Child Access Prevention Laws and Juvenile Firearm-Related Homicides

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Abstract. Debate over safe-storage gun regulations has captured public attention in the aftermath of several high-profile shootings committed by minors. Whether these laws actually decrease youth gun violence, however, is an unanswered question. Using data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013, this study is the first to estimate the relationship between child access prevention (CAP) laws and firearm-related homicides committed by juveniles. Our results suggest that CAP laws are associated with a 17 percent reduction in juvenile firearm-related homicides. The estimated effect is stronger among whites than blacks and is driven by states enforcing the strictest safe-storage standard. We find no evidence that CAP laws are associated with firearm-related homicides committed by adults or with non-firearm-related homicides committed by juveniles, suggesting that the observed relationship between CAP laws and juvenile firearm-related homicides is causal. This study provides the strongest evidence to date that CAP laws can improve public safety by reducing violent crime.

JEL Codes: K4, H7

Key Words: Gun Control, Child Access Prevention Laws, Homicides, Crime

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"Too often, minors have also used their families' unsecured firearms to intentionally perpetrate violence against others."

-Giffords Law Center to Prevent Gun Violence (2018a)

"This poorly thought out legislation is without any consideration for personal circumstances. It invades people's homes and forces them to render their firearms useless in a self-defense situation by locking them up."

-National Rifle Association-Institute for Legislative Action on Seattle's recently passed safe-storage ordinance (NRA-ILA 2018).

1. Introduction

The most recent mass school shooting in the United States has intensified the discourse over the safe storage of firearms after it was learned that the guns were taken from the shooter's home and belonged to his father (Coaston 2018; Mann 2018).[1] This comes at a time of rising youth gun violence and increasing public support for gun restrictions.[2] For instance, a 2017 U.S. survey found that approximately 60 percent of gun owners backed safe-storage requirements for guns in households with children (Barry et al. 2018).[3] As states grapple with decisions on gun control, Americans prefer child access prevention (CAP) laws to more divisive policies such as assault weapons and large-capacity magazine bans (Ingraham 2018).

CAP laws encourage the safe storage of firearms by imposing liability on adults who allow children unsupervised access to guns (Giffords Law Center to Prevent Gun Violence 2018a). Gun safety advocates support CAP laws as a way to limit firearm-related homicides, as

[1] On May 18, 2018, 17-year-old Dimitrios Pagourtzis used his father's shotgun and 0.38 revolver to kill 8 students and 2 teachers at Santa Fe High School in Santa Fe, Texas. Because Texas' safe-storage gun law applies only to children under the age of 17, Pagourtzis' family was not held liable (Platoff 2018; Sanchez 2018). Other recent high-profile school shootings committed by minors who obtained their guns from home (or the home of a relative) include the events in Chardon, Ohio (Crimesider Staff 2012); Sparks, Nevada (Associated Press 2013); Troutdale, Oregon (Bernstein 2014); and Benton, Kentucky (Markgraf 2018). In general, most guns used in school shootings come from home (Hobbs 2018).

[2] Gun violence has surpassed vehicle accidents as a leading cause of death for 15- to 29-year-olds in the United States (Parsons et al. 2018). In 2015 alone, 2,824 individuals 19 years of age or younger died from gun violence (National Center for Injury Prevention and Control 2017). Firearm-related injuries are currently the third leading cause of death among American children 1 to 17 years of age (Fowler et al. 2017). Public support for gun restrictions recently reached its highest point in the last 25 years (Clement 2018).

[3] In the same survey, nearly 80 percent of non-gun owners supported safe-storage requirements (Clement 2018).

well as a way to decrease suicides among minors and the number of children shot unintentionally (Jones 2017; Iannelli 2018). On the other hand, critics argue that safe-storage requirements impede a person's ability to defend their home and family during a violent intrusion, and that these laws may actually increase incidences of murders, rapes, robberies, and other forms of violent crime (Kopel et al. 2000).

As public calls for safe storage grow louder, it is likely that an increasing number of state legislatures will come under pressure to pass CAP laws or toughen their existing CAP requirements. In fact, New York lawmakers passed a bill in March, 2019 to require "gun owners who live with someone under 16, or who know that someone under that age could access their gun, to lock up their firearm when it is not in use" (Wang 2019). One of the few municipal-level ordinances requiring the safe storage of firearms passed in Seattle, Washington on July 9, 2018 (Norimine 2018).[4] Yet, only 27 states and the District of Columbia currently have some form of CAP law in place. Recent estimates suggest that 7 percent of U.S. children (≈ 4.6 million) live in homes with an unlocked and loaded firearm (Azrael et al. 2018).

[4] After the Seattle ordinance passed, Mayor Durkan distributed hundreds of lock boxes, trigger locks, and cable locks to the community to help ensure individual compliance and King County offered discounts for the purchase of safe storage devices (Hightower 2019). The Second Amendment Foundation and National Rifle Association (NRA) filed a lawsuit against the City of Seattle, claiming the safe-storage requirement violates the state's preemption statute (KOMO Staff 2018). In general, CAP laws are associated with vocal NRA opposition (Shaffer 2000). See Legal Community Against Violence (2008) for further discussion on local child access prevention laws. At the state level, sponsors gathered enough signatures to put a gun safety initiative, which includes a safe-storage requirement, on the November 2018 ballot in Washington (Porter 2018). In Oregon, a petition calling for stricter gun storage laws failed to make the November 2018 ballot, after being challenged in court by the NRA and Oregon Firearms Federation. Petitioners announced they would refile for the November 2020 ballot while concurrently working with the state legislature to pass the initiative in the 2019 session (Grippo 2018). On June 13, 2019, Governor Ned Lamont (D-Connecticut) signed Ethan's Law, named for Ethan Song, a 15-year-old boy who shot and killed himself using an unsafely stored firearm. The new law requires,

> "…gun owners to store firearms, whether they are loaded or unloaded, in a securely locked container, if a person under the age of 18 is likely to gain access to the weapon without permission. The prior law applied only to loaded weapons likely accessible to minors under the age of 16" (De Avila 2019)."

While a literature on CAP laws exists, it is focused primarily on unintentional shooting deaths among children (Cummings et al. 1997; Webster and Starnes 2000; Lott and Whitley 2001; Hepburn et al. 2006; DeSimone et al. 2013; Gius 2015) and youth suicides (Cummings et al. 1997; Lott and Whitley 2001; Webster et al. 2004; DeSimone et al. 2013; Gius 2015). With a few exceptions, which we discuss in detail below, little is known about how these laws affect violent crime and, more specifically, homicides.

Using the FBI's *Supplementary Homicide Reports* (SHR), a data source unique to the literature, this study is the first to explore the relationship between CAP laws and firearm-related homicides committed by juveniles. We focus on homicides, rather than other forms of violent crime, because information on the offender's age is available and the laws generate predictions as to which age groups should be most affected, predictions that could not be tested without age-specific information. Examining the period 1985-2013, a span when 26 states and the District of Columbia adopted CAP legislation, our estimates suggest that CAP laws are associated with a 17 percent reduction in the expected number of firearm-related homicides committed by juveniles, and this effect is driven by states enforcing a "negligent storage" standard, the strictest form of CAP legislation. Furthermore, we find that CAP laws are not associated with firearm-related homicides committed by adults nor are they associated with non-firearm-related homicides committed by juveniles, providing evidence that the relationship between CAP laws and juvenile firearm-related homicides is causal.

2. Background

The storage of firearms within the home was unregulated in the United States until 1981, when Missouri became the first state to pass a CAP law. Under the Missouri law, it is illegal to

recklessly provide firearm access to a person under the age of 18 (Giffords Law Center to Prevent Gun Violence 2017). Since 1981, 26 states and the District of Columbia have passed a CAP law (Table 1).[5] Appendix Figure 1 illustrates the evolution of CAP laws over time.

CAP laws take a variety of forms. Fourteen states and the District of Columbia impose criminal liability on individuals who negligently store firearms. In these states, if a minor gains access to a firearm that was not properly stored, the gun owner faces potential fines, imprisonment, or some combination of both. For instance, violation of Minnesota's negligent storage CAP law is punishable by up to a $3,000 fine and one year in jail (Peters 2013). The remaining states listed in Table 1 levy a weaker standard for criminal liability and "impose penalties only in the event of reckless, knowing or intentional conduct by the adult" (Giffords Law Center to Prevent Gun Violence 2018a). In some cases, CAP laws have been used to punish dealers and manufacturers who failed to include the appropriate safety devices with the sale of their firearms (Shaffer 2000).

CAP laws vary across other margins as well. For example, some negligent storage states impose criminal liability if a minor could simply gain access to a firearm, while others require the minor to have carried or used the firearm to impose liability. CAP laws may apply to all firearms, loaded firearms, or handguns only, and some states require that stored firearms include a locking device. Additionally, the definition of a "minor" varies from state to state (Giffords Law Center to Prevent Gun Violence 2018a).[6] For evidence on individuals being charged with unsafe gun storage in CAP law states, see Borden (1995), James (1996), "Parents Charged"

[5] The dates listed in Table 1 for Delaware and Nevada are different than those listed in Anderson and Sabia (2018). Based on further research and additional sources, the effective CAP laws dates were updated from 1998 to 1994 and from 1995 to 1991 for Delaware and Nevada, respectively. It should be noted, however, that the results presented below change little when using the original dates from Anderson and Sabia (2018).

[6] See Anderson and Sabia (2018) for further details on CAP laws.

(2009, 2017), Associated Press (2010), Young (2012), Harmacinski (2013), Ly (2013), Amaral (2014), Lopez and Goff (2014), Angst (2016), Bell (2016), Cutts and Majchrowicz (2016), Spies (2016), Boren (2017), "Father Charged" (2017), Stevens (2017), City News Service (2019), and Rabin (2019). A recent review of cases in which children under the age of 12 either shot and killed themselves or were shot and killed by another child found that approximately half of the deaths resulted in a criminal charge. If the parent involved was a felon, the case almost always resulted in a criminal charge (Penzenstadler et al. 2017).

Due to the absence of state panel data on household gun storage, we know little about the effect of CAP laws on the safe storage of firearms.[7] While Lott and Whitley (2001) and Prickett et al. (2014) found that CAP laws are associated with higher rates of safe-gun storage, the results from both studies are based on cross-sectional analyses, and should be viewed as largely descriptive.[8] Recent research, however, suggests that CAP laws are indeed successful at reducing youth gun carrying. Using data from the Youth Risk Behavior Surveys for the period 1993-2013, Anderson and Sabia (2018) explored the relationship between CAP laws and gun carrying among high school students under the age of 18. Their results suggest that CAP laws

[7] Using Google search data, we test whether searches on "gun safe" spiked in the Seattle-Tacoma metropolitan area after Seattle passed their recent safe-storage bill (Figure 1). On July 10, 2018, the day immediately after the bill passed, the volume of searches on "gun safe" hit its peak during the period June 15, 2018 through August 15, 2018. At a minimum, these results suggest that Seattle's law was particularly salient. There was no spike at the same time in Portland, a reasonable counterfactual city (Appendix Figure 2). For further details on the use of Google search data in economic research, see Stephens-Davidowitz (2014) or Anderson et al. (2018).

