

On the Tragedy of Mass Shooting: the Crime Effects

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Abstract

Mass shooting is a tragedy for the targeted community. While direct victims and their families undoubtedly suffer the most serious consequence of mass shootings, the negative impacts of the incidents are likely to reverberate beyond those immediately exposed to the incidents. In this paper, I examine the crime consequences of mass shootings. I hypothesize that mass shootings can increase crimes through its adverse effects on local labor market conditions. Utilizing difference-in-differences strategy that exploits geographic and temporal variation in mass shooting incidents across U.S. counties, the results of the analysis suggest that mass shooting incident is associated with a rise in crimes, especially those carried out for monetary gains. The most conservative estimate indicates that mass shooting incident increases the overall property crime rate by about 4%.

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Declarations of interest: none.

1 Introduction

From 2000 to 2019, there were approximately 67 mass shootings in the United States (Figure 1), resulting in a large number of fatalities and injuries.¹ As evidenced by recent research (e.g., [Lowe and Galea, 2017](#); [Bharadwaj et al., 2021](#); [Levine and McKnight, 2021](#)), direct victims and their families undoubtedly suffer the most serious consequence of mass shootings. Less is known, however, on whether the adverse impacts of mass shootings spill over into the communities where they occurred.

In this paper, I examine the crime consequences of mass shootings. I argue that the adverse economic impacts due to mass shootings decrease the opportunity costs of engaging in crime, leading to higher crime rates in the communities where a mass shooting occurred. Two strands of literature lend support to this hypothesis. First, since the seminal work by [Becker \(1968\)](#) on the economic theory of crime, the literature has documented strong evidence that worsening local labor market conditions increase crimes, especially those committed for financial gains, presumably due to deteriorating economic conditions make engaging in crimes more attractive ([Gould et al., 2002](#); [Öster and Agell, 2007](#); [Lin, 2008](#); [Fougère et al., 2009](#)). Second, consistent with the literature that documented a link between violent incidents and economic activity ([Abadie and Gardeazabal, 2003](#); [Robles et al., 2013](#); [Cook, 2014](#); [Pinotti, 2015](#)), recent work by [Brodeur and Yousaf \(2020\)](#) found that mass shootings negatively affected targeted areas' employment, earnings, and housing prices, mainly by lowering the inflow of investment to the local economy as well as worsen-

¹Mass shooting data are from Mother Jones, which defined mass shooting incidents as indiscriminate rampages in public places resulting in four or more victims killed by the attacker, excluding shootings stemming from more conventionally motivated crimes such as armed robbery or gang violence. Since January 2013, Mother Jones lowered the fatality threshold to three or more victims. For consistency purposes, I only included mass shootings incidents that resulted in at least four fatalities.

ing consumers' evaluation of the current and future economic outlook. Therefore, the worsening local labor market conditions due to the mass shooting can make engaging in criminal activities more attractive, resulting in a higher crime rate.

Utilizing the data on mass shooting incidents since 2000 from Mother Jones, I employed a difference-in-differences strategy to estimate the impact of mass shootings on crimes, exploiting geographic and temporal variation in mass shooting incidents across U.S. counties. I found that mass shooting incident is associated with an increase in crimes, especially those carried out for financial gains, consistent with the hypothesis that mass shootings lower the opportunity costs of crimes due to its impact on labor market opportunities. The most conservative estimate suggests that mass shooting incident increases the overall property crime rate by 4%. Further analysis shows that the increase in property crimes is driven by the rise in small thefts or larceny.

This finding is robust to a battery of sensitivity checks. To alleviate the concern that counties that were targeted by mass shootings are inherently different from those that were not targeted, I check the robustness of the findings using a set of counties with "successful" and "failed" mass shootings. This strategy relies on a weaker assumption that conditional on being a county targeted by a mass shooter, the success or failure of a mass shooting could be considered random. Additionally, since my empirical strategy essentially exploits the variation in the timing of mass shootings, I conducted Goodman-Bacon decomposition analysis, showing that the difference-in-differences estimates are largely obtained from the non-problematic comparison between counties with mass shootings and 'never-treated' counties. To further alleviate the concern of using two-way fixed effects difference-in-differences model outlined in [Goodman-Bacon \(2021\)](#), I estimated an event study model. The re-

sults from this model suggest a rise in overall property crime which persists up to four years after the incident and a lack of evidence that differential trends prior to a mass shooting are driving this finding. Estimating the event study using estimator that is robust to heterogeneous treatment effects (De Chaisemartin and d’Haultfoeuille, 2020b,a) yields qualitatively similar findings. Exploring the mechanism, I found that the number of jobs and earnings per capita declined in the years following mass shooting incident, consistent with the finding from Brodeur and Yousaf (2020).

This paper adds to the literature examining the impact of shooting incidents. Previous works have documented evidence that exposure to shootings adversely affects the physical and mental health of survivors (Lowe and Galea, 2017; Rossin-Slater et al., 2020; Bharadwaj et al., 2021; Levine and McKnight, 2021). Other recent works have also found that school shootings lower academic performances and future earnings of students exposed to the shootings (Beland and Kim, 2016; Levine and McKnight, 2021; Bharadwaj et al., 2021; Cabral et al., 2021). Fewer studies, however, examine the impact of shootings on the communities where they occurred beyond those immediately exposed to the incidents. Using county-level variation in exposure to mass shooting incidents, Soni and Tekin (2020) found that the adverse effects of mass shootings spill over into the communities where they occurred, reducing the community wellbeing and emotional health (e.g., satisfied and proud with the community where they live, feeling safe and secure). There is also evidence that mass shootings increase the polarization among U.S. voters with regards to gun policy (Luca et al., 2020; Yousaf, 2021) and worsen the economic conditions in places where they occurred (Brodeur and Yousaf, 2020). My paper complements these previous works by showing evidence that mass shootings can increase crimes in the communities where they occurred, inflicting adverse effects beyond those directly exposed

to the incidents. To my knowledge, this paper is the first study to examine the effects of mass shootings on crime.

This paper is also related to the literature examining the socioeconomic determinants of crimes. Crimes imposed sizable economic costs to society. A recent estimate suggests that the cost of crimes can be as high as \$310 billion, approximately 2% of U.S. GDP in 2012 (Chalfin, 2015). Previous works have suggested that demographic characteristics (Freeman, 1996; Grogger, 1998), income inequality (Freeman, 1996; Chiu and Madden, 1998; Kelly, 2000), and economic conditions (Gould et al., 2002; Öster and Agell, 2007; Lin, 2008; Fougère et al., 2009) are important factors determining local crime rates. My paper adds to this literature by providing evidence that mass shooting incidents can affect crimes through its effect on labor market conditions.

The rest of the paper is constructed as follows. Section 2 describes the data. Section 3 describes the empirical strategy used to analyze the impact of mass shootings on crimes. Section 4 documents the findings. Section 5 concludes.

2 Data

2.1 Mass Shootings Data

The list of mass shootings incidents from 2000 to 2019 was obtained from Mother Jones, a non-profit investigative news organization that maintains a database on mass shootings (Follman et al., 2020). Mother Jones defined mass shooting incidents as indiscriminate rampages in public places resulting in four or more victims killed by the attacker, excluding shootings stemming from more conventionally motivated

crimes such as armed robbery or gang violence.² This definition is consistent with the one used by the FBI as well as a recent report produced by Congressional Research Service (Krouse and Richardson, 2015). Mother Jones database has been widely used by studies examining the impact of mass shootings in the United States (e.g., Porfiri et al., 2019; Pappa et al., 2019; Soni and Tekin, 2020; Bharati and Banerjee, 2020).

Figure 1 shows the distribution of mass shootings over time in the United States. From 2000 to 2019, there were 67 mass shootings that occurred in the U.S., resulting in 653 fatalities and 1099 injuries. The figure also shows that mass shooting incidents have been rising in recent years. From 2000 to 2005, there were about one to two mass shootings per year in the U.S. In recent years, the number rose to four to eight mass shootings occurring annually. The locations targeted by mass shootings appear to be sporadic, with sixty-two counties across the 30 U.S. states had at least one mass shootings (Figure 2).³

2.2 Crime Data

The crime data are obtained from Uniform Crime Reporting (UCR) Program Data: Offenses Known and Clearances by Arrest publicly available on Inter-university Consortium for Political and Social Research (ICPSR) (Kaplan, 2021a). Maintained by the Federal Bureau of Investigation (FBI), the UCR contains crime data from more than 18,000 law enforcement agencies (LEA) in the United States, covering most of the U.S. population (Maltz, 1999). The UCR Offense Known and Clearances by Ar-

²As noted before, Mother Jones lowered the fatality threshold to three or more victims starting from January 2013. For consistency purposes, I only included mass shootings incidents that resulted in at least four fatalities.

³There were four counties with multiple mass shootings in the 2000-2019 period. The assignment of treatment status for these counties is made based on the first mass shooting.

rest data reports two types of offense: violent crime (murder, manslaughter, rape, robbery, and aggravated assault) and property crime (burglary, larceny, and motor vehicle theft).

While the UCR data have been widely used (Gould et al., 2002; Miles and Cox, 2014; Dave et al., 2021), it is worth noting that the LEA reporting requirement to UCR is voluntary, leading to differences in the reporting across agencies and potentially affecting the reliability of the estimates (Maltz and Targonski, 2002). To address this, I follow the crime literature and focus the analysis only on law enforcement agencies that consistently report crimes in all 12 months of the year, every year throughout the period of analysis (Maltz and Targonski, 2002; Dave et al., 2021). Since the information on whether an agency reported crime every month for the whole year in 2018 and 2019 cannot be ascertained in the current version (Version 16) of UCR Offense data from ICPSR (Kaplan, 2021a), I exclude these years from the crime analysis. Therefore, the analysis period for crime-related analysis is 2000-2017. The summary statistics for crime data are reported in Panel A of Table 1. To avoid dropping the agency-year observations with zero crime counts when the variable is (natural) log-transformed, I add one to the counts prior to computing the rate per 100,000. As shown later, the results are robust to not adding one to the crime counts and using inverse hyperbolic sine to transform the crime variables.

2.3 County Demographics Data

County demographics data from 2000 to 2019 are obtained from U.S. Census Bureau Annual County Resident Population Estimates by Age, Sex, Race, and Hispanic Origin. Using this data, I construct the following demographic variables to be used as

controls in the analysis: the population share of blacks, the population share of Hispanics, the population share of females, the share of the population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69. The summary statistics for county demographic characteristics are reported in Panel B of Table 1.

3 Empirical Methodology

To assess the impact of mass shootings on crime, I employed a difference-in-differences strategy, exploiting the geographical and temporal variation in mass shooting incidents across U.S. counties. Formally, the research design can be specified as follows

$$\ln(y_{act}) = \delta_a + \delta_t + \gamma MassShooting_{ct} + X'_{ct}\alpha + \varepsilon_{act}$$

where y_{act} is the number of crimes per 100,000 for agency a located in county c at time t . X is a vector of county-level control variables. Since demographic characteristics have been found to be important factors determining local crime rates (Freeman, 1996; Grogger, 1998), I added population share of blacks, population share of Hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69 as controls. δ_a and δ_t are agency and year fixed effects, respectively. Agency fixed effects were included in the model to absorb time-invariant differences across agencies (as well as time-invariant differences across counties since agencies are nested within counties). Year fixed effects were included to account for secular trends in crime rates over the analysis period. ε is the error term. The main variable of interest is $MassShooting_{ct}$, which takes a value of one for all years after county c had a mass shooting and zero otherwise. All regressions are

weighted by county population averaged over the analysis period, and the standard errors are clustered at the county level.⁴

The main assumption for the difference-in-differences research design describe above is that in the absence of mass shooting, the outcomes in the ‘treated’ counties would evolve in a similar way as those in control counties. While it is not possible to test this parallel trend assumption directly, one can assess the plausibility of this assumption by checking the pre-trends. Specifically, I estimated an event study model as follows

$$\ln(y_{act}) = \delta_a + \delta_t + \sum_{\tau=2}^4 \beta_{-\tau} MassShooting_{c,t-\tau} + \sum_{\tau=0}^4 \beta_{+\tau} MassShooting_{c,t+\tau} + X'_{ct}\alpha + \varepsilon_{act}$$

where all the variables are defined in the same way as before. $MassShooting_{c,t-1}$ is excluded from the model, so that the estimated effects (β) are relative to the year prior to the mass shooting incident. It should be noted that for $MassShooting_{c,t-4}$, the variable is equal to one for $t - 4$ and each year prior to $t - 4$. Similarly, $MassShooting_{c,t+4}$ is equal to one for $t + 4$ and each year after $t + 4$. The absence of visible difference in the trends between treated and control counties prior to the mass shooting would support the validity of the difference-in-differences research design described above.

