300)	(0.328)
Rep. Legislature	0.279*	0.243	0.436**	0.325
	(0.159)	(0.164)	(0.216)	(0.227)
Dem. Trifecta	0.420**	0.433**	0.045	0.035
	(0.208)	(0.207)	(0.290)	(0.289)
Rep. Trifecta	-0.197	-0.199	0.116	0.152
	(0.226)	(0.227)	(0.334)	(0.332)
Rep. Governor	0.215*	0.222*	-0.141	-0.137
	(0.130)	(0.131)	(0.226)	(0.221)
Institutional Controls	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	1,250	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). Models 2 and 4 show the effect of mass shootings in Republican, Democratic, and split legislatures; the omitted group in these models is states without a mass shooting. All variables are defined as in Table 1.

Appendix A: Coding Gun Laws

id	summary	tighten	loosen	uncertain
1	Creates a new felony for firing a gun within 1,000 feet of an educational facility.	1	0	0
2	Reduces the age limit for purchase of a handgun from 21 to 18.	0	1	0
3	Allows parole officers to carry a loaded firearm while commuting to and from work.	0	0	0
4	Relates to the use of firearms in state parks and campgrounds.	0	0	1
5	Requires a license to operate a gun show. Eliminates the waiting period for firearm sales if the purchaser has a valid permit to carry a concealed weapon.	1	1	0

Note: Table shows examples of coding gun laws based on bill summaries. Coders were given a full manual to explain the meaning of "tighten", "loosen", "neutral," and "uncertain" along with the following examples. This table mimics the appearance of the Excel workbooks used by the coders. The first bill creates a new crime related to firearms. It tightens restrictions on firearms. The second bill makes it easier for people to acquire guns; it loosens restrictions on firearms. The third bill is exclusively about parole officers; it is neutral because it does not affect the general public. The fourth bill is uncertain because the summary is a generic description that does not specify whether the law tightens or loosens restrictions on firearms. The fifth bill both tightens and loosens; it regulates gun shows, but also eliminates a restriction on firearm purchasers.

Appendix B: Laws Enacted

Table B1: Laws Enacted and Mass Shootings

Dependent variable: number of firearm-related laws enacted (i.e. bills that became law).

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Mass Shooting	0.074	0.020	0.079	0.102	-0.004	-0.058	0.012	0.018
	(0.118)	(0.108)	(0.075)	(0.067)	(0.101)	(0.102)	(0.090)	(0.078)
Fatalities					0.012	0.012	0.010	0.012
					(0.011)	(0.009)	(0.010)	(0.009)
Dem. Legislature				-0.071				-0.073
				(0.095)				(0.096)
Rep. Legislature				0.252**				0.269***
				(0.099)				(0.100)
Dem. Trifecta				0.086				0.096
				(0.098)				(0.099)
Rep. Trifecta				0.028				0.007
				(0.141)				(0.140)
Rep. Governor				0.031				0.043
				(0.083)				(0.084)
Institutional Controls	No	No	Yes	Yes	No	No	Yes	Yes
Demographic Controls	No	No	No	Yes	No	No	No	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
N	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). Variables are identical to those in Table 2, except for the dependent variable, which is the number of firearm-related laws enacted instead of the number of bills introduced. See note to Table 1 for variable definitions.

Appendix C: Predicting Mass Shootings

Table C1: Linear Probability Model for Mass Shooting using Control Variables

Dependent variable: indicator for state-year with a mass shooting.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag Bills Introduced				0.000			
				(0.001)			
Lag Laws Enacted					0.000		
					(0.005)		
Lag Tightening laws						0.000	
						(0.009)	
Lag Loosening laws							0.015
							(0.014)
Dem. Legislature		-0.020	-0.016	-0.007	-0.007	-0.007	-0.006
		(0.056)	(0.056)	(0.057)	(0.057)	(0.056)	(0.056)
Rep. Legislature		0.026	0.026	0.027	0.027	0.027	0.026
		(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)
Dem. Trifecta		0.052	0.054	0.039	0.039	0.039	0.039
		(0.060)	(0.060)	(0.059)	(0.059)	(0.059)	(0.059)
Rep. Trifecta		-0.110**	-0.109*	-0.104*	-0.104*	-0.104*	-0.103*
		(0.055)	(0.055)	(0.056)	(0.056)	(0.055)	(0.055)
Rep. Governor		0.042	0.044	0.036	0.036	0.036	0.036
		(0.047)	(0.047)	(0.049)	(0.049)	(0.049)	(0.049)
Legislature Size			0.001	0.001	0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Regular Session			0.122	0.123*	0.121*	0.122	0.128*
			(0.077)	(0.072)	(0.067)	(0.073)	(0.073)
Bill Carryover[a]			0.057**	0.056*	0.055**	0.055**	0.056**
			(0.026)	(0.030)	(0.027)	(0.027)	(0.027)
Limited Leg. Topic			-0.047	-0.064	-0.063	-0.063	-0.066
			(0.062)	(0.059)	(0.060)	(0.059)	(0.060)
Elderly (65+) %	-0.003	-0.006	-0.006	-0.002	-0.002	-0.002	-0.003
	(0.025)	(0.024)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)
Under 25 %	0.001	-0.001	-0.000	0.002	0.002	0.002	0.002
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Black %	-0.010	-0.011	-0.010	-0.003	-0.004	-0.003	-0.002
	(0.016)	(0.016)	(0.016)	(0.018)	(0.019)	(0.018)	(0.018)
Hispanic %	-0.008	-0.007	-0.007	-0.008	-0.008	-0.008	-0.008
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)
Unemployment %	0.025**	0.027**	0.027**	0.026**	0.026**	0.026**	0.026**
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.012)
Income per capita	0.014	0.012	0.013	0.013	0.013	0.013	0.013
	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
High School %	-0.004	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Veteran %	-0.003	-0.000	0.000	-0.003	-0.003	-0.003	-0.002
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Divorced %	-0.004	-0.003	-0.002	0.001	0.001	0.001	0.001
	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Constant	0.192	0.075	-0.279	-0.413	-0.413	-0.414	-0.388
	(0.954)	(0.938)	(0.993)	(0.939)	(0.942)	(0.943)	(0.931)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,250	1,250	1,250	1,200	1,200	1,200	1,200