[8] Specifically, Lott and Whitley (2001) found that households were less likely to leave their guns loaded and unlocked the longer their state's CAP law had been in effect. Prickett et al. (2014) found that families in states with both CAP laws and stronger firearm legislation were more likely to safely store their firearms. There is also evidence that education campaigns to promote safe firearm storage, the distribution of free locking devices, and clinical interventions increase the likelihood that households store and lock their guns (Sidman et al. 2005; Barkin et al. 2008; Simonetti et al. 2018). Information on state gun policies, including CAP laws, is commonly provided to gun owners through the NRA's Institute for Legislative Action (www.nraila.org), from state gun owner organizations (e.g., Gun Owners of New Hampshire, www.gonh.org), during state gun licensing procedures (Giffords Law Center to Prevent Gun Violence 2018b), and by media coverage of legislative action (e.g., De Avila 2019; Wang 2019).

are associated with an almost 20 percent decrease in the rate of past-month gun carrying, and these effects are driven by states that enforce a negligent storage standard. Within the literature on CAP laws, Anderson and Sabia's (2018) estimates reflect the most convincing evidence of a "first-stage" effect.

Only a few previous studies have explored the relationship between CAP laws and some form of violent crime. Using data from the Compressed Mortality Files of the National Center for Health Statistics for the period 1979-1994, Cummings et al. (1997) found that CAP laws were associated with an 11 percent decrease in gun-related homicides among victims under the age of 15, but this estimate was statistically insignificant at conventional levels. Using data from the FBI's Uniform Crime Reports (UCR) for the periods 1979-1996 and 1977-1998, Lott and Whitley (2001) and Lott (2003), respectively, found that CAP laws were associated with increases in homicides, rapes, robberies, and burglaries. However, Pepper (2005) showed that Lott's results are sensitive to model specification and that some of the reported estimates are not replicable.[9] Using hospital discharge data from 11 states for the period 1988-2003, DeSimone et al. (2013) found that CAP laws were associated with a 5 percent reduction in non-self-inflicted gun injuries, which included injuries from assaults.[10] Finally, Anderson and Sabia (2018) assembled the first comprehensive data set of school-associated shooting deaths in the United States and estimated the relationship between CAP laws and these events. Given the imprecision of their estimates, they were unable to rule out substantially-sized effects in either direction. These results should perhaps be viewed as unsurprising due to the fact that, from a statistical perspective, school-associated shooting deaths represent a relatively small number of events. In

[9] For a critical review of research on state gun laws, see National Research Council (2005).

[10] In DeSimone et al. (2013), when injuries from assaults were considered as a separate outcome, the estimated CAP law coefficient was not consistently statistically significant at conventional levels across model specifications.

the data set described below, school shooting deaths committed by minors make up less than one percent of all juvenile firearm-related homicides.

Our research extends the literature in at least four important ways. This study is the first to estimate the effects of CAP laws on firearm-related homicides committed by juveniles. This contribution is made possible because the SHR data include information on the age of the offender and whether a firearm was used in the commission of the crime. Information on the age of the offender was unavailable in the data used by Cummings et al. (1997), Lott and Whitely (2001), and Lott (2003), preventing these authors from estimating the juvenile-gun-crime effects of a policy that targets households with minors. By using data on homicides committed by offenders of all ages, one could easily fail to detect an effect that is concentrated among minors. Indeed, none of these studies found that CAP laws were associated with fewer homicides.[11] Consequently, our study provides the strongest evidence to date that CAP laws improve public safety by reducing violent crime.

Second, given the sample time frame under study, we exploit a considerable amount of CAP law variation relative to previous research. For instance, Cummings et al. (1997), Lott and Whitley (2001), Lott (2003), and DeSimone et al. (2013) observed pre- and post-treatment data for 12, 15, 16, and 8 states, respectively. We observe pre- and post-treatment data for 26 states and the District of Columbia. Third, given prevailing racial disparities in gun violence, it is important to consider heterogeneous effects by race (Bindu et al. 2018). To our knowledge, no previous studies on CAP laws have estimated effects separately for whites versus nonwhites.

[11] Lott and Whitley (2001) and Lott (2003) were not able to discern between firearm- and non-firearm-related homicides.

Finally, because these studies predate the recent uptick in youth gun violence, a fresh investigation is needed.

3. Data and Empirical Framework

State-level homicide data come from the FBI's *Supplementary Homicide Reports* (SHR) for the period 1985-2013.[12] The SHR data are part of the Uniform Crime Reporting (UCR) program and are based on information from individual law enforcement agencies that are compiled by state authorities and forwarded to the FBI. Unlike the standard data made available by the UCR, the SHR data provide details on each incident, such as offender demographics and whether a firearm was used in the commission of the crime (U.S. Department of Justice 2014).[13]

To explore the relationship between CAP laws and juvenile firearm-related homicides, we estimate a Poisson regression that takes the following form:

$$(1) \qquad ln\ Juvenile\ Firearm\ Homicides_{st} = \beta_0 + \beta_1 CAP\ Law_{st} + \boldsymbol{X'_{st}\beta_2} + v_s + w_t + r_s \bullet w_t + \varepsilon_{st},$$

where $Juvenile\ Firearm\ Homicides_{st}$ represents the expected number of firearm-related homicides committed by under-18-year-olds in state s and year t.[14] The natural logarithm of the

[12] The data are made available by the U.S. Department of Justice's Office of Juvenile Justice and Delinquency Prevention at the following location: https://www.ojjdp.gov/ojstatbb/ezashr/. See this website for details regarding data collection procedures. See Iyengar (2009) and Raissian (2016) for other research that uses the SHR data.

[13] The other source for U.S. homicide data is the National Vital Statistics System's (NVSS) Fatal Injury Reports. These data are compiled from the registration of deaths at the state and local levels, but do not contain information on the offender. Despite the differences in coverage and scope across the SHR and NVSS, both sources show similar trends in homicide rates over time (U.S. Department of Justice 2014).

[14] Our identification strategy follows a similar state-level differences-in-differences approach taken by previous researchers interested in the effects of gun control. For examples, see Ludwig (1998), Marvell (2001), Cheng and Hoekstra (2013), McClellan and Tekin (2017), and Edwards et al. (2018). The Poisson regression is commonly used in the crime literature to explicitly model the count nature of crime data. For examples, see Sampson et al. (1997), Kelly (2000), Osgood (2000), Weiner et al. (2009), Card and Dahl (2011), Duggan et al. (2011), and Anderson and Rees (2015). Within the gun policy literature in particular, the Poisson regression has been used to model the effects

state population of under-18-year-olds is used as an offset variable.[15] One advantage of the Poisson is that it accommodates values equal to 0. In our data, 215 of the 1,382 state-year cells are equal to 0.[16]

The independent variable of interest, $CAP\ Law_{st}$, is equal to 1 if state s was enforcing a CAP law during year t, and equal to 0 otherwise.[17] The vector $\boldsymbol{X_{st}}$ includes state-level controls for demographics (*% Nonwhite*, *% Under 18*, *% Male*), economic conditions (*Unemployment Rate*, *Per Capita Income*), policing resources (*Police Expenditures*), political preferences (*Democrat*), mental health coverage (*Mental Health Parity Law*), and other gun laws (*Shall Issue Law*, *Stand Your Ground Law*, *Minimum Possession Age*, *Background Check Law*, *Trigger Lock Law*).[18] Table 2 provides weighted means and definitions for the variables included in $\boldsymbol{X_{st}}$.[19] The vectors v_s and w_t represent state and year fixed effects, respectively. Following Cheng and Hoekstra (2013), we also include Census region-by-year fixed effects, denoted by $r_s \bullet w_t$.[20] These allow us to control for differential shocks by region over time. Lastly, in most

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of state-level CAP laws (DeSimone et al. 2013), Stand Your Ground laws (McClellan and Tekin 2017), Right to Carry laws (Plassman and Tideman 2001), and handgun waiting periods (Luca et al. 2017), among other types of firearm-related policies. See Osgood (2000) and Plassman and Tideman (2001) for detailed discussions as to why the Poisson model is preferred to OLS when analyzing aggregate crime data.

[15] Our model is equivalent to specifying the dependent variable as a rate, excluding the offset variable, and weighting by the relevant state population. Charnes et al. (1976) showed that maximum likelihood for the Poisson regression is equivalent to a generalized weighted least squares problem.

[16] Appendix Figure 3 shows the distribution of the data. The mean and median number of juvenile firearm-related homicides are 53.4 and 9, respectively.

[17] This variable is equal to fractional values during the year in which a CAP law took effect.

[18] For research on concealed-handgun-carrying (or "shall issue") laws, see Ludwig (1998) and Grossman and Lee (2008). Cheng and Hoekstra (2013) and McClellan and Tekin (2017) studied the effects of Stand Your Ground laws, and Marvell (2001) explored the effects of juvenile gun possession bans.

[19] Appendix Table 1 lists data sources and Appendix Table 2 provides unweighted means.

[20] The four Census regions are the West, Midwest, South, and Northeast. Region of residence is a strong predictor of gun ownership and attitudes towards gun control (Pederson et al. 2015; Parker et al. 2017).

specifications, we include state-specific linear time trends to control for state-level unobservables that evolve smoothly over time, such as attitudes towards gun control. Standard errors are corrected for clustering at the state level (Bertrand et al. 2004).[21]

4. Results

The baseline results of our analysis are presented in Table 3. The estimate of β_1 reported in column (1) comes from a model that does not control for any of the state-level covariates listed in Table 2. It suggests that CAP laws are associated with a 24 ($e^{-0.272} - 1 = -0.238$) percent reduction in firearm-related homicides committed by juveniles. Controlling for state-level demographic characteristics, economic conditions, and political and mental health controls reduces the size of the estimated coefficient on *CAP Law* by 7.7 log points, while including the other gun law controls reduces the size of the estimated effect by only a small amount.[22] Likewise, including the state-specific linear time trends has little impact on the estimate of β_1. Specifically, the estimate reported in column (4) suggests that CAP laws lead to a 17 percent reduction in juvenile firearm homicides. While we do not observe every policy or state-level characteristic that may be simultaneously correlated with our outcome of interest and CAP laws, the stability of the estimates in columns (1) through (4) is encouraging.[23]

[21] The Poisson regression assumes that the variance and the mean of the dependent variable are equal. However, the use of robust standard errors should mitigate concerns regarding overdispersed data (Cameron and Trivedi 2010). Another advantage of a Poisson specification is that including fixed effects does not lead to an incidental parameters problem (Cameron and Trivedi 1998).

[22] We found little consistent evidence that any of the other gun laws were successful at reducing juvenile firearm-related homicides.

[23] While most CAP law states define a "minor" as anyone under 18 years of age, some states use a lower age threshold (Giffords Law Center to Prevent Gun Violence 2018a). Consequently, we potentially capture a lower bound effect of the policy.