⁴As noted in section 2.2, the analysis period for crime-related analysis is 2000-2017 since the information on whether an agency reported crime every month for the whole year in 2018 and 2019 cannot be ascertained in the current version (Version 16) of UCR Offense data from ICPSR (Kaplan, 2021a). For other outcomes, the period of analysis is 2000-2019.

4 Results

4.1 Main Findings

Tables 2 and 3 present the results of the analysis. There is a lack of evidence that violent crimes are affected by mass shootings (Panel A of Table 2). The estimate shows that mass shooting is associated with a 2.7% decline in the overall violent crime rate (Column 1), but it is not statistically significantly different from zero. Disaggregating violent crimes into its components (Columns 2 to 5), the estimated effects suggest that mass shootings are not statistically significantly associated with changes in murder, rape, robbery, and aggravated assault crime rates.

On the other hand, there is strong evidence that mass shootings increase the property crime rate (Panel A of Table 3), consistent with the hypothesis that the effects of mass shootings on crime operate through its effect on labor market opportunities. The estimate shows that mass shooting incident is associated with 7.2% increase in the overall property crime rate (Column 1). Disaggregating property crimes into its components (Columns 2 to 4), the results of the analysis suggest that the increase in overall property crime rate following the mass shooting is mainly driven by the rise in burglary and larceny.

To assess whether the findings above are due to differences in pre-trend between counties targeted by mass shootings and those without mass shootings, Figures 3a and 4a show the results from the event study model. For violent crime, there is evidence of a difference in trend before mass shooting (Figure 3a), suggesting caution in interpreting the results for violent crime.⁵ For property crime, however, there is

⁵Note that this difference in pre-trend shown in Figure 3a indicates that the effects of mass shooting on violent crime in Table 2 are underestimated.

no evidence of differential trends prior to the mass shooting incident. Overall, the results from the event study model suggest that the effect of the mass shooting on property crime rate is not driven by the difference in pre-trend between counties with and without mass shooting incidents.⁶

One concern is that mass shooting incidents might not randomly occur across U.S. counties. That is, counties targeted by mass shootings might be inherently different from those that are not targeted by mass shootings. To address this concern, I further restrict the control group to only counties that experienced failed mass shootings based on the FBI Active Shooter Incidents reports. FBI defines an active shooter incident as an event in which “one or more individuals actively engaged in killing or attempting to kill people in a populated area.” It excludes shootings that resulted from gang violence or those that did not put others in danger (e.g., an individual who chose to publicly commit suicide in a parking lot), in line with mass shootings definition from Mother Jones. I defined failed mass shootings as the incidents that resulted in fewer than four casualties in the FBI Active Shooter Incident Report. The advantage of this strategy is that it relies on a more weaker assumption that conditional on being a county targeted by a mass shooter, the success or failure of a mass shooting could be considered random. Indeed, the counties with successful mass shootings, including the law enforcement agencies within these counties, were much similar in characteristics to those with failed mass shootings compared to counties without successful or failed mass shootings (Table 1).⁷ However, it is worth noting that this strategy comes at a cost of more impreciseness in the estimates due

⁶The results of the event study model for crimes disaggregated by its components are reported in Appendix Figures 1a-4a for violent crimes and Appendix Figures 5a-7a for property crimes. There is no evidence that the rise in burglary and larceny following the mass shooting is driven by pre-trend differences between counties with and without mass shootings.

⁷Similarly, [Brodeur and Yousaf \(2020\)](#) also documented that successful and failed mass shooting counties are similar along a large number of observable characteristics.

to fewer number of counties included in the sample.

The results of this exercise are reported in Panel B of Tables 2 and 3. Similar to before, there is a lack of evidence that mass shootings affect violent crime. For overall violent crime, at 90% confidence level, the estimate suggests that a large increase in violent crime rate by more than 4% or a large decline in violent crime rate by 5% can be ruled out. In general, the estimates for violent crimes are close to zero and not statistically significant. For property crimes, the estimated effects are in line, although smaller in magnitude, to the baseline specifications in Panel A. Mass shooting is associated with a 4.8% increase in overall property crime, and this effect is mainly driven by the rise in burglary and larceny. The event study model from restricting the control group only to counties with failed mass shootings is reported in Figures 3b and 4b.⁸ While there is evidence of pre-trends in violent crimes analysis, suggesting caution in interpreting the results for violent crimes, the results of the event study model show that the effects for property crimes are unlikely to be due to differential trends between treated and control counties prior to the mass shooting.

In sum, the evidence suggests that mass shootings are associated with an increase in crimes, especially those committed for financial gains, consistent with the hypothesis that the effects of mass shootings on crimes operate through its effect on labor market opportunities. In the next subsection, I examine the sensitivity of this finding to a battery of robustness checks. Since the specifications restricting the control group only to counties with failed mass shootings give the most conservative estimates on the main finding (i.e., mass shooting is associated with a rise in

⁸The corresponding results of the event study model from this specification for crimes disaggregated by its components are reported in Appendix Figures 1b to 7b.

property crimes) and rely on a more weaker assumption that the success or failure of mass shooting could be considered random in counties targeted by the shooting, I focus on this specification with the restricted control group in the sensitivity analysis below.

4.2 Additional Sensitivity Checks

4.2.1 Goodman-Bacon Decomposition

Recent work by [Goodman-Bacon \(2021\)](#) shows that the estimated effects obtained from the two-way fixed effects difference-in-differences (DD) model exploiting variation in treatment timing is a weighted average of all possible two-group and two-period DD estimators. The author shows that, in the presence of dynamic treatment effects, the difference-in-differences estimate obtained using variation in treatment timing is biased since it is partly identified using early treated groups (that are still being affected by the treatment) as a control for later treated groups. Since my empirical strategy essentially exploits the variation in the timing of mass shootings, the difference-in-differences estimates reported in Tables 2 and 3 are subject to the concern outlined in [Goodman-Bacon \(2021\)](#).⁹ To address this concern, I conducted Goodman-Bacon decomposition analysis.

The results of this exercise are reported in Figure 5 and Tables 4 to 5.¹⁰ There are three main takeaways from Goodman-Bacon decomposition analysis. First, while a

⁹It is worth noting that the bias outlined in [Goodman-Bacon \(2021\)](#) is specific to a single-coefficient difference-in-differences specification. Therefore, the event study results in Figures 3 and 4 will be valid under the assumption of homogeneous treatment effects; in the presence of heterogeneous treatment effects, [Sun and Abraham \(2020\)](#) shows that the event study results can be incorrect. Later, I will check the robustness of the event study results using [De Chaisemartin and d’Haultfoeuille \(2020a\)](#) estimator that is robust to heterogeneous treatment effects.

¹⁰The corresponding figures of Goodman-Bacon decomposition analysis for crimes disaggregated by its components are reported in Appendix Figures 8 and 9.

sizable portion of the difference-in-differences estimates is obtained through potentially problematic comparisons (“Timing Groups”), most of them are identified from the non-problematic comparison (“Never vs Timing”). Second, focusing on the estimates obtained from non-problematic comparisons (third row of Tables 4 and 5), the results indicate that mass shooting is associated with a small decline (-1.3%) in the overall violent crime rate while it is associated with a rise in the overall property crime rate (12.5%). These estimates are consistent with the main findings (Panel B of Tables 2 and 3) that also show mass shooting is associated with a small, not statistically significant, decline in the overall violent crime rate (-0.7%) while it is associated with an increase in overall property crime rate by about 4.8%. Finally, as shown in Figure 5, the effects of mass shootings on crime are likely to vary across places, the timing of mass shootings, and the counterfactual/control group used to estimate the effects.

4.2.2 Controlling for State-by-Year Fixed Effects

While crime rates have been declining since the 1990s in the United States ([Gramlich, 2020](#)), the rate of decline is likely to vary across regions. A concern is that mass shootings might be more likely to occur in regions experiencing a faster/slower decline in crimes. Additionally, many states implemented changes to firearm control policies throughout the analysis period ([Gius, 2015](#); [Luca et al., 2017](#); [Anderson and Sabia, 2018](#)), potentially affecting both the incidents of mass shooting and crime rates. To address this concern, I include state-by-year fixed effects in the model.

The results of this exercise are reported in Panel C of Tables 2 and 3. Consistent with the main findings, mass shooting is associated with a 4.9% increase in property crime rate, which is driven by the rise in larceny, while it is not associated with

statistically significant changes in violent crimes. The event study results in Figures 3c and 4c also correspond closely with the findings from previous specifications.¹¹ Since including state-by-year fixed effects improves the precision of the estimates and helps to address the potential confounding factors noted above, I include state-by-year fixed effects in the model for the rest of the analysis.

4.2.3 Leave-one-out Analysis

One concern is that the findings above may be driven by a specific mass shooting incident. To see if this is the case, I conducted a leave-one-out analysis, dropping one treated county at a time and re-estimating the effects (Figure 6).¹² The mass shooting coefficients are mostly stable, suggesting that the findings are not driven by a specific mass shooting incident.

4.2.4 Using Estimator Robust to Heterogeneous Treatment Effects

As noted by [Sun and Abraham \(2020\)](#), the event study results can break down in the presence of heterogeneous treatment effects. To address this concern, I employed [De Chaisemartin and d'Haultfoeuille \(2020b,a\)](#) estimator to estimate the event study model that is robust to heterogeneous treatment effect. The results of this exercise are reported in Figures 3d and 4d. Although imprecisely estimated, the event study results obtained using [De Chaisemartin and d'Haultfoeuille \(2020b,a\)](#) estimator show evidence of an increase in the overall violent crime rate after the mass shooting. Examining this result further by disaggregating violent crimes by its components (Appendix Figures 1d to 4d), this increase in overall violent crime rate ap-

¹¹The event study results for crimes disaggregated by its components are reported in Appendix Figures 1c to 7c.

¹²The results of leave-one-out analysis for crimes disaggregated by its components are reported in Appendix Figures 10 and 11.

pears to be driven by the type of violent crime that is carried out for monetary gains (i.e., robbery) rather than other violent crimes where pecuniary considerations are lower,¹³ consistent with the hypothesis that the effects of mass shooting on crimes mainly operates through its effect on the labor market. For property crime, the rate increases shortly after the mass shooting, and this effect persists up to four years after the shooting (Figure 4d). Disaggregating property crimes by its components, this increase in property crime rate is mainly driven by the rise in larceny and burglary (Appendix Figures 5d to 7d), similar to the main findings.

4.2.5 Using Inverse Hyperbolic Sine Transformation

In the main analysis above, I added one to the crime counts prior to computing the rate per 100,000 to avoid dropping the agency-year observations with zero crime counts when the variable was (natural) log-transformed. An alternative is to use inverse hyperbolic sine transformation to approximate a logarithm and interpret the coefficients as one would for a logarithmic equation.¹⁴ The results of this exercise are reported in Panel D of Tables 2 and 3. The main findings qualitatively hold.

4.2.6 Demographic Changes After Mass Shootings

A concern is that mass shootings may lead to the outmigration of individuals away from where it occurred. I am not aware of data that has information on annual county-to-county migration flows.¹⁵ Nevertheless, it is worth noting that unless mass

¹³Although aggravated assault crime rate rises after mass shooting (Appendix Figure 4d), there is a lack of evidence that murder and rape crime rates are affected by mass shootings (Appendix Figures 1d and 2d).

¹⁴It should be noted that the work by [Bellemare and Wichman \(2020\)](#) shows that researchers may want to be careful when interpreting inverse hyperbolic sine coefficients as one would for a logarithmic equation since it can be sizably different from the correct percentage effects.