[a] There is no *a priori* reason to think bill carryover would be related to mass shootings; this correlation is insignificant when Virginia, which unlike most states, allows carryover in even years, is dropped from the sample. Four of Virginia's six mass shootings happened in even years.

Table C2: Linear Probability Model for Mass Shooting using Policy Variables

Dependent variable: indicator for state-year with a mass shooting.

	(1)	(2)
Handgun Waiting Period (days)	0.004	0.005
	(0.004)	(0.004)
Long-gun Waiting Period (days)	-0.008	-0.006
	(0.019)	(0.019)
Age 18+ for Transaction	0.007	0.010
	(0.025)	(0.026)
Age 21+ for Transaction	-0.059	-0.075
	(0.051)	(0.051)
Handgun Permit System	-0.009	0.004
	(0.115)	(0.117)
Background Check, All Handgun Sales	-0.112	-0.124
	(0.089)	(0.098)
Background Check, All Firearm Sales	0.011	-0.032
	(0.131)	(0.142)
Assault Weapons Ban	0.062	0.067
	(0.056)	(0.057)
Shall Issue Concealed Carry	-0.011	-0.009
	(0.039)	(0.038)
No Permit Needed Concealed Carry	0.152	0.207
	(0.182)	(0.180)
Political Controls	No	Yes
Demographic Controls	Yes	Yes
State Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
N	1,250	1,250

Note: Handgun Waiting Period is the number of days purchasers must wait before accepting delivery of a handgun. *Long-gun Waiting Period* is similarly defined for long-guns (e.g. rifles and shotguns). *Age 18+ Transaction* is an indicator for laws that prevent vendors from selling handguns to minors or prevent minors from purchasing handguns. *Age 21+ Transaction* is defined the same way for persons under 21. *Handgun Permit System* is an indicator for states that require permits to purchase a handgun. *Background Check, All Handgun Sales* is an indicator for requiring a background check for all handgun transactions (including private sales). *Background Check, All Firearm Sales* is an indicator for requiring a background check for all firearm transactions (including private sales). *Assault Weapons Ban* is an indicator for states that ban some types of assault rifles or pistols. *Shall Issue Concealed Carry* is an indicator for states that require the permitting authority to grant a license to anyone meeting the minimum statutory qualifications (i.e. do not permit law enforcement discretion in issuing permits). *No Permit Needed Concealed Carry* is an indicator for states that allow concealed carry without a permit.

Appendix D: State-Specific Time Trends

Table D1: The Effect of Mass Shootings on Gun Bill Introductions

Dependent variable: number of firearm-related bills introduced in the state legislature.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Mass Shooting	0.074	0.151**	0.164***	-0.146**	-0.027	-0.013
	(0.075)	(0.069)	(0.056)	(0.071)	(0.093)	(0.080)
Fatalities				0.033***	0.026**	0.026***
				(0.011)	(0.012)	(0.010)
Institutional Controls	No	Yes	Yes	No	Yes	Yes
Political Controls	No	No	Yes	No	No	Yes
Demographic Controls	No	No	Yes	No	No	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1,250	1,250	1,250	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). Variables are identical to those in Table 2 and defined in the note to Table 1.

Table D2: Mass Shootings, Ordinary Gun Homicides, and Bill Introductions

Dependent variable: number of firearm-related bills introduced in the state legislature.