In column (1) of Table 4, we test the parallel trends assumption by adding a lead on *CAP Law* to the model, equal to 1 if a CAP law was passed in year $t + 1$, and equal to 0 otherwise. The estimated coefficient on the lead is small, positive, and nowhere near statistically significant. In columns (2) and (3) of Table 4, we add a series of leads to the model. They are, without exception, statistically indistinguishable from zero. Importantly, we observe no clear systematic trend in juvenile firearm-related homicides leading up to the passage of CAP laws, providing further evidence that the parallel trends assumption is satisfied.

Next, in column (4) of Table 4, we replace *CAP Law* with an indicator that is equal to 1 the year in which a CAP law went into effect, 3 leads of this indicator, and 3 lags. In column (5), we consider 5 leads and 5 lags.[24] Again, there is no evidence that juvenile firearm-related homicides began trending prior to the adoption of CAP laws. In addition, we observe that the effect of CAP laws grows stronger over time. Figures 2a and 2b plot the estimates shown in columns (4) and (5), respectively.[25]

4.1. Adult Firearm-Related Homicides, Juvenile Non-Firearm-Related Homicides, and Firearm-Related Homicides Committed by an Unknown Offender

In the first two columns of Table 5, we replace juvenile firearm-related homicides with firearm-related homicides committed by adults. Specifically, in column (1), we consider the number of firearm-related homicides committed by 18+ year-olds. In the second column, we

[24] For the results reported in columns (4) and (5), the omitted categories are 4 or more years before treatment and 6 or more years before treatment, respectively.

[25] Standard difference-in-differences estimates may be biased if treatment is not constant over time (Goodman-Bacon 2018). One way to assess the degree of bias is to compare the conventional difference-in-differences estimate with an average of event-study coefficients. In Figure 2a, the average of the coefficient estimates for years 0 through 3+ is -0.186. By comparison, the estimated effect of CAP laws in column (4) of Table 3 is -0.184.

restrict this age range and consider the number of firearm-related homicides committed by 18- to 24-year-olds. Because these laws may have spillover effects across individuals within households (e.g., siblings), we are hesitant to refer to these as true falsification tests. However, we do expect CAP laws to bind less for these older age groups. The estimated coefficients indeed suggest this is the case, as both are small in magnitude and statistically insignificant. Moreover, an event study analysis of adult firearm-related homicides (Appendix Figure 4) shows little evidence of pre-CAP law differences between treatment and control states, suggesting that CAP laws were not simply passed in the midst of a downward trend in firearm-related homicide rates or as a reactionary response to increasing gun violence.

In the third column of Table 5, we consider the relationship between juvenile non-firearm-related homicides and CAP laws. If CAP laws were associated with large reductions in juvenile non-firearm-related homicides, we would be worried that the estimates in Table 3 simply reflect some unobserved and confounding factor. This turns out to not be the case, as the estimated coefficient on *CAP Law* is small in magnitude and statistically indistinguishable from zero. This result also suggests that juveniles do not turn to weapons other than firearms to commit homicides in the wake of CAP legislation.

Approximately 30 percent of SHR cases have an unknown offender (U.S. Department of Justice 2014). To the extent that state-level rates of missing information on the offender are correlated with CAP laws, our results could be biased. To address this issue, we regress the number of firearm-related homicides where information on the offender is unknown in state s during year t on *CAP Law* and the full set of controls. The estimated coefficient in the final column of Table 5 suggests this type of measurement error is not systematic to CAP laws, as it is small in magnitude and nowhere near statistically significant. In sum, the Table 5 results support

the notion that the observed relationship between CAP laws and juvenile firearm-related homicides is causal.

4.2. Heterogeneous Effects

We explore heterogeneous effects in Table 6. In columns (1) and (2), we consider firearm-related homicides committed by white and nonwhite juveniles, respectively.[26] The estimated effect for whites indicates that CAP laws are associated with a 23 percent decrease in firearm-related homicides, while the estimate for nonwhites indicates an 11 percent decrease. The latter estimate, however, is not statistically significant at conventional levels (p-value = 0.160).[27] Given that white Americans own guns at significantly higher rates than blacks, this pattern of results is perhaps not surprising (Parker et al. 2017). When we restrict our attention to male juvenile offenders (column (3)), the estimated coefficient suggests that CAP laws lead to a 17 percent decrease in firearm-related homicides.[28]

In column (4) of Table 6, we exclude homicides that were committed with a long gun (e.g., a long rifle or a shot gun). While homicides committed by a long gun represent less than 15 percent of all juvenile firearm homicides in the data, they are often the weapon of choice in

[26] Anecdotal evidence from Georgia suggests that charges are more likely to be brought against black gun owners, as opposed to white gun owners, when children find loaded weapons and shoot themselves or someone else (Stevens 2017).

[27] Recent research shows that, in the cross-section, gun-storage behavior does not vary by race (Azrael et al. 2018; Crifasi et al. 2018). Support for gun control, however, is generally stronger among nonwhites than whites (Filindra and Kaplan 2017).

[28] Because firearm-related homicides committed by 12- to 17-year-old females are such rare events, Poisson models failed to converge. When we specified the dependent variable as equal to 1 if state *s* during year *t* experienced a firearm-related homicide committed by a female juvenile (and equal to 0 otherwise), the estimated coefficient on *CAP Law* was positive in sign but statistically indistinguishable from zero.

high-profile events, such as school shootings.[29] The estimated coefficient in column (4) indicates that long gun-related homicides are not driving the observed relationship between CAP laws and total juvenile firearm-related homicides. In columns (5) and (6), we exclude multiple-victim events and school-associated shooting deaths, respectively, from the juvenile firearm homicide count.[30] The estimated coefficient on *CAP Law* changes little when considering either of these alternative definitions of the dependent variable, indicating that mass or school shootings are not particularly important for the observed reduction in juvenile firearm-related homicides.[31] In sum, the results in columns (4) through (6) indicate that CAP laws are successful at deterring the most common type of juvenile firearm-related homicides, single-victim events where a firearm other than a long gun was used in the commission of the offense.

In column (7) of Table 6, we interact *CAP Law* with pre- and post-1995 indicators.[32] Cummings et al. (1997) focused on the period 1979 through 1994 and found that CAP laws were associated with a (statistically insignificant) decrease in gun-related homicides among *victims* under the age of 15. Our results are similar to those in Cummings et al. (1997) despite our focus on the age of the offender, rather than the age of the victim.[33] Specifically, we find that CAP laws are associated with a (statistically insignificant) 10 percent decrease in juvenile firearm

[29] Between 2000 and 2015, in roughly 40 percent of "active" school shooting events, the most powerful weapon used was either a shotgun or a rifle (Advanced Law Enforcement Rapid Response Training n.d.).

[30] Data on school shooting deaths come from Anderson and Sabia (2018). Multiple-victim events and school-associated shooting deaths represent 0.3 and 3 percent of all juvenile firearm-related homicides, respectively.

[31] A "mass" murder is typically defined as four or more murders committed during the same incident, without a distinctive period of time between the murders (Krouse and Richardson 2015). Clearly, the results shown in column (5) of Table 6 change little if we exclude events with 4 or more deaths, rather than only 2 or more deaths.

[32] The indicator *pre-1995* is equal to 1 for the period 1985 through 1994, and equal to 0 otherwise. The indicator *post-1995* is equal to 1 for the period 1995 through 2013, and equal to 0 otherwise.

[33] The incidence rate ratio reported in Cummings et al. (1997) for gun homicides among victims under the age of 15 was 0.89, with a 95 percent confidence interval equal to 0.76-1.05.

homicides for the pre-1995 period. The estimated effect is larger in magnitude and more precisely measured for the post-1995 period.

In the final column of Table 6, we replace *CAP Law* with two mutually exclusive indicators, *Negligent Storage* and *Reckless Endangerment*. As mentioned above, negligent storage laws are the stricter form of CAP legislation and impose criminal liability on individuals who allow a minor access to a firearm that was not properly stored. On the other hand, reckless endangerment laws only impose criminal liability when an individual "intentionally, knowingly, and/or recklessly" provides a firearm to a minor (Giffords Law Center to Prevent Gun Violence 2018a). The results in column (8) suggest that the observed CAP law effects are driven by the stricter negligent storage laws. These results are consistent with the results in Anderson and Sabia (2018), who found that negligent storage laws were considerably more effective than reckless endangerment laws at reducing gun carrying among minors.[34] Figure 3 shows no evidence that juvenile firearm-related homicides began trending prior to the adoption of negligent storage laws. In addition, we observe that the effect of negligent storage laws grows stronger over time.

4.3. Robustness Checks

We report the results of various robustness checks in Table 7. In the first column, we list our preferred estimate from column (4) in Table 3 for comparison. In the second and third

[34] Specifically, Anderson and Sabia (2018) found that negligent storage laws were associated with a 25 percent decrease in the likelihood high school students reported past-month gun carrying. Reckless endangerment laws were associated with a (statistically insignificant) 9 percent decrease in the likelihood high school students reported past-month gun carrying.

columns, we drop states with 10 or more and 5 or more missing years of data, respectively.[35] Some states did not report any data to the SHR program in some years, while other state-year cells are so severely underreported that they have been made unavailable by the Office of Juvenile Justice and Delinquency Prevention.[36] When dropping states with missing years of data the estimated coefficient on *CAP Law* changes little in magnitude and remains statistically significant at the 5 percent level. In column (4), we restrict our attention to only those states that passed a CAP law during the period 1985-2013. With this restriction in place, the estimated coefficient on *CAP Law* again changes little in magnitude and remains statistically significant.

Next, we drop the region-by-year fixed effects from the right-hand-side of the estimating equation. The estimated coefficient from this exercise suggests that CAP laws are associated with a 15 percent decrease in juvenile firearm-related homicides, and is statistically significant at the 10 percent level. In columns (6) and (7), we control for the adult property crime rate and consider unweighted estimates, respectively.[37] The estimated coefficient on *CAP Law* changes little under these alternative specifications.

Finally, we estimate equation (1) with OLS rather than modeling homicides as a count process. In column (8), we consider a level-level specification, while results from a log-level

[35] The states with 5 to 9 years of missing data are Kansas and Kentucky. The states with 10 or more years of missing data are Florida, Montana, and Nebraska. The District of Columbia has 13 years of missing data. A full list of data coverage by state is available at: https://www.ojjdp.gov/ojstatbb/ezashr/asp/methods.asp.

[36] If all states and the District of Columbia had data available for each of the 29 years in our panel, the sample size would be N = 1,479. Given our sample size of N = 1,382, this means that roughly 7 percent of state-year cells are unavailable due to reporting issues.

[37] We control for the adult property crime rate (i.e., the sum of burglaries, motor vehicle thefts, and larcenies per 100,000 population) as an attempt to capture the general trend in crime. Results were similar if we simply controlled for the adult larceny rate or if we controlled for the adult violent crime rate, rather than the adult property crime rate. We also experimented with regressing the adult property crime rate on *CAP Law* and the full set of controls. The results from this exercise, which are available from the authors upon request, were consistent with the notion that CAP laws are not correlated with the overall trend in crime. In our Poisson model, unweighted estimates are obtained by not controlling for the population exposure variable.

specification are shown in column (9). The estimated coefficient on *CAP Law* is negative, large in magnitude, and statistically significant at the 10 percent level under the level-level specification, but loses precision when the dependent variable is defined as the natural log of the juvenile firearm homicide rate.[38]

In Table 8, we repeat the robustness checks listed above to examine the sensitivity of the *Negligent Storage* estimated reported in Table 6. In general, the estimated coefficient on *Negligent Storage* is quite robust across the alternative specifications under consideration. Again, there is little evidence to suggest that the weaker reckless endangerment laws are effective at reducing gun violence among juveniles.