¹⁵The U.S. Census Bureau does publish county-to-county migration flows estimates based on American Community Survey (ACS) data. However, they are based on 5-year dataset (2005-2009 ACS, 2006-2010 ACS, and so on).

shooting leads to systematic outmigration of individuals, it will not cause bias in the estimates. To see if this is the case, I regress county-level demographics on the indicator for mass shootings controlling for county and state-by-year fixed effects.¹⁶ The results of this analysis are reported in Table 6. There is a lack of evidence that mass shootings lead to systematic changes in population composition in the area where it occurred.¹⁷ Most of the estimates are small and not statistically significantly different from zero. If any, the results suggest that mass shooting is associated with a lower share of young individuals in the population, indicating that the estimates in Tables 2 and 3 are the lower bound of the effects since younger individuals have been found to have a higher propensity to commit crime compared to older population (Freeman, 1996; Grogger, 1998).¹⁸

4.3 Mechanism

The results above provide strong evidence that mass shootings affect crimes, especially those committed for financial gains. This finding is consistent with the hypothesis that mass shooting affects crime mainly through its effect on labor market opportunities. Indeed, recent work by Brodeur and Yousaf (2020) found that mass shootings worsened targeted areas' employment and earnings, mainly by lowering the inflow of investment to the local economy as well as adversely affecting consumers' sentiments. In this subsection, I re-examine the relationship between mass shootings and economic conditions using mass shooting data from Mother Jones and

¹⁶Specifically, I run the following regression: $\ln(y_{ct}) = \delta_c + \delta_{st} + \gamma MassShooting_{ct} + \varepsilon_{ct}$ where y_{ct} is county-level demographic for county c at time t , $MassShooting_{ct}$ is an indicator variable which takes a value of one for all years after county c had a mass shooting and zero otherwise, δ_c and δ_{st} are county and state-by-year fixed effects, and ε_{ct} is the error term. The period of the analysis is 2000-2019.

¹⁷This finding is consistent with Brodeur and Yousaf (2020), which checked the distribution of population after mass shootings and found no evidence of selective migration.

¹⁸The event study results for this analysis are reported in Appendix Figure 12.

a longer period of analysis (2000-2019).¹⁹

Specifically, I estimated the following event study specification:

$$\ln(y_{ct}) = \delta_c + \delta_{st} + \sum_{\tau=2}^4 \beta_{-\tau} \text{MassShooting}_{c,t-\tau} + \sum_{\tau=0}^4 \beta_{+\tau} \text{MassShooting}_{c,t+\tau} + X'_{ct} \alpha + \varepsilon_{ct}$$

where y_{ct} is the economic outcomes (i.e., jobs per capita, earnings per capita) in county c at time t obtained from Quarterly Census of Employment and Wages (QCEW), which is also used by [Brodeur and Yousaf \(2020\)](#). X_{ct} is a vector of county-level control variables. δ_c and δ_{st} are county and state-by-year fixed effects, and ε_{ct} is the error term.

The results of this analysis are reported in Appendix Figures 13 and 14. Shortly after the mass shooting, the number of jobs and earnings per capita started to decline (Appendix Figures 13a and 14a). Four years after the incident, the number of jobs and earnings per capita in counties with mass shootings are about 1.6% and 2% lower compared to those without mass shootings. Estimating the event study model using an estimator that is robust to heterogeneous treatment effects yields qualitatively similar results (Appendix Figures 13b and 14b). Restricting the control groups only to counties with failed mass shootings also yields qualitatively similar findings, although the estimates are imprecise due to the fewer number of counties used in the analysis (Appendix Figures 13c-d and 14c-d).

Overall, the results in Appendix Figures 13 and 14 indicate that mass shootings have negative effects on targeted counties' economic conditions, consistent with the

¹⁹[Brodeur and Yousaf \(2020\)](#) examined the effect of mass shootings in the 2000-2015 period using primarily FBI Supplementary Homicide Reports (SHR) data. I used the Mother Jones mass shootings database due to the known limitations of using SHR data. For example, SHR mainly relies on voluntary submissions by law enforcement agencies across the United States, and the missing data are not random ([Fox, 2004](#)). Another work by ([Duwe, 2000](#)) found coding errors in SHR data that could result in misclassification of mass shooting incidents such as double counting of victims/incidents and classifying a nonfatal injury as a fatal one.

findings in [Brodeur and Yousaf \(2020\)](#). In the four years following the mass shooting, the number of jobs per capita in the targeted counties declined by 1-2%, while earnings per capita are reduced by 2-4%.²⁰

5 Conclusion

Mass shooting is a tragedy for the targeted community. Direct victims and their families undoubtedly suffer the most serious consequence of mass shootings. However, the negative impacts of mass shootings are likely to reverberate beyond those directly affected by the incidents.

In this paper, I examine the crime consequence of mass shootings. I hypothesize that mass shootings can increase crimes through its adverse effects on local labor market conditions. Utilizing difference-in-differences strategy that exploits geographic and temporal variation in mass shooting incidents across the U.S. counties, the results of the analysis suggest that mass shooting incident is associated with a rise in crimes, especially those carried out for monetary gains. The most conservative estimate indicates that mass shooting incident increases the overall property crime rate by about 4%.

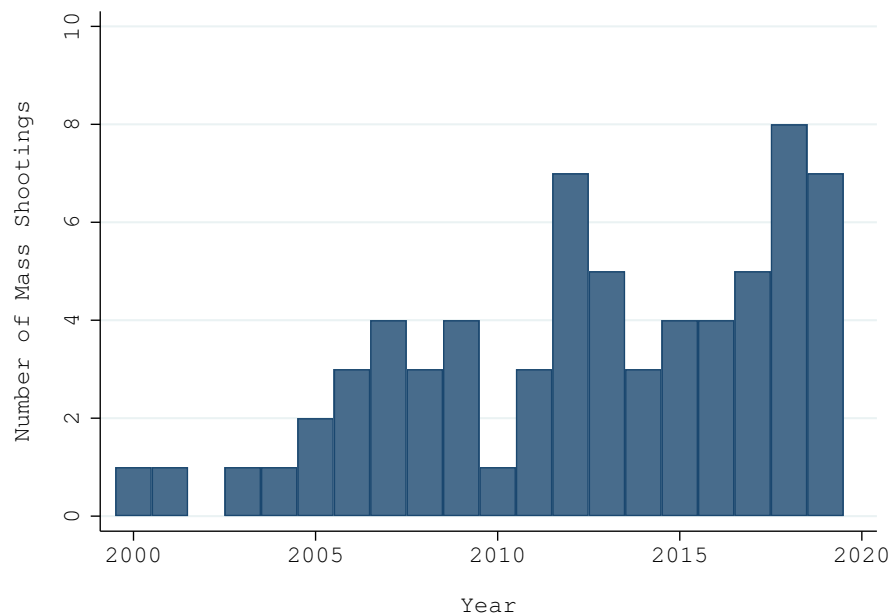
The finding above indicates that mass shootings can impose additional damage to the targeted communities beyond those immediately exposed to the incidents. Since the increase in crimes following a mass shooting is likely to be coming from worsening

²⁰There is a concern that mass shooting might alter resources allocated for law enforcement, which in turn affects crimes. To see if this is the case, I analyze whether the number of police officers per 100,000 was affected by mass shooting using an event study model as follows: $\ln(PolicePer100,000_{act}) = \delta_a + \delta_{st} + \sum_{\tau=2}^4 \beta_{-\tau} MassShooting_{c,t-\tau} + \sum_{\tau=0}^4 \beta_{+\tau} MassShooting_{c,t+\tau} + X'_{ct} \alpha + \varepsilon_{act}$ where $PolicePer100,000_{act}$ is the number of officers per 100,000 for agency a located in county c at time t , X_{ct} is a vector of county-level control variables, δ_a and δ_{st} are agency and state-by-year fixed effects. The results of this exercise indicate that the number of officers per 100,000 was not affected by mass shooting (Appendix Figure 15). The number of officers data are obtained from Uniform Crime Reporting Program Data: Law Enforcement Officers Killed and Assaulted (LEOKA) ([Kaplan, 2021b](#)).

local labor market conditions, public policy should consider efforts to improve the current and future economic outlook in the targeted communities.

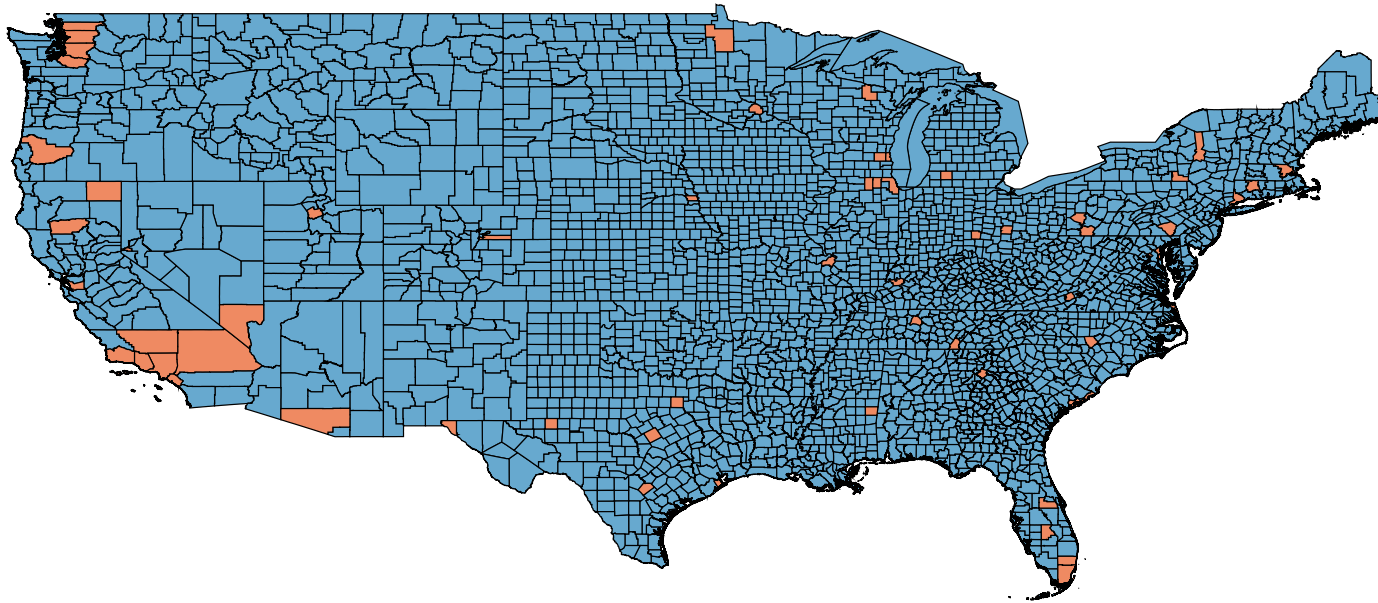
6 Figures and Tables

Figure 1: Number of Mass Shootings 2000-2019



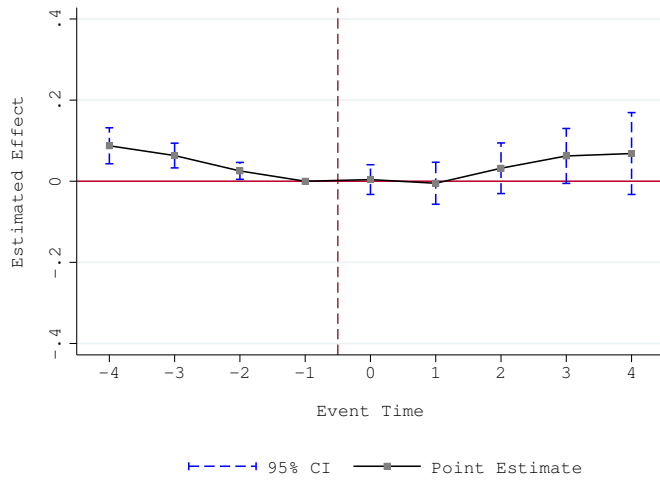
Notes: The mass shootings data are obtained from Mother Jones. Mass shooting is defined as indiscriminate rampages in public places resulting in four or more victims killed by the attacker, excluding shootings arose from more conventionally motivated crimes such as armed robbery or gang violence.

Figure 2: Location of Mass Shootings 2000-2019

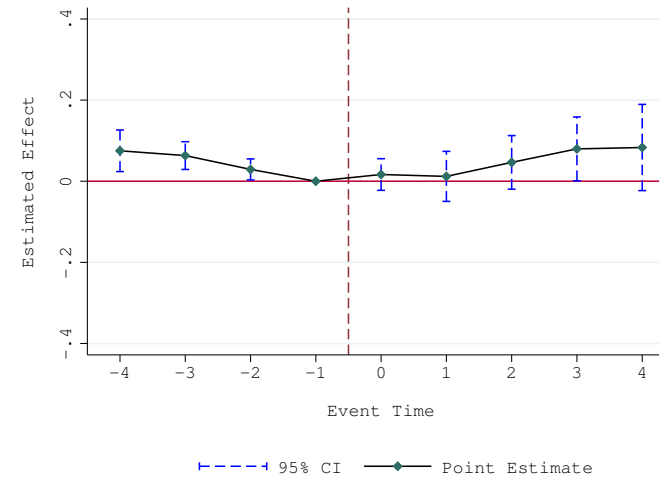


Notes: The mass shootings data are obtained from Mother Jones. Mass shooting is defined as indiscriminate rampages in public places resulting in four or more victims killed by the attacker, excluding shootings arose from more conventionally motivated crimes such as armed robbery or gang violence.