	(1)	**(2)**	**(3)**
Mass Shooting Fatalities / 100,000	1.504***	1.481***	1.427***
	(0.323)	(0.261)	(0.183)
Ordinary Gun Homicides / 100,000	0.010	0.005	0.017
	(0.058)	(0.055)	(0.044)
Institutional Controls	No	Yes	Yes
Political Controls	No	No	Yes
Demographic Controls	No	No	Yes
State Fixed Effects	Yes	Yes	Yes
State-Specific Trends	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N	1,250	1,250	1,250

Note: Robust standard errors clustered by state in parentheses. Stars following coefficients represent *p*-values less than .10 (*), .05 (**) and .01 (***). Variables are identical to those in Table 3 and defined in the note to Table 1.

Appendix E: Placebo Mass Shooting Analysis

Table E1: Placebo Analysis for Bill Introductions (Mirrors Table 2)

		Percentiles of Placebo Test Statistic					
	Actual	**1st**	**5th**	**10th**	**90th**	**95th**	**99th**
Shooting Indicator (model 4)							
Shooting	2.64	-3.59	-2.82	-2.30	0.72	1.10	1.89
Shooting Indicator and Fatalities (model 8)							
Shooting	-0.30	-3.96	-2.53	-2.04	1.29	1.72	2.86
Fatalities	2.89	-3.70	-2.62	-1.91	1.79	2.51	4.11

Table E2: Placebo Analysis for Enacted Laws (Mirrors Table 4)

		Percentiles of Placebo Test Statistic					
	Actual	**1st**	**5th**	**10th**	**90th**	**95th**	**99th**
Tightening Laws (models 1 and 2)							
Pooled Shooting	-0.12	-2.21	-1.45	-1.08	1.73	2.18	3.00
Rep. Leg. × Shooting	0.02	-2.85	-1.69	-1.19	1.66	2.21	3.27
Dem. Leg. × Shooting	0.50	-2.35	-1.63	-1.33	1.45	1.92	2.63
Split Leg. × Shooting	-0.89	-2.68	-1.60	-1.12	1.95	2.35	4.13
Loosening Laws (models 3 and 4)							
Pooled Shooting	1.35	-3.19	-2.30	-1.89	0.83	1.23	2.03
Rep. Leg. × Shooting	2.92	-2.99	-2.28	-1.97	0.68	1.05	1.68
Dem. Leg. × Shooting	-0.60	-2.71	-1.80	-1.40	1.21	1.61	2.72
Split Leg. × Shooting	0.50	-3.12	-2.08	-1.72	1.37	1.84	2.87

Notes: We randomly assign placebo mass shootings to state-years in which no actual shooting occurred with probability equal to each state's frequency of shootings, and randomly draw a fatality count from the empirical distribution of fatalities. We then re-run the models and calculate the test statistic for the placebo shooting and fatality coefficients. The above percentiles are based on 1,000 replications. The "Pooled" rows in Table E2 mirror models 1 and 3 of Table 4 (the models without interaction effects). The legislature effects mirror models 2 and 4.

Appendix F: Mass Shootings as an Instrument for Gun Policy

In this appendix we use mass shootings as an instrumental variable to study the impact of gun laws on gun deaths. We start with the following model:

$$\ln(D_{st}) = \alpha_s + \theta_t + \beta\ Gun\ Control_{st} + \delta' Z_{st} + \epsilon_{st}$$

where D_{st} is non-mass shooting gun deaths per 100,000 people in state s and year t, α_s and θ_t are state and year effects, $Gun\ Control_{st}$ is an index representing the strictness of gun policy, and Z_{st} is a vector of controls –demographic, political, and economic factors – that potentially affect gun deaths. We use the same variables as Levitt (1996) as controls, but also include dummies for Republican and Democratic trifectas or legislatures, and a dummy for Republican governors.

We do not directly observe $Gun\ Control_{st}$; instead, we observe the enactment of new laws that change gun policy. Therefore, we estimate the equation in first differences:

$$\Delta \ln(D_{st}) = \lambda_t + \beta\ New\ Gun\ Laws_{st} + \Delta Z_{st}\delta + \Delta\epsilon_{st}$$

where $New\ Gun\ Laws_{st} = \Delta Gun\ Control_{st}$ is negative for laws that loosen gun control and positive for laws that increase gun control (according to our coders, see data description). Based on our main results, we instrument for gun laws using the first lags of mass shooting fatalities and the interaction of lagged mass shooting fatalities with Republican control of state government. The former should be positively correlated with new laws and the latter negatively correlated with new laws.

We estimate the model using Fuller's (1977) modified LIML with $\alpha = 1$ (Baum, Schaffer, and Stillman 2007). First stage results suggest the instruments are weak despite being jointly significant ($F = 4.83$) with the expected sign (Stock and Yogo 2005). The

coefficients on the exogenous instruments in the reduced form equation for firearm deaths are not significant, but also have the expected signs (negative for lagged mass shooting fatalities and positive for the interaction of lagged fatalities with Republican control of government). Our estimate $\hat{\beta}$ is -0.021 with standard error 0.014. A conditional likelihood ratio test (Moreira 2003; Andrews, Moreira, and Stock 2004; Finlay and Magnusson 2009) cannot reject the null hypothesis that $\beta = 0$ ($p = 0.14$).