In Figure 4, we assess the robustness of the estimated coefficient on *CAP Law* to dropping one CAP law state at a time. The effect sizes range from -6.3 log points when we drop California to -22.6 log points when we drop Indiana. As indicated above, populous states enforcing a negligent storage standard (e.g., California, Illinois, and Texas) contribute important weight to the estimated effect of CAP laws.[39] We repeat this exercise in Figure 5 to examine the robustness of the estimated coefficient on *Negligent Storage*. Here, the estimated effects range from -18.0 log points when we drop California to -35.4 log points when we drop New Jersey. In all cases, the estimated coefficient on *Negligent Storage* is statistically significant at the 5 percent level.

[38] Because 215 of the 1,382 observations are equal to 0, we added 1 to the rate before taking the natural log. We also experimented with taking the quartic root of the rate, rather than the natural log. The quartic root function mimics the natural log function for positive numbers, and this method of dealing with zeroes has been used by Thomas et al. (2006), Tarozzi et al. (2014), and Ashraf et al. (2015), among others. Results based on taking the quartic root were similar and are available from the authors upon request.

[39] The estimated coefficient on *CAP Law* is no longer statistically significant at conventional levels when we drop California, Illinois, or Texas.

4.4. Background Check Analysis

As mentioned above, little is known about the relationship between CAP laws and the safe storage of firearms due to an absence of state panel data on household gun storage behavior. However, another mechanism through which CAP laws may affect juvenile firearm-related homicides is gun ownership, because these laws increase the costs of owning a firearm. While state panel data on firearm ownership rates also do not exist, Lang (2013a, 2016) used data on firearm background checks as a proxy for changes in gun ownership rates.

Following Lang (2013a, 2016) and using data from the FBI's *National Instant Check System* for the period 1999-2013, we estimate an OLS regression where the dependent variable is defined as the natural log of the firearm background check rate per 100,000 population in state *s* during year *t*. The right-hand side of the estimating equation is identical to that of equation (1) above. The results in Table 9 show that CAP laws are associated with a 9.3 percent decrease in the total background check rate. While this estimate is statistically insignificant at conventional levels (p-value = 0.149), the sign of the relationship is consistent with the argument that CAP laws increase the costs of firearm ownership. The size of the effect is larger in absolute magnitude if the analysis is restricted to background checks for handguns only (column (2)) or long guns only (column (3)).[40] However, these estimates are also statistically insignificant.

5. Conclusion

While the majority of gun owners in the United States do not safely store all of their firearms (Crifasi et al. 2018), we know very little about the causal effects of gun storage on gun

[40] The number of total background checks includes checks for handguns, long guns, "other" types of guns, and permits (e.g., concealed carry permits). An important caveat to the results reported in Table 9 is that, because the data on background checks are only available from 1999 and onwards, identification of the coefficient estimate on *CAP Law* comes from only three states (Colorado, Illinois, and New Hampshire) and the District of Columbia.

violence. This policy question has taken on increased salience in the wake of several high-profile school shootings carried out by minors who obtained their guns from home (or the home of a relative). To better understand how safe-storage laws affect gun crime, the current study exploits state-level variation in safe-storage requirements. Specifically, using data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013, we examine the relationship between child access prevention laws and firearm-related homicides committed by juveniles.

Our results suggest that CAP laws lead to a 17 percent reduction in the expected number of firearm-related homicides committed by juveniles (i.e., under-18-year-olds), an effect size that is similar to those reported in previous studies on unintentional shooting deaths (Cummings et al. 1997), self-inflicted gun injuries (DeSimone et al. 2013), and youth suicides (Gius 2015).[41] The estimated effect is stronger for whites, as opposed to nonwhites, and is driven by states enforcing a negligent storage standard, the strictest form of CAP legislation. Negligent storage laws impose criminal liability on individuals who allow a minor access to a firearm that was not properly stored. Event-study analyses show that the effects of CAP laws grow stronger over time and our estimated coefficient of interest is robust to a range of specification checks and sample selection criteria.

We also find that CAP laws are not associated with firearm-related homicides committed by adults or with non-firearm-related homicides committed by juveniles, providing evidence that the observed relationship between CAP laws and juvenile firearm-related homicides is not simply being driven by confounding trends in gun crime or juvenile violence.[42]

[41] Cummings et al. (1997) found that CAP laws were associated with a 23 percent reduction in unintentional shooting deaths among youths under the age of 15. DeSimone et al. (2013) found that CAP laws were associated with a 26 percent reduction in self-inflicted gun injuries among youths under the age of 18. Gius (2015) found that CAP laws were associated with an 11 percent reduction in suicides among youths under the age of 20.

[42] These results also suggest that increases in the time costs of accessing firearms for lawful gun owners during a home invasion does not lead to an increase in the firearm-related homicide rate. Opposition to CAP laws generally

Although the welfare gains attributable to CAP laws are difficult to gauge, their benefits to society can be calculated by combining the estimates reported in Table 3 with cost-of-crime figures published by McCollister et al. (2010). For states with CAP laws, our results suggest that the annual value of homicides avoided ranges between $39 million and $108 million (in 2019 dollars).[43]

From a policy perspective, understanding the effects of CAP laws is vital as youth gun violence rises alongside public support for gun control (Parsons et al. 2018; Clement 2018). The juvenile homicide arrest rate has been increasing since 2012, while support for gun restrictions among Americans recently reached its highest point in the last 25 years (Clement 2018; Office of Juvenile Justice and Delinquency Prevention 2018). We view the results above as the most credible estimates of the relationship between CAP laws and youth gun violence, and the strongest evidence to date that CAP laws reduce juvenile firearm-related homicides. Because the majority of gun owners support safe-storage requirements for guns in households with children (Barry et al. 2018), our findings are particularly relevant for policymakers who are looking to find a middle ground on gun control.

rests on this concern. It is possible that CAP laws promote important technological changes that mitigates this tradeoff. Safe-storage innovations such as biometrically-enhanced "gun boxes" that safely store firearms, but also make guns quickly accessible via eye scan or thumb print, may deter gun crimes by juveniles as well as reduce incentives for home invasions. Retail prices for these products generally range between $150 and $300. For example, one popular product, "The Gun Box", retails for $259 at www.gunbox.com.

[43] See Table 1 in McCollister et al. (2010) for a number of homicide cost estimates from the literature. In 2019 dollars, the costs per homicide range from $4,919,411 (Miller et al. 1993) to $13,472,387 (Cohen et al. 2004). McCollister et al. (2010) estimated the cost of a homicide to be $10,662,015. Among states with a CAP law, the (unweighted) average number of juvenile firearm-related homicides in the year prior to the law's passage was 47.6. Given our estimates reported in Table 3, this implies 8 (0.168*47.6 = 8.00) fewer homicides per CAP law state per year. Using the homicide cost estimates from Miller et al. (1993) and Cohen et al. (2004), we calculate CAP law benefits ranging between $39 million (8*$4,919,411 = $39,339,545) and $108 million (8*$13,472,387 = $107,779,096).

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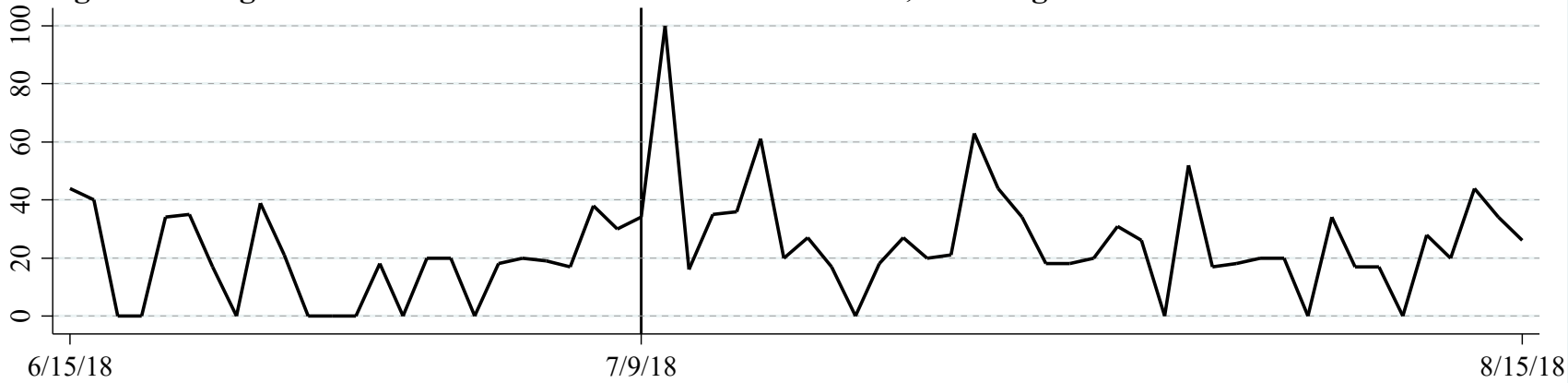
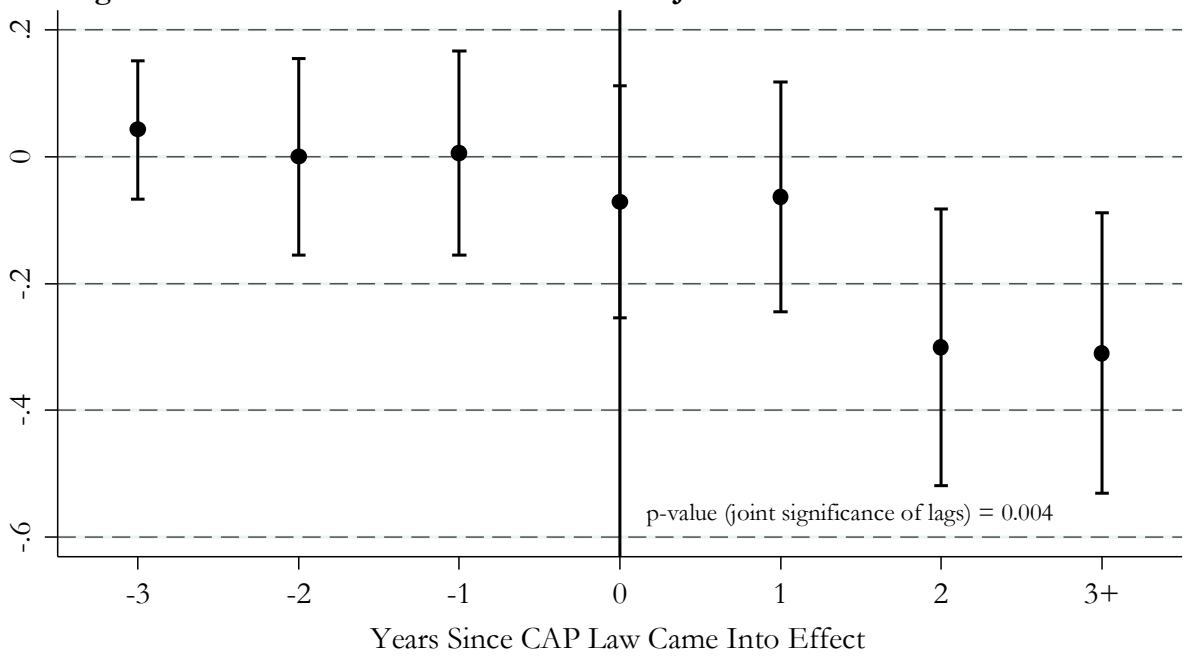
Figure 1. Google Searches for "Gun Safe" in Seattle-Tacoma, Washington Pre- and Post-Seattle CAP Law