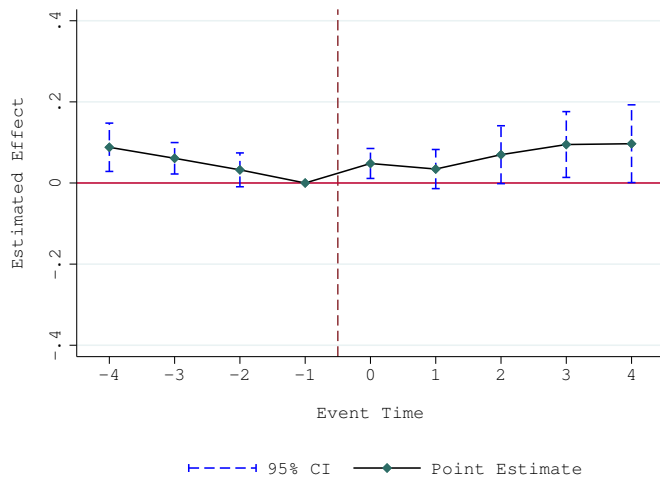
Figure 3: Effect of Mass Shooting on Natural Log of Violent Crime Rate



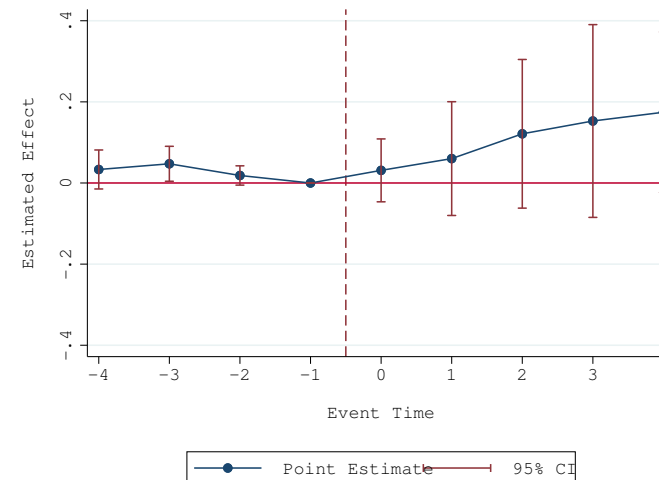
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



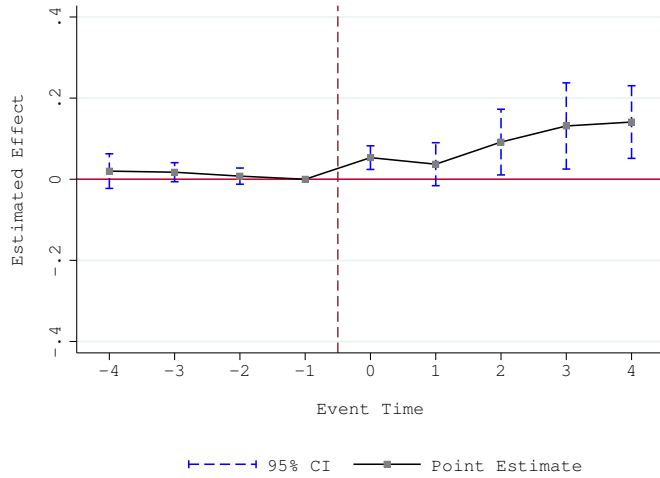
(c) With State-by-Year Fixed Effects



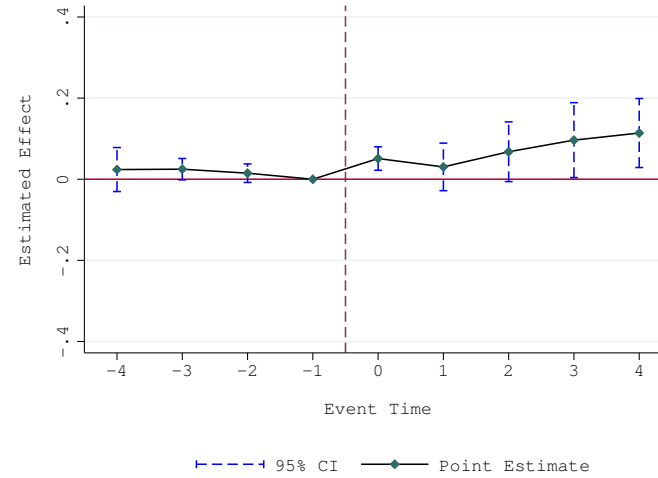
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

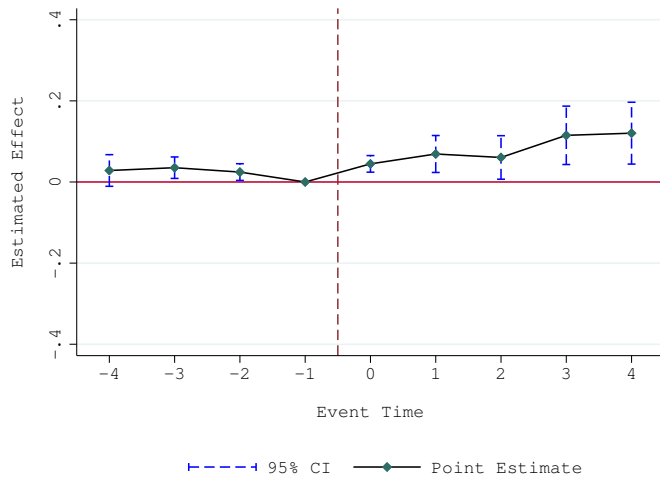
Figure 4: Effect of Mass Shooting on Natural Log of Property Crime Rate



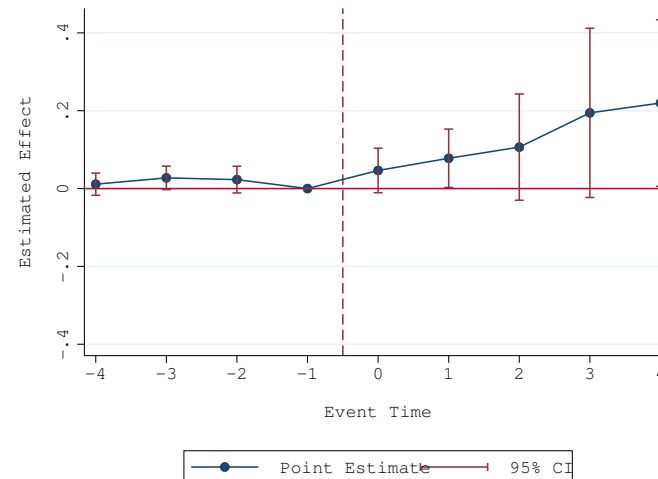
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



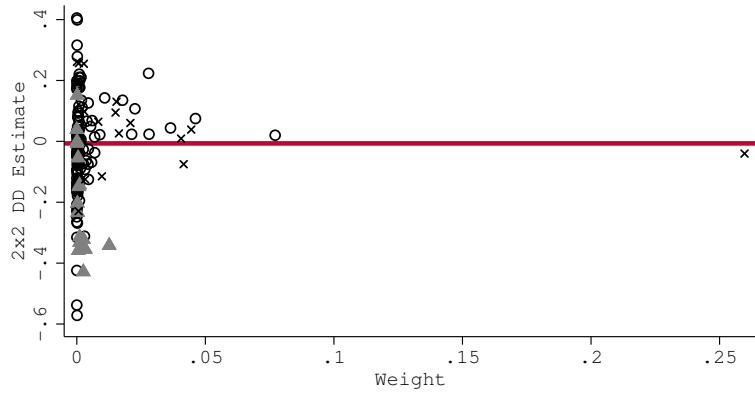
(c) With State-by-Year Fixed Effects



(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

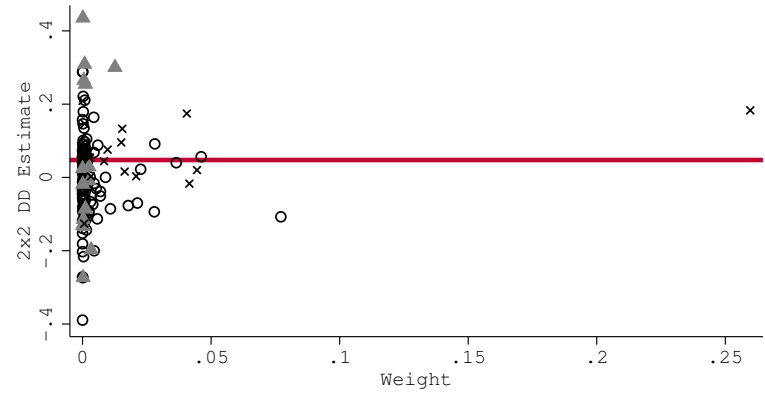
Figure 5: Goodman-Bacon Decomposition



○ Timing groups ▲ Always treated vs timing
 × Never treated vs timing

Overall DD Estimate = $-.00677229$
 Always vs never treated = $.77225357$ (weight = $.08349231$)
 Within component = $-.15454757$ (weight = $.08349231$)

(a) Overall Violent Crime



○ Timing groups ▲ Always treated vs timing
 × Never treated vs timing

Overall DD Estimate = $.04753018$
 Always vs never treated = $-.42818418$ (weight = $.08349231$)
 Within component = $-.07109233$ (weight = $.08349231$)

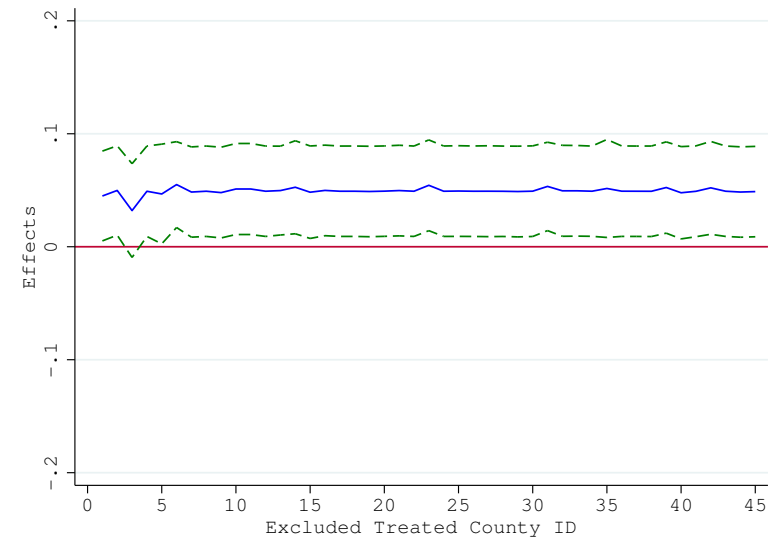
(b) Overall Property Crime

Notes: The y-axis reports the two-way fixed-effect estimate for one of the groups based on treatment timing. The x-axis reports the weight in the overall difference-in-differences estimate based on treatment timing.

Figure 6: Leave-one-out Analysis



(a) Violent Crime



(b) Property Crime

Notes: The figure show the estimate of the effect when the treated county ID in the corresponding x-axis is excluded from the regression. Only counties with successful and failed mass shootings are included in the analysis. The blue line represents the coefficient estimates, while the green dash lines represent the 95% confidence interval constructed based on standard errors cluster at the county level. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county and state-by-year fixed effects.

Table 1: Summary Statistics

	All Counties	No Successful/Failed Mass Shootings	Successful Mass Shootings	Failed Mass Shootings
Panel A: Agency-level Crime Statistics				
ln(Violent Crimes per 100,000)	5.33 (0.99)	5.30 (0.97)	5.39 (1.06)	5.54 (0.98)
ln(Property Crimes per 100,000)	7.67 (0.76)	7.63 (0.77)	7.82 (0.75)	7.86 (0.69)
ln(Murders per 100,000)	2.46 (1.04)	2.54 (1.03)	2.02 (1.03)	2.22 (0.99)
ln(Rapes per 100,000)	3.46 (0.89)	3.51 (0.89)	3.19 (0.92)	3.35 (0.84)
ln(Robberies per 100,000)	3.75 (1.08)	3.64 (1.05)	4.24 (1.17)	4.16 (1.04)
ln(Aggravated Assaults per 100,000)	4.96 (1.04)	4.95 (1.04)	4.85 (1.10)	5.11 (1.03)
ln(Burglaries per 100,000)	6.11 (0.80)	6.08 (0.80)	6.17 (0.80)	6.23 (0.77)
ln(Larcenies per 100,000)	7.30 (0.82)	7.26 (0.83)	7.43 (0.80)	7.49 (0.74)
ln(Motor Vehicle Thefts per 100,000)	4.89 (0.98)	4.80 (0.92)	5.37 (1.20)	5.21 (1.03)
ln(Police per 100,000)	5.23 (0.67)	5.25 (0.59)	5.11 (1.08)	5.22 (0.78)
Panel B: County-level Demographics Statistics				
Population Share of Blacks	0.09 (0.15)	0.09 (0.15)	0.12 (0.11)	0.13 (0.14)
Population Share of Hispanics	0.08 (0.13)	0.08 (0.13)	0.18 (0.17)	0.12 (0.14)
Population Share of Female	0.50 (0.02)	0.50 (0.02)	0.51 (0.01)	0.51 (0.02)
Population Share of <15 Years Old	0.19 (0.03)	0.19 (0.03)	0.20 (0.03)	0.20 (0.03)
Population Share of 15- to 24-year-olds	0.13 (0.04)	0.13 (0.03)	0.14 (0.04)	0.14 (0.04)
Population Share of 25- to 39-year-olds	0.18 (0.03)	0.18 (0.03)	0.21 (0.03)	0.20 (0.03)
Population Share of 40- to 54-year-olds	0.21 (0.02)	0.21 (0.02)	0.21 (0.02)	0.21 (0.02)
Population Share of 55- to 69-year-olds	0.17 (0.04)	0.17 (0.04)	0.15 (0.03)	0.15 (0.03)
Population Share of >69 Years Old	0.11 (0.03)	0.11 (0.03)	0.09 (0.03)	0.09 (0.03)

Notes: The 2000-2017 crime data are from FBI Uniform Crime Report available on ICPSR (Kaplan, 2021a,b). Counties demographics data are obtained from U.S. Census Bureau Intercensal Population Estimates. Standard deviations are reported in the parentheses.

Table 2: The Effect of Mass Shooting Incident on Natural Log of Violent Crimes

	(1)	(2)	(3)	(4)	(5)
	Overall	Murder	Rape	Robbery	Agg. Assault
Panel A: All Counties					
Mass Shooting	-0.027 (0.026)	-0.029 (0.019)	-0.016 (0.040)	-0.010 (0.020)	-0.012 (0.034)
Observations	99900	99900	99900	99900	99900
Panel B: Successful + Failed Mass Shootings Counties					
Mass Shooting	-0.007 (0.027)	-0.012 (0.021)	-0.023 (0.053)	-0.008 (0.027)	0.011 (0.031)
Observations	19818	19818	19818	19818	19818
Panel C: Panel B Counties + State-by-Year Fixed Effects					
Mass Shooting	0.012 (0.025)	0.004 (0.030)	0.044 (0.032)	0.018 (0.033)	0.015 (0.026)
Observations	19818	19818	19818	19818	19818
Panel D: Panel C Specs. + Inverse Hyperbolic Sine					
Mass Shooting	0.049 (0.031)	-0.013 (0.065)	0.068 (0.057)	0.035 (0.052)	0.015 (0.026)
Observations	19818	19818	19818	19818	19818

Notes: The crime data are obtained from FBI Uniform Crime Report available on ICPSR (Kaplan, 2021a). The estimates show the effect of mass shooting on natural log of crime rate. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. Heteroskedastic- and clustered-robust standard errors at the county level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 3: The Effect of Mass Shooting Incident on Natural Log of Property Crimes

	(1) Overall	(2) Burglary	(3) Larceny	(4) Vehicle Theft
Panel A: All Counties				
Mass Shooting	0.072*** (0.024)	0.127*** (0.044)	0.062*** (0.016)	0.047 (0.051)
Observations	99900	99900	99900	99900
Panel B: Successful + Failed Mass Shootings Counties				
Mass Shooting	0.048* (0.027)	0.099** (0.046)	0.037** (0.017)	0.018 (0.063)
Observations	19818	19818	19818	19818
Panel C: Panel B Counties + State-by-Year Fixed Effects				
Mass Shooting	0.049** (0.020)	0.072 (0.046)	0.061*** (0.018)	-0.010 (0.055)
Observations	19818	19818	19818	19818
Panel D: Panel C Specs. + Inverse Hyperbolic Sine				
Mass Shooting	0.041* (0.022)	0.074 (0.046)	0.053*** (0.019)	-0.023 (0.062)
Observations	19818	19818	19818	19818

Notes: The crime data are obtained from FBI Uniform Crime Report available on ICPSR (Kaplan, 2021a). The estimates show the effect of mass shooting on natural log of crime rate. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. Heteroskedastic- and clustered-robust standard errors at the county level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$ * $p < .1$, ** $p < .05$, *** $p < .01$

Table 4: Goodman-Bacon Decomposition (Violent Crime)

	Weight	Beta				
		Overall Violent	Murder	Rape	Robbery	Agg. Assault
Timing Groups	0.405	0.049	0.039	-0.082	0.033	0.067
Always vs Timing	0.027	-0.322	-0.110	-0.117	-0.083	-0.353
Never vs Timing	0.483	-0.013	-0.062	0.052	-0.020	0.004
Always vs Never	0.002	0.772	-0.004	-0.116	-0.354	1.046
Within	0.083	-0.155	0.054	-0.132	-0.106	-0.117

Notes: The table reports Goodman-Bacon Decomposition analysis for violent crimes. Weight column reports the weight in the overall difference-in-differences estimate based on treatment timing. Beta columns report the two-way fixed-effect estimate for one of the groups based on treatment timing.

Table 5: Goodman-Bacon Decomposition (Property Crime)

	Weight	Beta			
		Overall Property	Burglary	Larceny	Vehicle Theft
Timing Groups	0.405	-0.024	0.009	-0.042	-0.079
Always vs Timing	0.027	0.130	0.120	0.140	0.209
Never vs Timing	0.483	0.125	0.219	0.116	0.076
Always vs Never	0.002	-0.428	-0.360	-0.429	-0.778
Within	0.083	-0.071	-0.158	-0.052	0.104

Notes: The table reports Goodman-Bacon Decomposition analysis for violent crimes. Weight column reports the weight in the overall difference-in-differences estimate based on treatment timing. Beta columns report the two-way fixed-effect estimate for one of the groups based on treatment timing.

Table 6: The Effect of Mass Shooting Incident on Counties Demographics (Successful + Failed Mass Shootings Counties)

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Share of <15 Yrs. Old)	ln(Share of 15-24 Yrs. Old)	ln(Share of 25-39 Yrs. Old)	ln(Share of 40-54 Yrs. Old)	ln(Share of 55-69 Yrs. Old)	ln(Share of >69 Yrs. Old)
Panel A: Age Demographics						
Mass Shooting	-0.016*	-0.001	-0.011	0.015	0.012	0.020*
	(0.008)	(0.010)	(0.008)	(0.012)	(0.008)	(0.011)
Observations	4140	4140	4140	4140	4140	4140
Panel B: Other Demographics						
	(1)	(2)	(3)			
	ln(Share of Blacks)	ln(Share of Hispanics)	ln(Share of Female)			
Mass Shooting	-0.019	-0.026	0.001			
	(0.022)	(0.018)	(0.001)			
Observations	4140	4140	4140			

Notes: The counties demographics data are obtained from U.S. Census Bureau Intercensal Population Estimate. The estimates show the effect of mass shooting on counties demographics. All regressions are weighted by county population averaged over the analysis period (2000-2019) and include controls for county and state-by-year fixed effects. Heteroskedastic- and clustered-robust standard errors at the county level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

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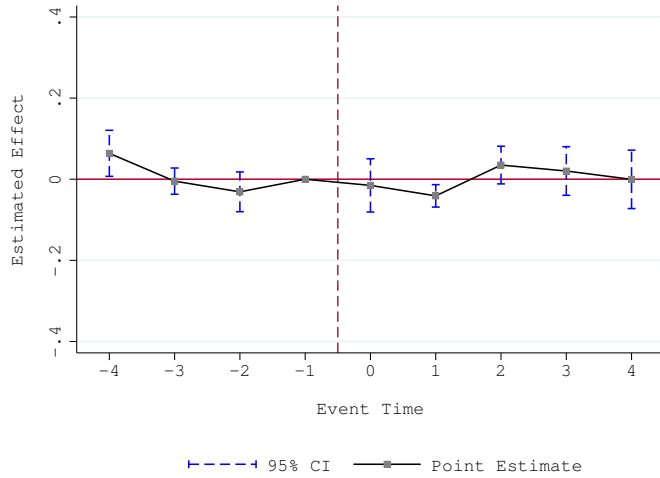
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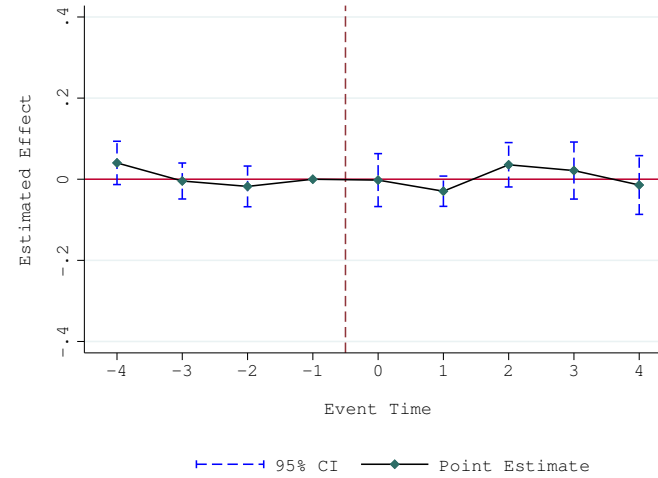
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Appendix

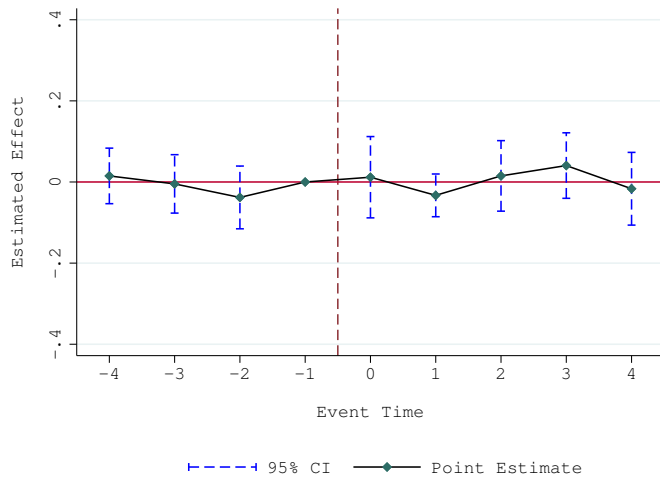
Figure 1: Effect of Mass Shooting on Natural Log of Murder Rate



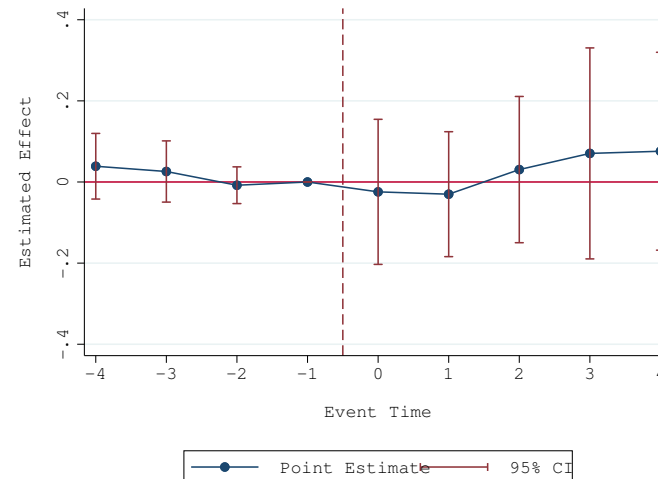
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