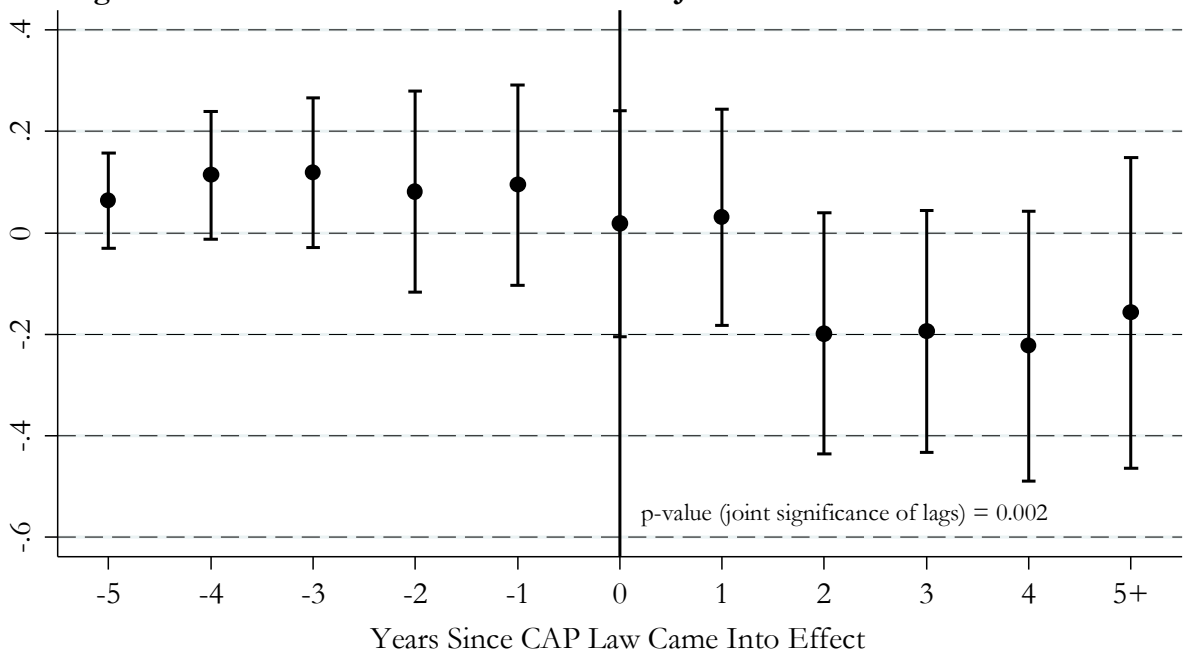
Notes: On July 9, 2018, Seattle, Washington passed a bill mandating the safe storage of firearms. The bill created civil infractions for failing to safely store a gun when the owner should reasonably know that the gun could be accessed by a minor (Groover 2018). Google search data are from the Seattle-Tacoma metropolitan area. Values on the vertical axis represent Google search interest relative to the highest point during the period June 15, 2018 to August 15, 2018. A value equal to 100 indicates peak search volume, whereas a value of 50 indicates a day where the term was half as popular. A value of 0 means there were not enough data for this day.

Figure 2a. Pre- and Post-CAP Law Trends in Juvenile Firearm-Related Homicides



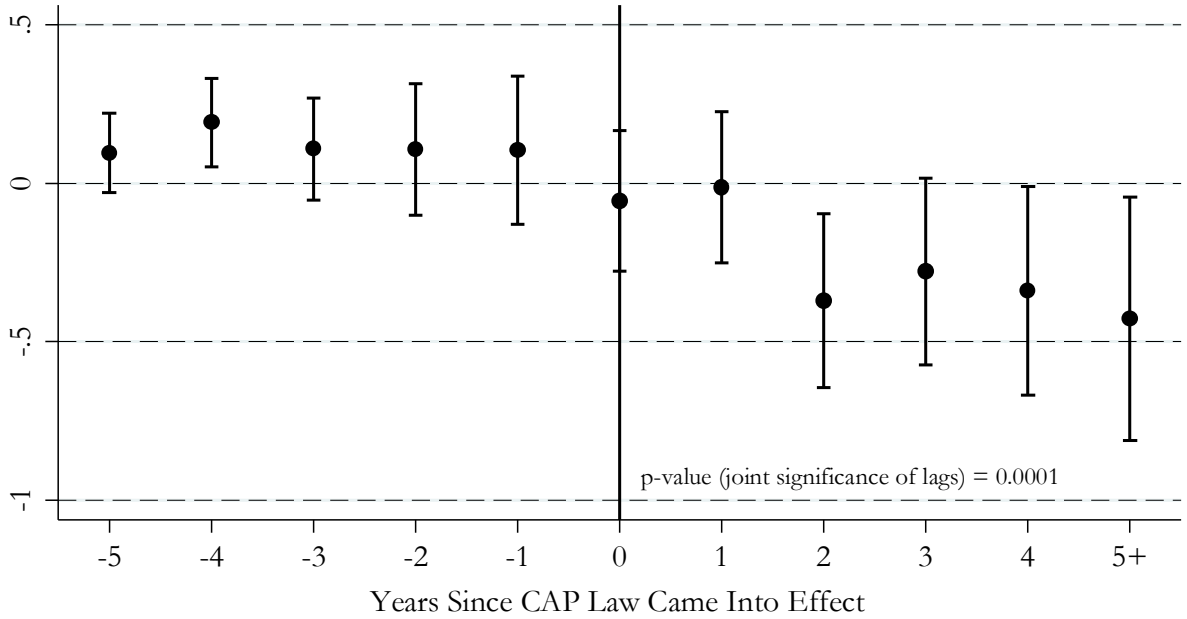
Notes: Poisson coefficient estimates (and their 90% confidence intervals) are reported, where the omitted category is four or more years before treatment. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Figure 2b. Pre- and Post-CAP Law Trends in Juvenile Firearm-Related Homicides



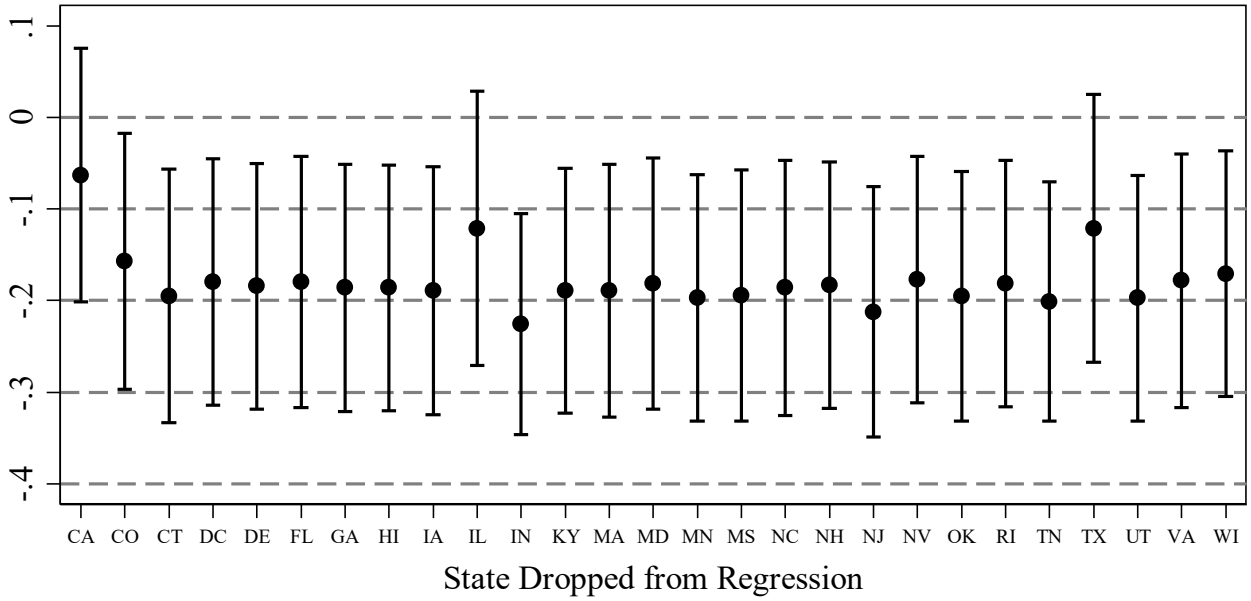
Notes: Poisson coefficient estimates (and their 90% confidence intervals) are reported, where the omitted category is six or more years before treatment. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Figure 3. Pre- and Post-Negligent Storage Law Trends in Juvenile Firearm-Related Homicides



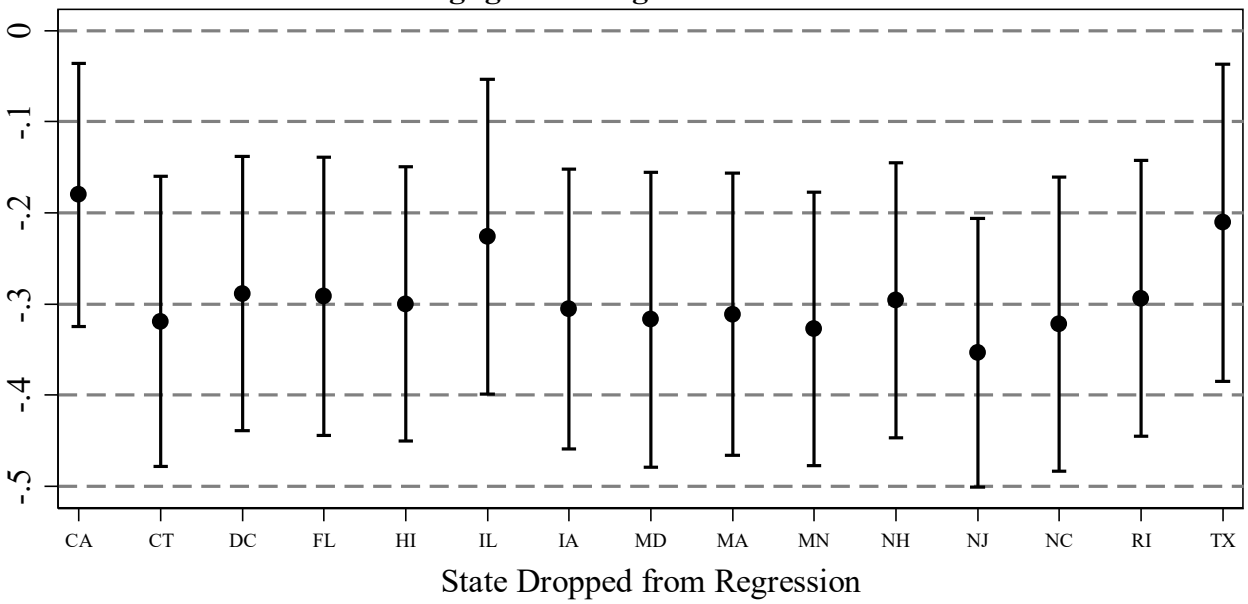
Notes: Poisson coefficient estimates (and their 90% confidence intervals) are reported, where the omitted category is six or more years before treatment. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, *Reckless Endangerment*, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Figure 4. Robustness of Estimated Coefficient on *CAP Law* to Dropping One CAP Law State at a Time