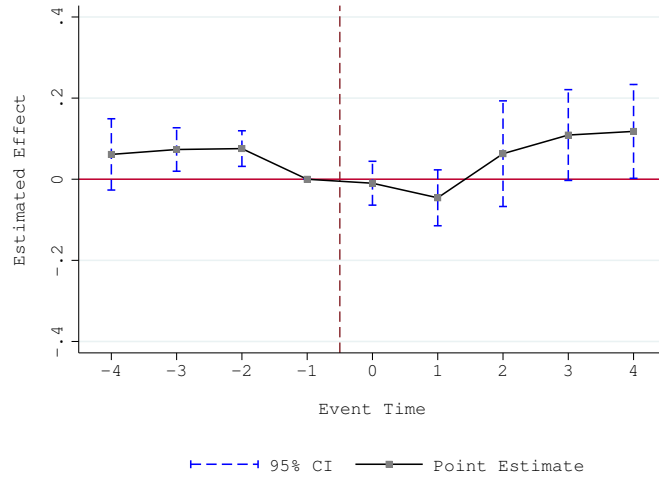
(c) With State-by-Year Fixed Effects



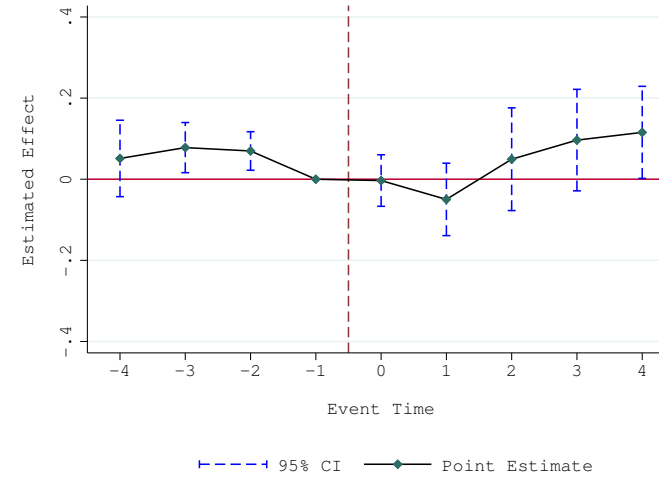
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

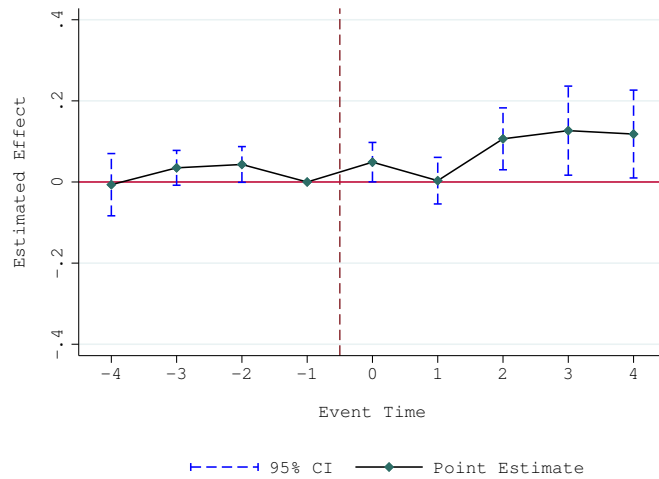
Figure 2: Effect of Mass Shooting on Natural Log of Rape Rate



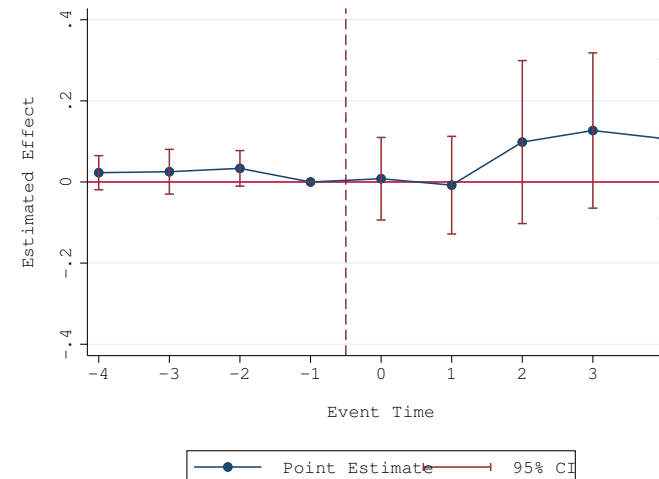
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



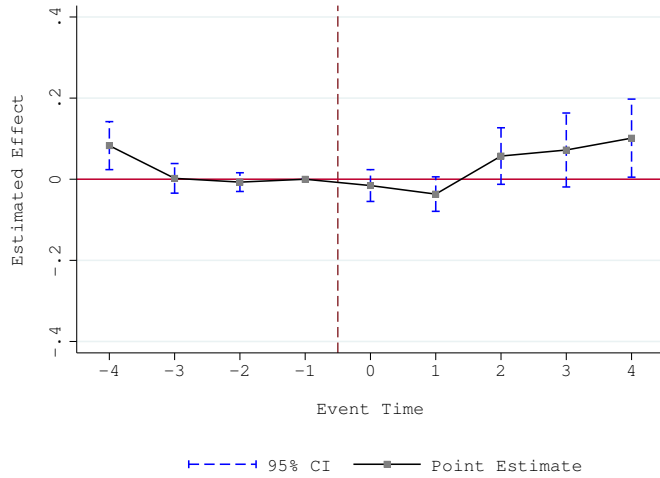
(c) With State-by-Year Fixed Effects



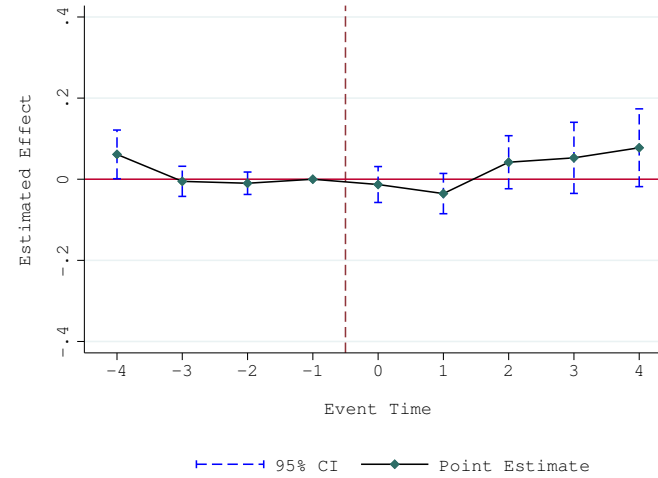
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

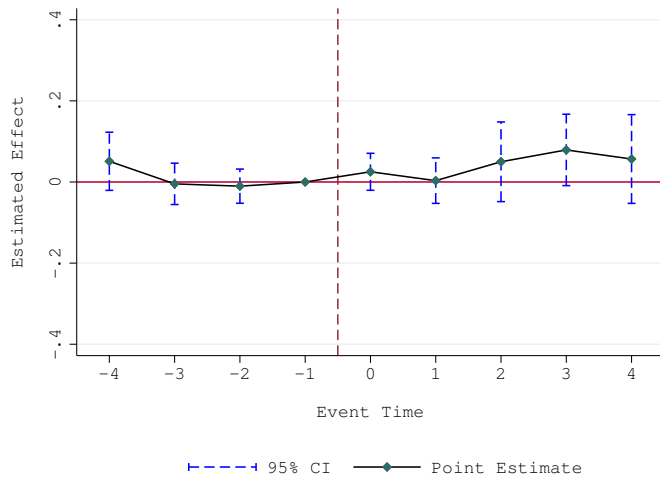
Figure 3: Effect of Mass Shooting on Natural Log of Robbery Rate



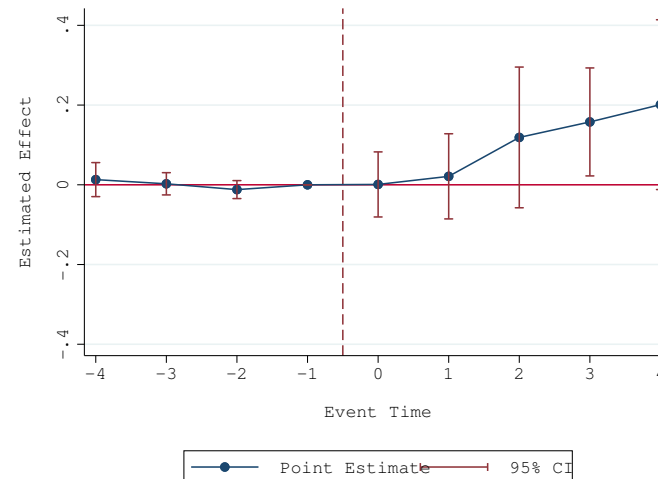
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



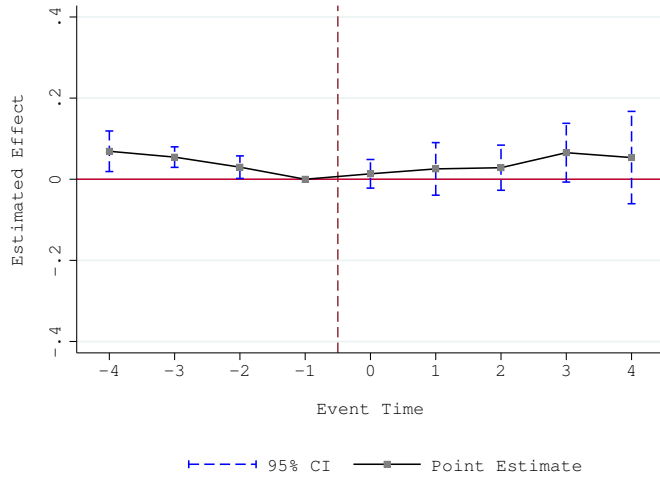
(c) With State-by-Year Fixed Effects



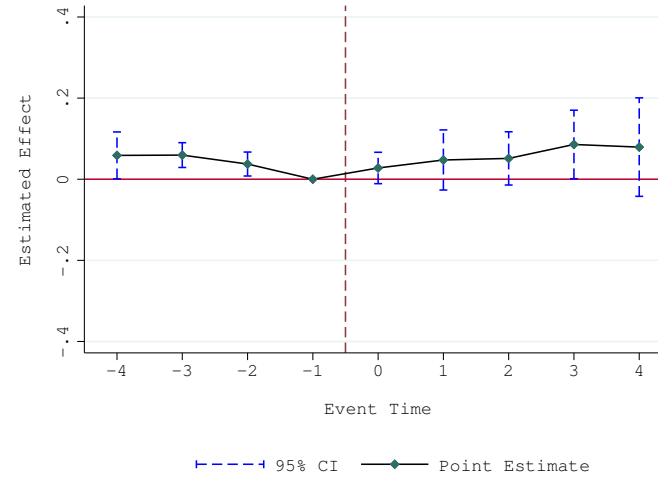
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

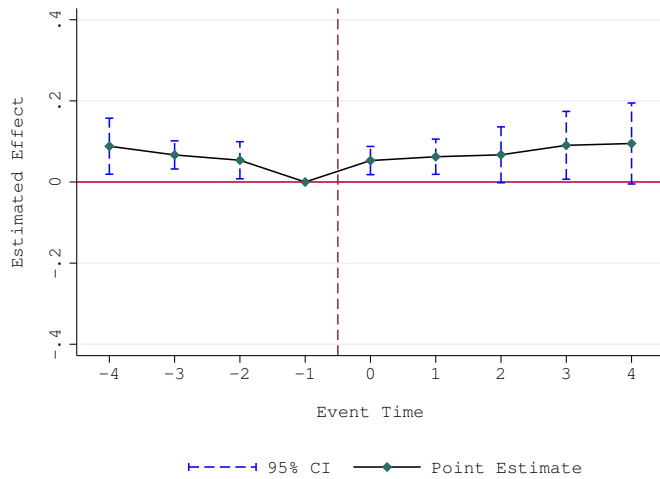
Figure 4: Effect of Mass Shooting on Natural Log of Aggravated Assault Rate



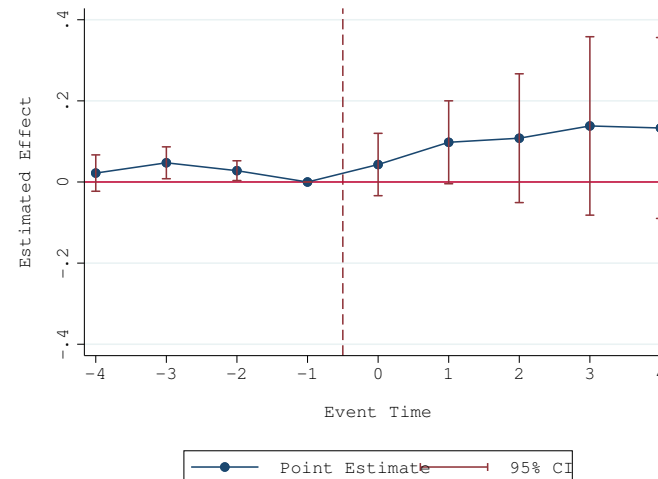
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



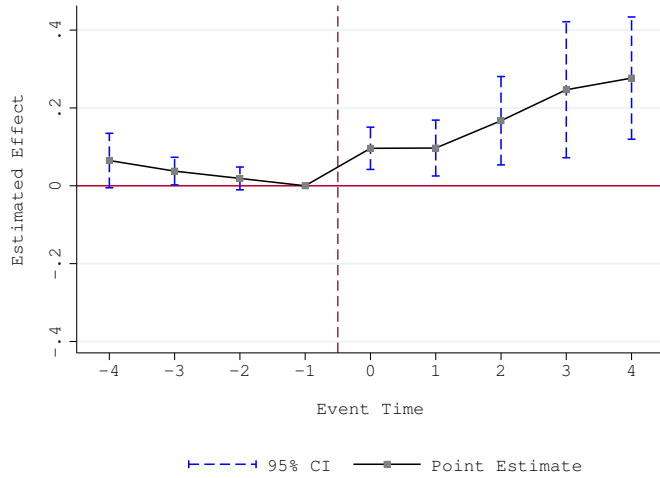
(c) With State-by-Year Fixed Effects



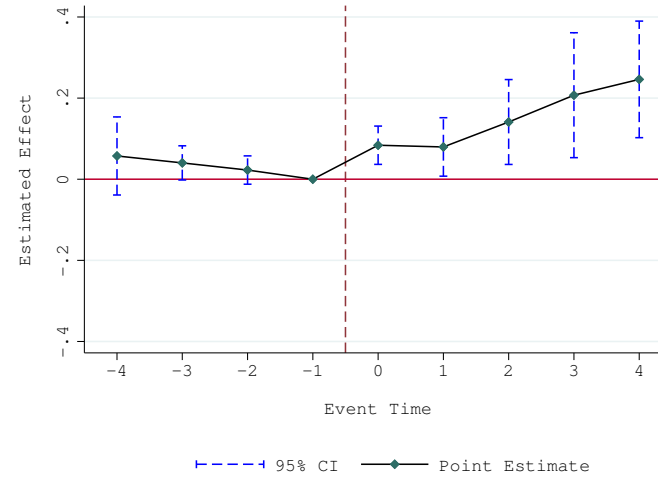
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

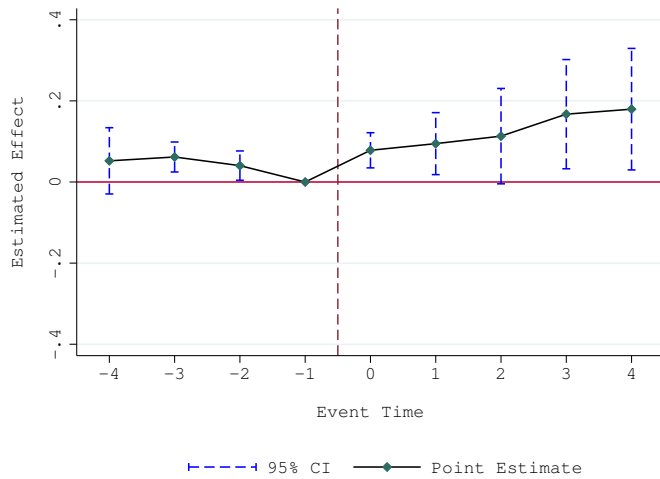
Figure 5: Effect of Mass Shooting on Natural Log of Burglary Rate



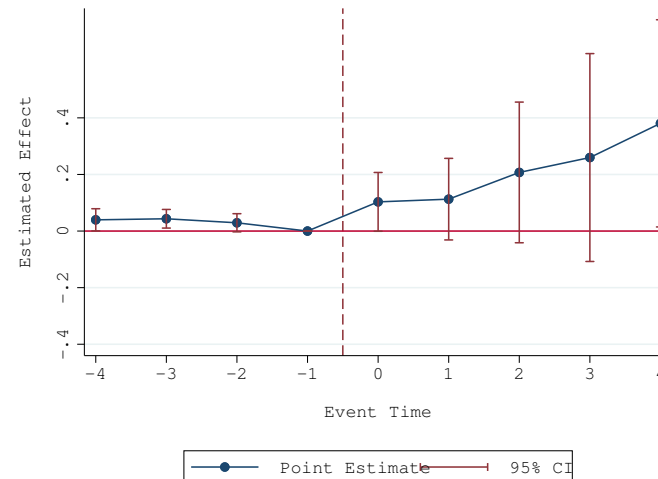
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



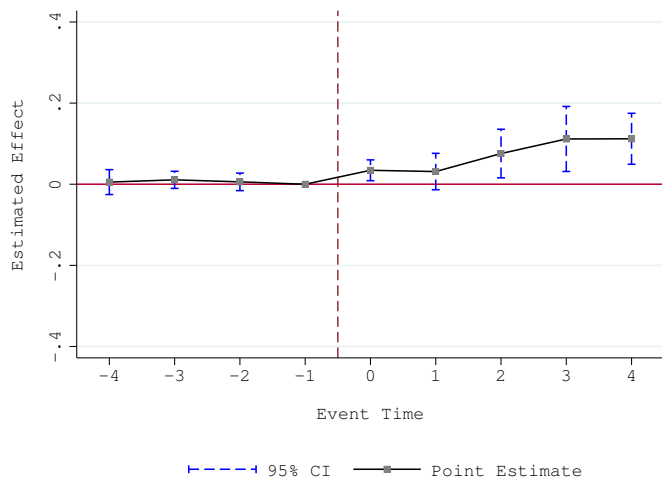
(c) With State-by-Year Fixed Effects



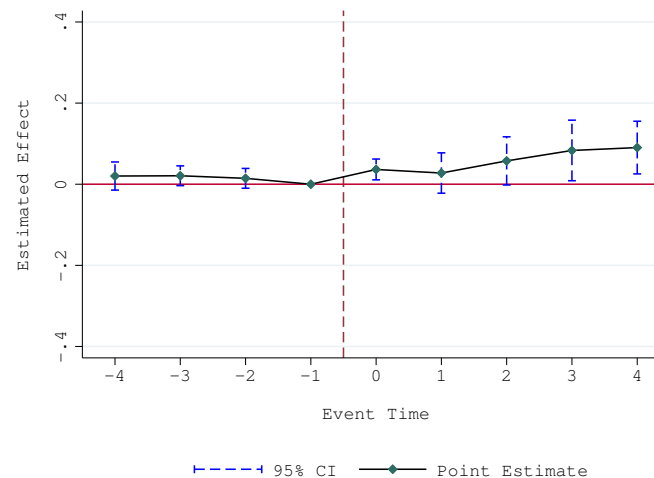
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

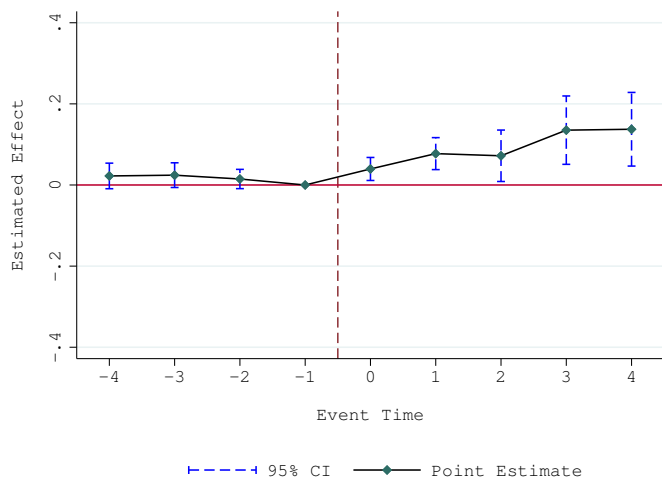
Figure 6: Effect of Mass Shooting on Natural Log of Larceny Rate



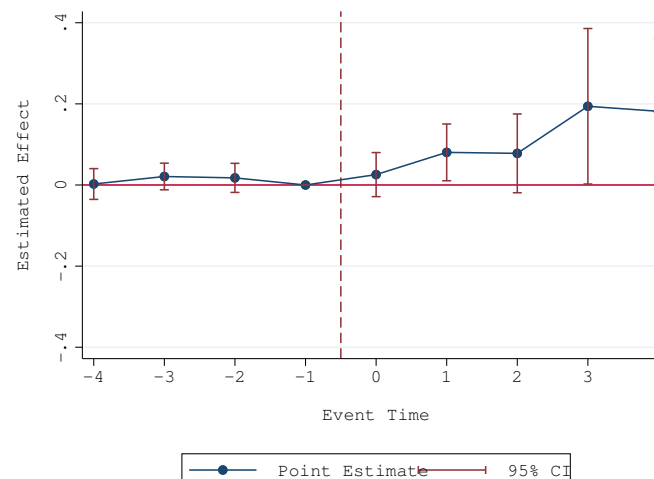
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



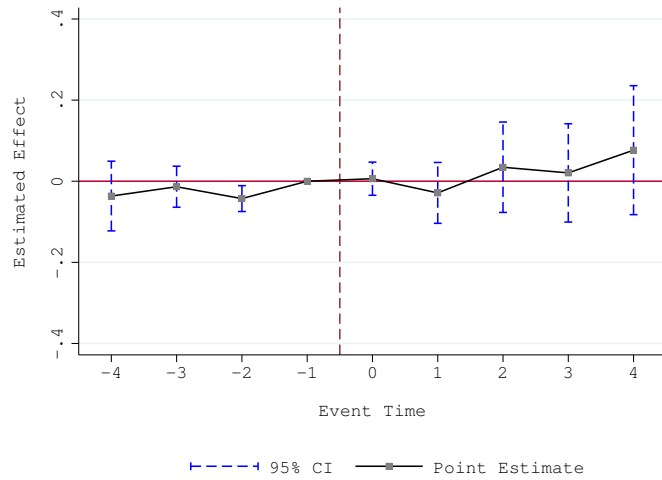
(c) With State-by-Year Fixed Effects



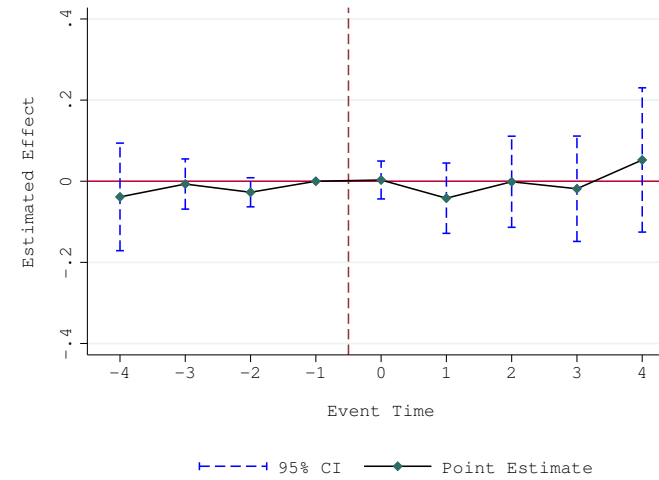
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

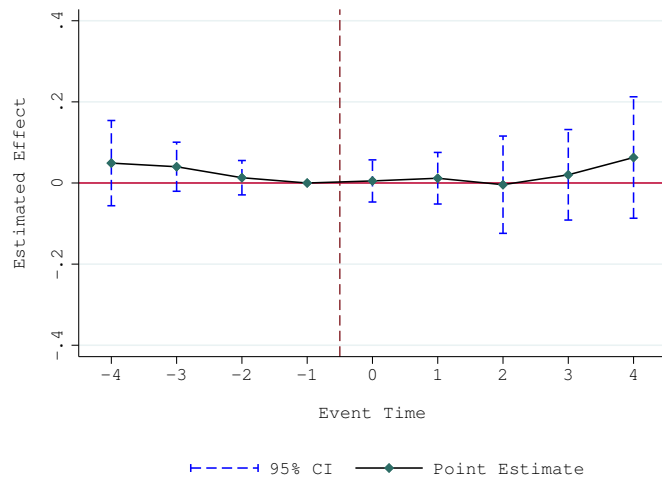
Figure 7: Effect of Mass Shooting on Natural Log of Vehicle Theft Rate