Notes: Poisson coefficient estimates (and their 90% confidence intervals) come from separate regressions where one CAP law state is dropped at a time. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Figure 5. Robustness of Estimated Coefficient on *Negligent Storage* to Dropping One Negligent Storage Law State at a Time



Notes: Poisson coefficient estimates (and their 90% confidence intervals) come from separate regressions where one negligent storage state is dropped at a time. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, *Reckless Endangerment*, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Table 1. Child Access Prevention Laws

	Effective Year	Type of CAP Law
California	1992	Negligent Storage
Colorado	2000	Reckless Endangerment
Connecticut	1990	Negligent Storage
Delaware	1994	Reckless Endangerment
D.C.	2009	Negligent Storage
Florida	1989	Negligent Storage
Georgia	1994	Reckless Endangerment
Hawaii	1992	Negligent Storage
Illinois	2000	Negligent Storage
Indiana	1994	Reckless Endangerment
Iowa	1990	Negligent Storage
Kentucky	1994	Reckless Endangerment
Maryland	1992	Negligent Storage
Massachusetts	1998	Negligent Storage
Minnesota	1993	Negligent Storage
Mississippi	1994	Reckless Endangerment
Missouri	1981	Reckless Endangerment
Nevada	1991	Reckless Endangerment
New Hampshire	2001	Negligent Storage
New Jersey	1992	Negligent Storage
North Carolina	1993	Negligent Storage
Oklahoma	1993	Reckless Endangerment
Rhode Island	1995	Negligent Storage
Tennessee	1994	Reckless Endangerment
Texas	1995	Negligent Storage
Utah	1993	Reckless Endangerment
Virginia	1992	Reckless Endangerment
Wisconsin	1992	Reckless Endangerment

Notes: Data on CAP laws were obtained from Lott and Whitley (2001), Webster et al. (2004), DeSimone et al. (2013), Giffords Law Center to Prevent Gun Violence (2018a), and our own searches of legislative codes.

Table 2. Descriptive Statistics for Juvenile Firearm-Homicides and CAP Law Analysis, 1985-2013

	CAP Law = 1[a]	*CAP Law* = 0	*Full Sample*	Description
Juvenile Firearm Homicides	57.4	49.8	53.4	Number of firearm-related homicides
	(77.1)	(70.1)	(73.6)	committed by under-18-year-olds
Independent variables				
% Nonwhite	0.198	0.169	0.183	Percent of the state population that is nonwhite
	(0.089)	(0.084)	(0.088)	
% Under 18	0.256	0.254	0.255	Percent of the state population that is under 18
	(0.019)	(0.020)	(0.020)	years of age
% Male	0.492	0.488	0.490	Percent of the state population that is male
	(0.006)	(0.007)	(0.007)	
Unemployment Rate	0.130	0.129	0.130	State youth unemployment rate
	(0.036)	(0.031)	(0.034)	
Per Capita Income	39,213	34,561	36,772	State real income per capita (2010 dollars)
	(6,145)	(5,914)	(6,455)	
Police Expenditures	270	230	240	State police expenditures per capita (2010
	(73.9)	(80.0)	(80.0)	dollars)
Democrat	0.417	0.498	0.460	= 1 if state has a democratic governor, = 0
	(0.490)	(0.497)	(0.495)	otherwise
Mental Health Parity Law	0.547	0.183	0.356	= 1 if state has a mental health parity law, = 0
	(0.494)	(0.385)	(0.476)	otherwise
Shall Issue Law	0.507	0.375	0.438	= 1 if state has a shall issue gun law, = 0
	(0.500)	(0.484)	(0.496)	otherwise
Stand Your Ground Law	0.174	0.090	0.130	= 1 if state has a stand-your-ground gun law, =
	(0.373)	(0.280)	(0.330)	0 otherwise
Minimum Possession Age	0.958	0.594	0.767	State minimum age requirement to possess a
	(0.191)	(0.485)	(0.417)	handgun
Background Check Law	0.535	0.355	0.441	= 1 if state requires background checks for
	(0.499)	(0.479)	(0.497)	private sales on firearms, = 0 otherwise
Trigger Lock Law	0.229	0.000	0.109	= 1 if state requires trigger locks to accompany
	(0.420)	(0.000)	(0.311)	dealer and private firearm sales, = 0 otherwise
N	529	853	1,382	

[a] If a CAP law is in effect for any portion of the year, the observation is included in this column.

Notes: Means are weighted and standard deviations are in parentheses.

Table 3. Juvenile Firearm-Related Homicides and CAP Laws

	(1)	(2)	(3)	(4)
	Juvenile Firearm Homicides	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*
CAP Law	-0.272**	-0.195*	-0.190*	-0.184**
	(0.131)	(0.116)	(0.112)	(0.081)
Mean	53.4	53.4	53.4	53.4
N	1,382	1,382	1,382	1,382
Demographic, economic, political, and mental health controls	No	Yes	Yes	Yes
Other gun laws	No	No	Yes	Yes
State-specific linear trends	No	No	No	Yes

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate Poisson regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t.* Weighted means for the dependent variable are reported. Demographic and economic controls: *% Nonwhite, % Under 18, % Male, Unemployment Rate,* and *Per Capita Income*. Mental health and political controls: *Police Expenditures, Democrat,* and *Mental Health Parity Law*. Other gun laws: *Shall Issue Law, Stand Your Ground Law, Minimum Possession Age, Background Check Law,* and *Trigger Lock Law*. All models control for state fixed effects, year fixed effects, and region-by-year fixed effects. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 4. Leads and Lags of *CAP Law*

	(1)	(2)	(3)	(4)	(5)
	Juvenile Firearm Homicides	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*
5 Years Prior to CAP Law	...	...	...	...	0.064
					(0.057)
4 Years Prior to CAP Law	...	...	...	...	0.113
					(0.077)
3 Years Prior to CAP Law	...	...	0.066	0.042	0.119
			(0.057)	(0.067)	(0.090)
2 Years Prior to CAP Law	...	0.001	0.025	0.0003	0.081
		(0.068)	(0.077)	(0.094)	(0.121)
Year Prior to CAP Law	0.015	0.015	0.040	0.006	0.094
	(0.058)	(0.071)	(0.084)	(0.098)	(0.120)
CAP Law	-0.178**	-0.177*	-0.148	...	...
	(0.087)	(0.092)	(0.097)		
Year of Law Change	...	...	...	-0.071	0.018
				(0.111)	(0.136)
1 Year After CAP Law	...	...	...	-0.063	0.031
				(0.110)	(0.130)
2 Years After CAP Law	...	...	...	-0.301**	-0.198
				(0.133)	(0.145)
3 Years After CAP Law	...	...	...	...	-0.194
					(0.145)
3+ Years After CAP Law	...	...	...	-0.310**	...
				(0.134)	
4 Years After CAP Law	...	...	...	...	-0.223
					(0.162)
5+ Years After CAP Law	...	...	...	...	-0.158
					(0.187)
p-value (joint significance of lags)	...	...	...	0.004	0.002
Mean	53.4	53.4	53.4	53.4	53.4
N	1,382	1,382	1,382	1,382	1,382

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate Poisson regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. The dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t.* Weighted means for the dependent variable are reported. All models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 5. Adult Firearm-Related Homicides, Juvenile Non-Firearm-Related Homicides, and Firearm-Related Homicides where Offender is Unknown

	(1)	(2)	(3)	(4)
	Adult Firearm Homicides (18+ year-olds)	*Adult Firearm Homicides (18- to 24-year-olds)*	*Juvenile Non-Firearm Homicides*	*Firearm Homicides, Offender Unknown*
CAP Law	0.011	-0.046	-0.001	0.030
	(0.042)	(0.054)	(0.068)	(0.091)
Mean	352.0	170.9	18.5	222.2
N	1,382	1,382	1,382	1,382

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate Poisson regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. The dependent variable is equal to the number of specified homicides in state *s* during year *t.* Weighted means for the dependent variable are reported. All models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 6. Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	White Juvenile Firearm Homicides	*Nonwhite Juvenile Firearm Homicides*	*Male Juvenile Firearm Homicides*	*Juvenile Firearm Homicides, Excluding Long Guns*	*Juvenile Firearm Homicides, Excluding Multiple-Victim Events*	*Juvenile Firearm Homicides, Excluding School Shootings*	*Juvenile Firearm Homicides*	*Juvenile Firearm Homicides*
CAP Law	-0.267**	-0.121	-0.181**	-0.168**	-0.182**	-0.179**	...	...
	(0.110)	(0.086)	(0.077)	(0.083)	(0.080)	(0.081)		
CAP Law × pre-1995	...	...	...	...	...	...	-0.110	...
							(0.081)	
CAP Law × post-1995	...	...	...	...	...	...	-0.269**	...
							(0.105)	
Negligent Storage	...	...	...	...	...	...	...	-0.298***
								(0.091)
Reckless Endangerment	...	...	...	...	...	...	...	-0.011
								(0.110)
Mean	21.8	31.0	51.0	49.7	51.8	53.3	53.4	53.4
N	1,382	1,382	1,382	1,145	1,382	1,382	1,382	1,382

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate Poisson regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. The dependent variable is equal to the number of specified homicides in state *s* during year *t*. Weighted means for the dependent variable are reported. All models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 7. Robustness of Relationship between Juvenile Firearm-Related Homicides and CAP Laws

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Estimate from column (4) of Table 3 for comparison	Drop states with 10+ years of missing data	Drop states with 5+ years of missing data	Drop states that never passed a CAP law	Drop region-by-year fixed effects	Control for adult property crime rate	Unweighted	OLS (levels)	OLS (log)
CAP Law	-0.184**	-0.173**	-0.181**	-0.194**	-0.167*	-0.176**	-0.184**	-0.558*	-0.089
	(0.081)	(0.083)	(0.083)	(0.080)	(0.087)	(0.081)	(0.081)	(0.326)	(0.074)
Mean	53.4	53.8	54.7	66.5	53.4	53.4	20.9	1.52	2.52
N	1,382	1,328	1,287	762	1,382	1,382	1,382	1,382	1,382

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. In columns (1)-(7), the dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t*. In column (8), the dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds per 100,000 population of this age group in state *s* during year *t*. In column (9), the dependent variable is equal to the natural log of the number of firearm-related homicides committed by under-18-year-olds per 100,000 population of this age group in state *s* during year *t* plus 1. Unless stated otherwise, weighted means for the dependent variable are reported. Unless stated otherwise, all models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 8. Robustness of Relationship between Juvenile Firearm-Related Homicides and Negligent Storage Laws

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Estimates from column (8) of Table 6 for comparison	Drop states with 10+ years of missing data	Drop states with 5+ years of missing data	Drop states that never passed a CAP law	Drop region-by-year fixed effects	Control for adult property crime rate	Unweighted	OLS (levels)	OLS (log)
Negligent Storage	-0.298***	-0.282***	-0.278***	-0.255***	-0.246***	-0.284***	-0.302***	-0.829**	-0.151*
	(0.091)	(0.092)	(0.090)	(0.086)	(0.092)	(0.086)	(0.092)	(0.388)	(0.086)
Reckless Endangerment	-0.011	-0.011	-0.034	-0.117	-0.009	-0.015	-0.005	-0.045	0.030
	(0.110)	(0.113)	(0.113)	(0.123)	(0.113)	(0.110)	(0.109)	(0.305)	(0.090)
Mean	53.4	53.8	54.7	66.5	53.4	53.4	20.9	1.52	2.52
N	1,382	1,328	1,287	762	1,382	1,382	1,382	1,382	1,382

* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate regression based on data from the FBI's *Supplementary Homicide Reports* for the period 1985-2013. In columns (1)-(7), the dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds in state *s* during year *t.* In column (8), the dependent variable is equal to the number of firearm-related homicides committed by under-18-year-olds per 100,000 population of this age group in state *s* during year *t*. In column (9), the dependent variable is equal to the natural log of the number of firearm-related homicides committed by under-18-year-olds per 100,000 population of this age group in state *s* during year *t* plus 1. Unless stated otherwise, weighted means for the dependent variable are reported. Unless stated otherwise, all models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

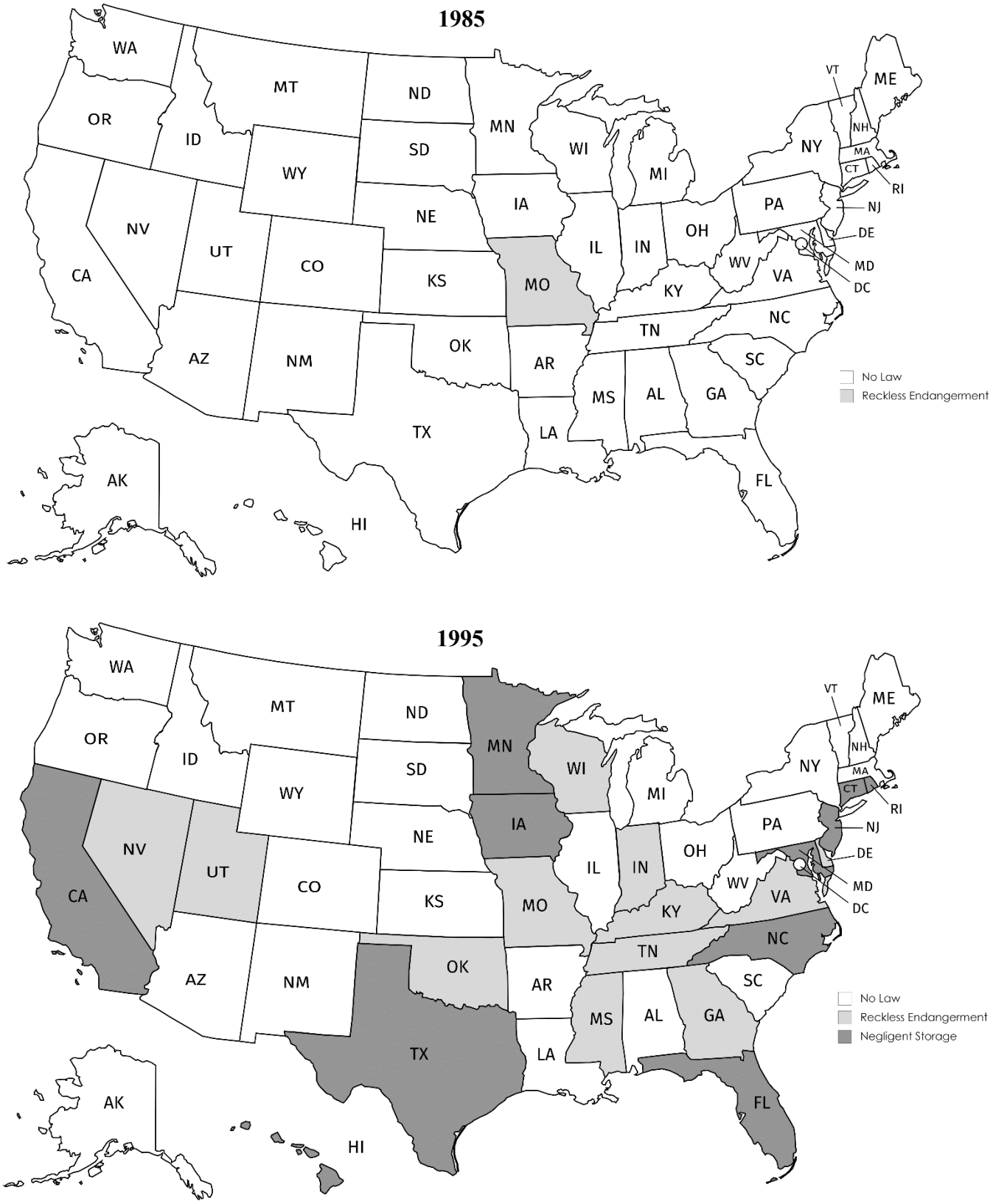
Table 9. Background Checks and CAP Laws

	(1)	(2)	(3)
	Total Background Checks	*Background Checks for Handguns*	*Background Checks for Long Guns*
CAP Law	-0.098	-0.355	-0.186
	(0.067)	(0.243)	(0.149)
Mean	4,612	1,115	2,119
N	765	765	765

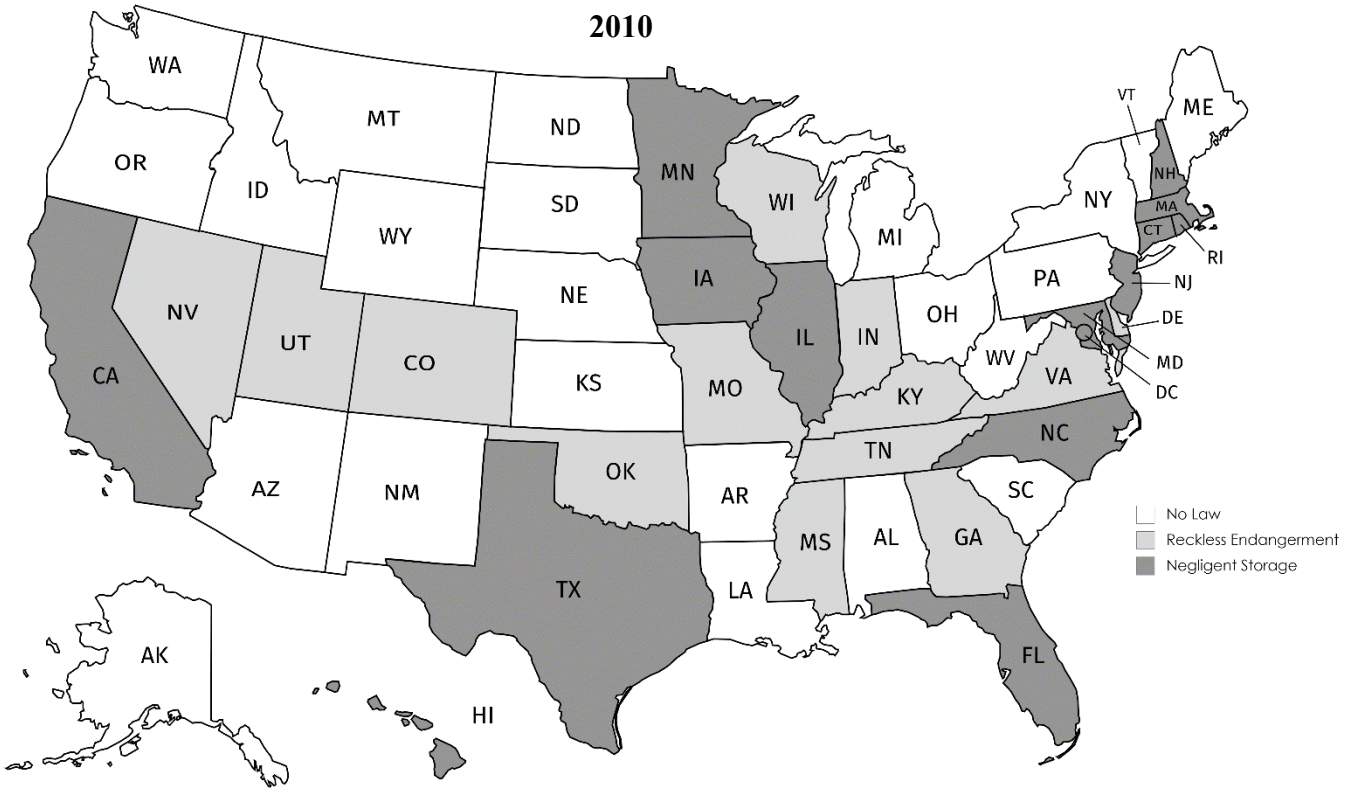
* Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Each column represents results from a separate OLS regression based on data from the FBI's *National Instant Check System* for the period 1999-2013. The dependent variable is equal to the natural log of the number of specified background checks per 100,000 population in state *s* during year *t.* Weighted means for the dependent variable are reported. All models control for the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors, corrected for clustering at the state level, are in parentheses.

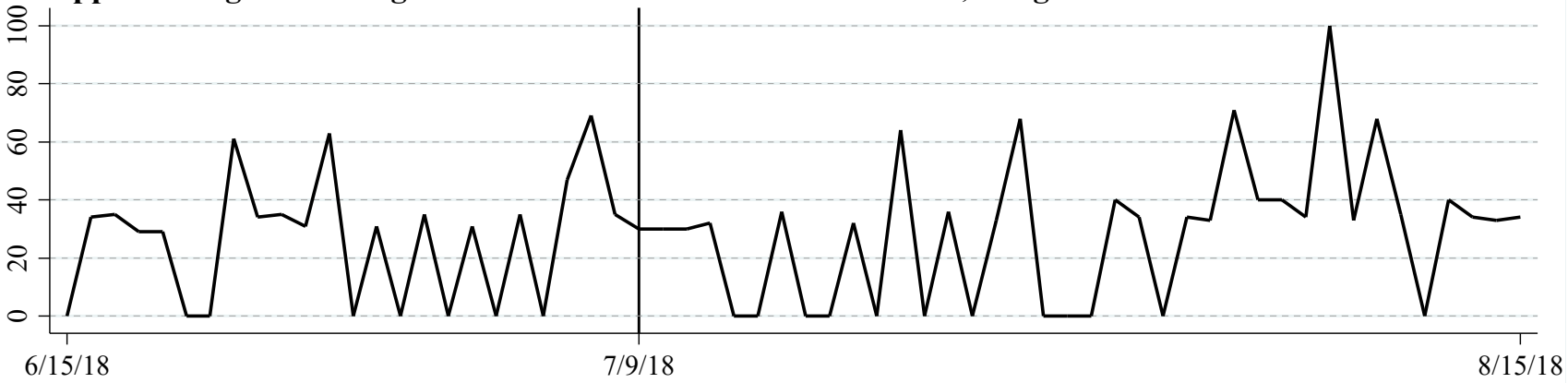
Appendix Figure 1. Child Access Prevention Laws Over Time



Appendix Figure 1. Child Access Prevention Laws Over Time (continued)

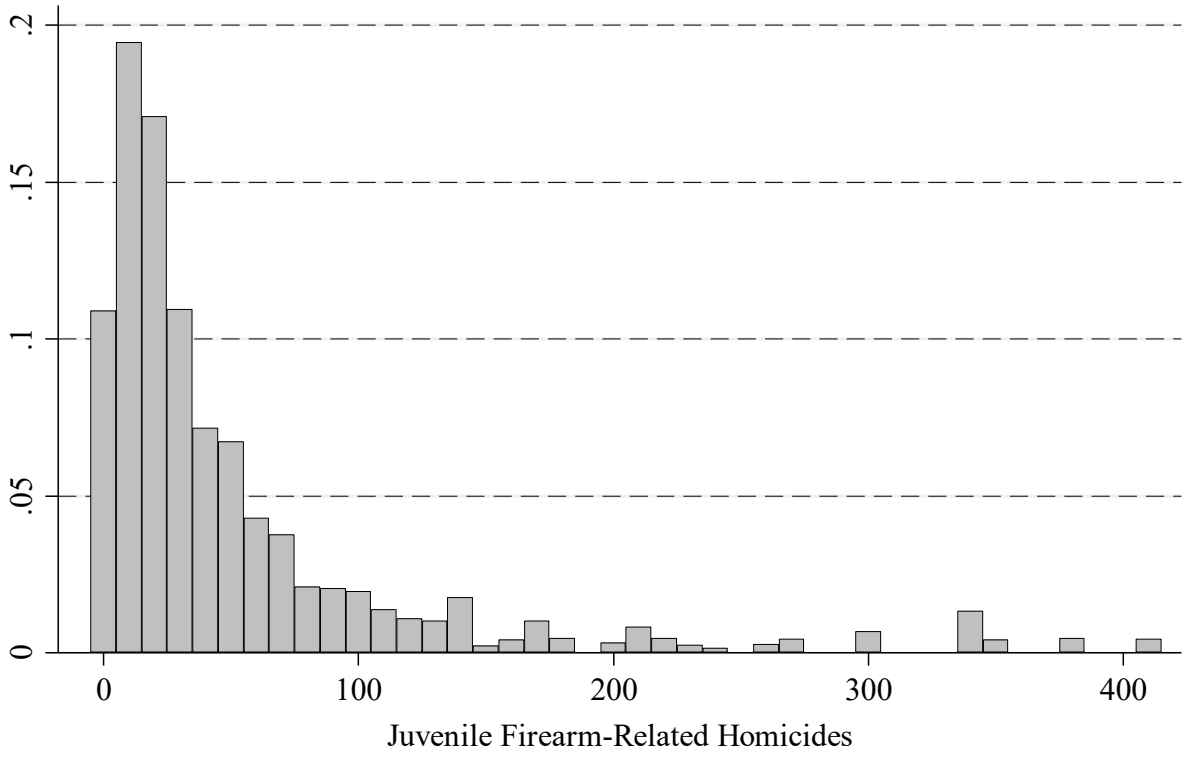


Appendix Figure 2. Google Searches for "Gun Safe" in Portland, Oregon Pre- and Post-Seattle CAP Law



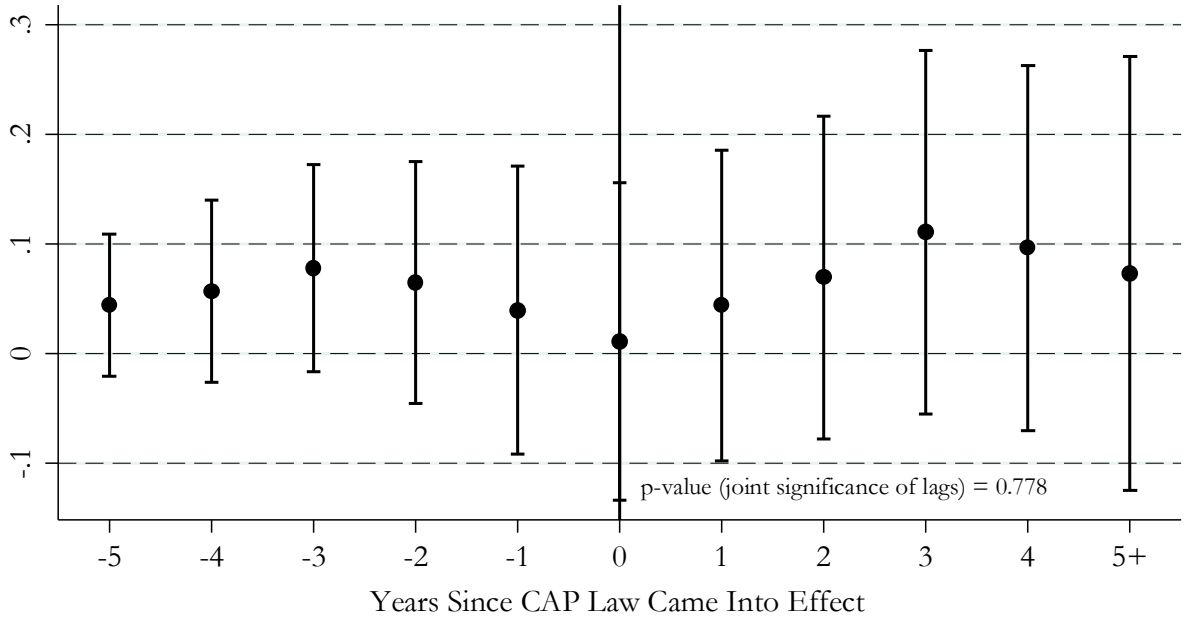
Notes: On July 9, 2018, Seattle, Washington passed a bill mandating the safe storage of firearms. The bill created civil infractions for failing to safely store a gun when the owner should reasonably know that the gun could be accessed by a minor (Groover 2018). Google search data are from Portland, Oregon. Values on the vertical axis represent Google search interest relative to the highest point during the period June 15, 2018 to August 15, 2018. A value equal to 100 indicates peak search volume, whereas a value of 50 indicates a day where the term was half as popular. A value of 0 means there were not enough data for this day.

Appendix Figure 3. Distribution of Juvenile Firearm-Related Homicides



Notes: Weighted by state populations of under-18-year-olds.

Appendix Figure 4. Pre- and Post-CAP Law Trends in Adult Firearm-Related Homicides



Notes: Poisson coefficient estimates (and their 90% confidence intervals) are reported, where the omitted category is six or more years before treatment. The dependent variable is equal to the number of firearm-related homicides committed by 18+ year-olds in state *s* during year *t*. Controls include the covariates listed in Table 2, state fixed effects, year fixed effects, region-by-year fixed effects, and state-specific linear time trends. Standard errors are corrected for clustering at the state level.

Appendix Table 1. Data Sources for State-Level Covariates

	Data Source
% Nonwhite	National Cancer Institute's SEER population data
% Under 18	National Cancer Institute's SEER population data
% Male	National Cancer Institute's SEER population data
Unemployment Rate	Bureau of Labor Statistics
Per Capita Income	Bureau of Economic Analysis
Police Expenditures	Bureau of Justice Statistics
Democrat	Authors' own internet searches
Mental Health Parity Law	Lang (2013b) and updates to Lang (2013b) were provided via personal correspondence with the author
Shall Issue Law	Grossman and Lee (2008), Donohue and Ayers (2009), Aneja et al. (2012), Hinkston (2012), United States Government Accountability Office (2012), Arnold (2015), and USA Carry (2015)
Stand Your Ground Law	McClellan and Tekin (2017)
Minimum Possession Age	Marvell (2001) and Gius (2015)
Background Check Law	Vernick and Hepburn (2003), Webster et al. (2014), and Giffords Law Center to Prevent Gun Violence (2018c)
Trigger Lock Law	Giffords Law Center to Prevent Gun Violence (2018d) and authors' own searches of state legislative codes

Appendix Table 2. Unweighted Means

	CAP Law = 1[a]	*CAP Law* = 0	*Full Sample*	Description
Juvenile Firearm Homicides	23.0	19.6	20.9	Number of firearm-related homicides
	(40.9)	(38.6)	(39.5)	committed by under-18-year-olds
Independent variables				
% Nonwhite	0.202	0.148	0.169	Percent of the state population that is nonwhite
	(0.150)	(0.124)	(0.137)	
% Under 18	0.250	0.257	0.254	Percent of the state population that is under 18
	(0.022)	(0.025)	(0.024)	years of age
% Male	0.491	0.491	0.491	Percent of the state population that is male
	(0.007)	(0.010)	(0.009)	
Unemployment Rate	0.122	0.125	0.124	State youth unemployment rate
	(0.037)	(0.036)	(0.037)	
Per Capita Income	39,086	33,405	35,580	State real income per capita (2010 dollars)
	(7,224)	(5,928)	(7,019)	
Police Expenditures	256	215	231	State police expenditures per capita (2010
	(87.3)	(91.9)	(92.2)	dollars)
Democrat	0.468	0.519	0.499	= 1 if state has a democratic governor, = 0
	(0.496)	(0.496)	(0.497)	otherwise
Mental Health Parity Law	0.489	0.241	0.336	= 1 if state has a mental health parity law, = 0
	(0.498)	(0.426)	(0.470)	otherwise
Shall Issue Law	0.548	0.498	0.517	= 1 if state has a shall issue gun law, = 0
	(0.498)	(0.500)	(0.500)	otherwise
Stand Your Ground Law	0.167	0.117	0.136	= 1 if state has a stand-your-ground gun law, =
	(0.367)	(0.315)	(0.336)	0 otherwise
Minimum Possession Age	0.934	0.601	0.729	State minimum age requirement to possess a
	(0.235)	(0.484)	(0.438)	handgun
Background Check Law	0.457	0.184	0.289	= 1 if state requires background checks for
	(0.499)	(0.388)	(0.453)	private sales on firearms, = 0 otherwise
Trigger Lock Law	0.117	0.000	0.045	= 1 if state requires trigger locks to accompany
	(0.322)	(0.000)	(0.207)	dealer and private firearm sales, = 0 otherwise
N	529	853	1,382	

[a] If a CAP law is in effect for any portion of the year, the observation is included in this column.

Notes: Means are unweighted and standard deviations are in parentheses.