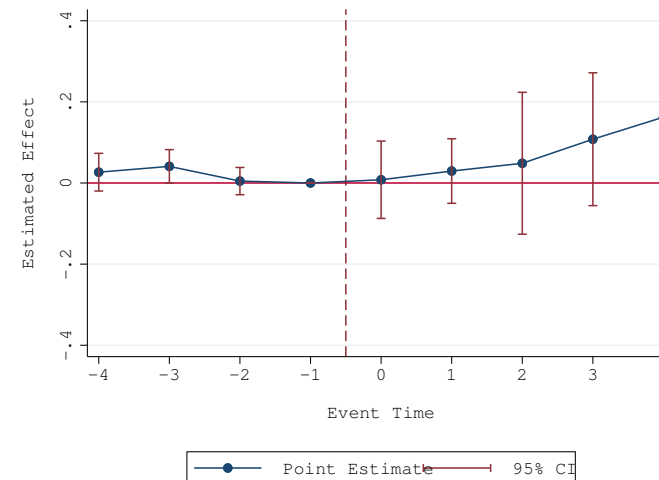
(a) All Counties



(b) Successful + Failed Mass Shooting Counties



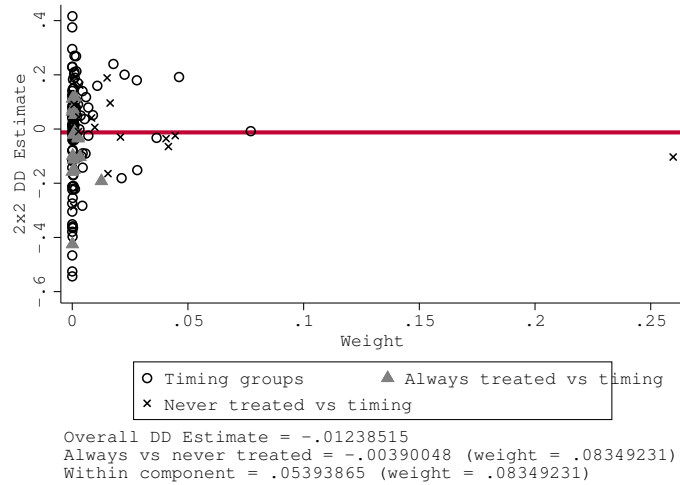
(c) With State-by-Year Fixed Effects



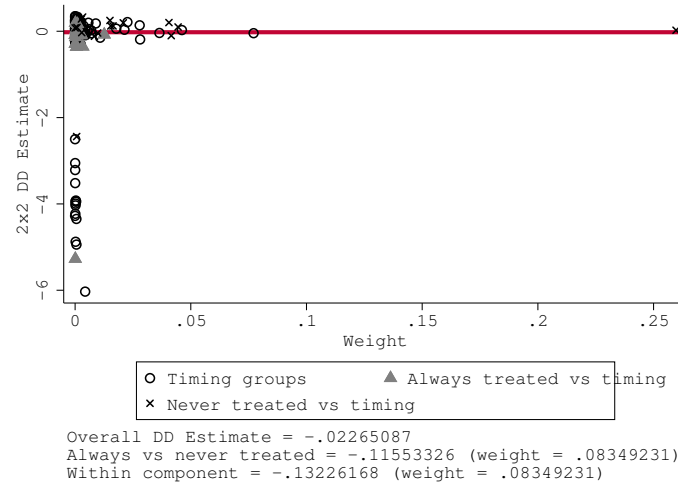
(d) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

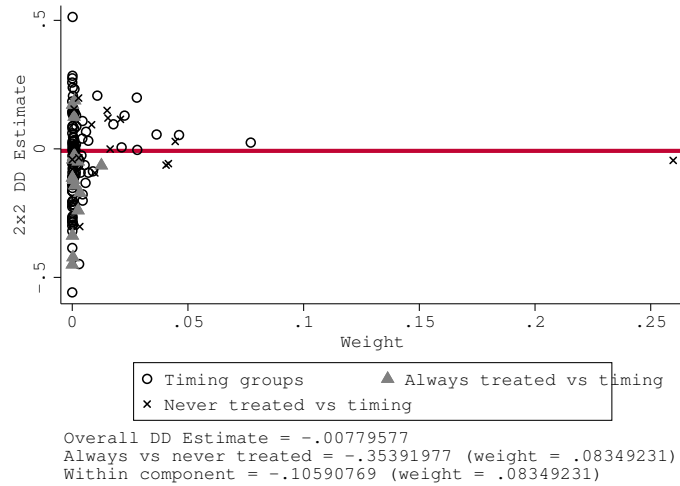
Figure 8: Goodman-Bacon Decomposition (Violent Crimes)



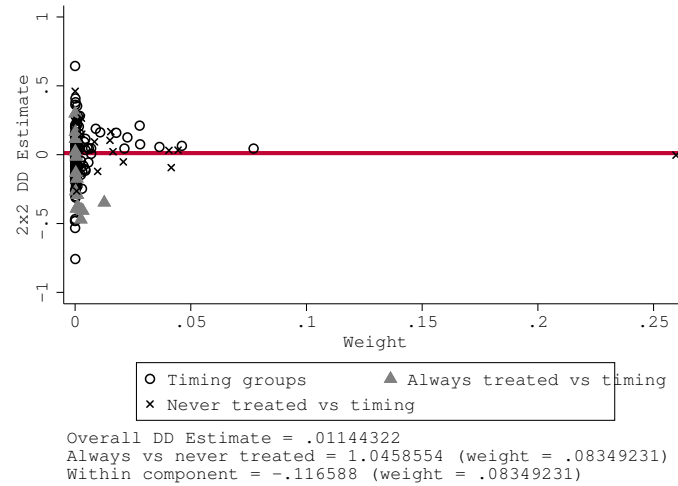
(a) Murder



(b) Rape



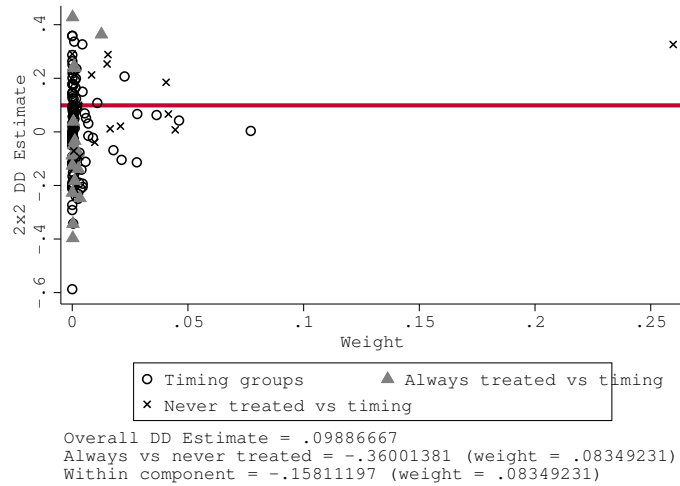
(c) Robbery



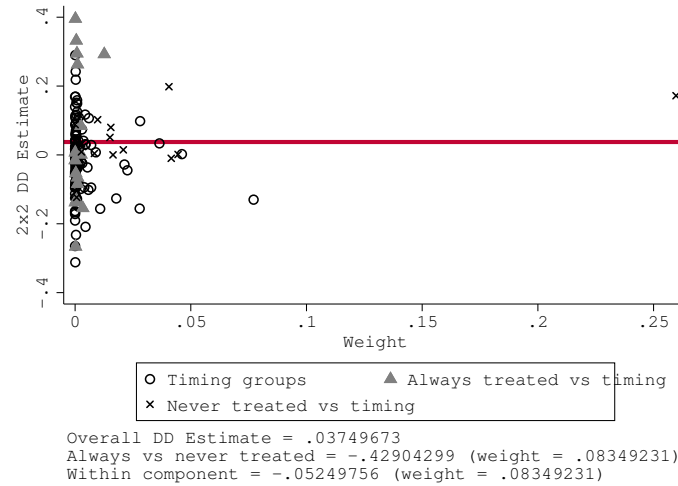
(d) Aggravated Assault

Notes: The y-axis reports the two-way fixed-effect estimate for one of the groups based on treatment timing. The x-axis reports the weight in the overall difference-in-differences estimate based on treatment timing.

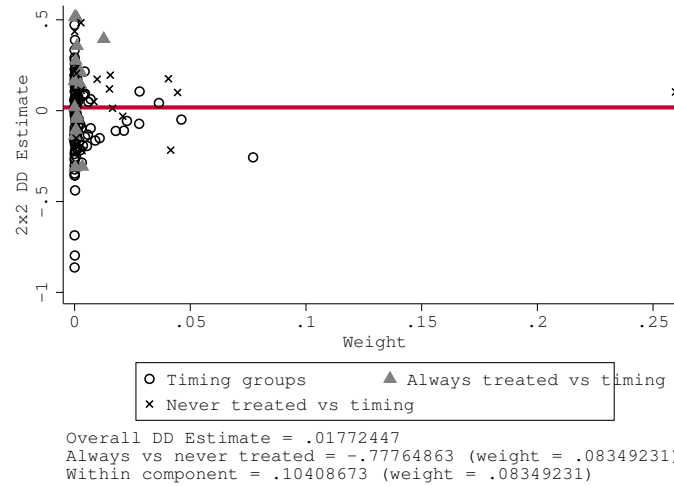
Figure 9: Goodman-Bacon Decomposition (Property Crimes)



(a) Burglary



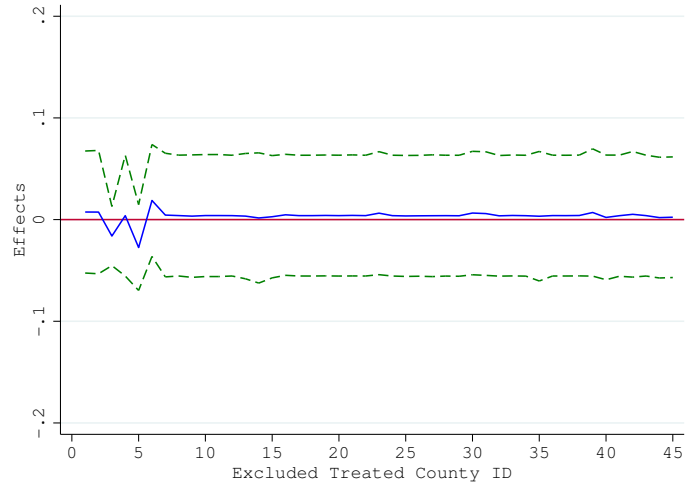
(b) Larceny



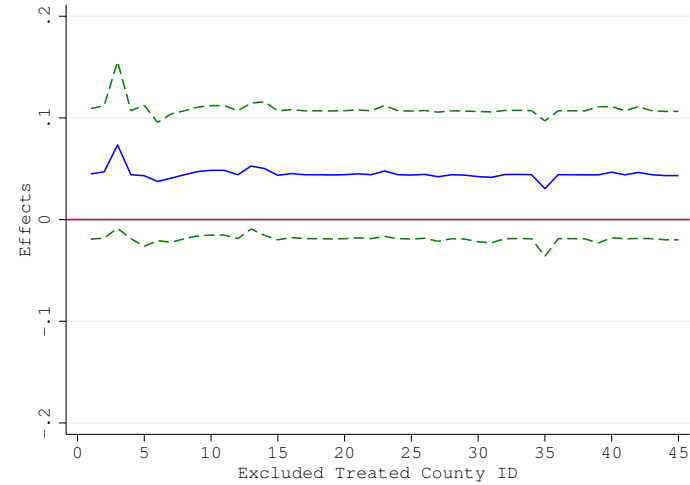
(c) Vehicle Theft

Notes: The y-axis reports the two-way fixed-effect estimate for one of the groups based on treatment timing. The x-axis reports the weight in the overall difference-in-differences estimate based on treatment timing.

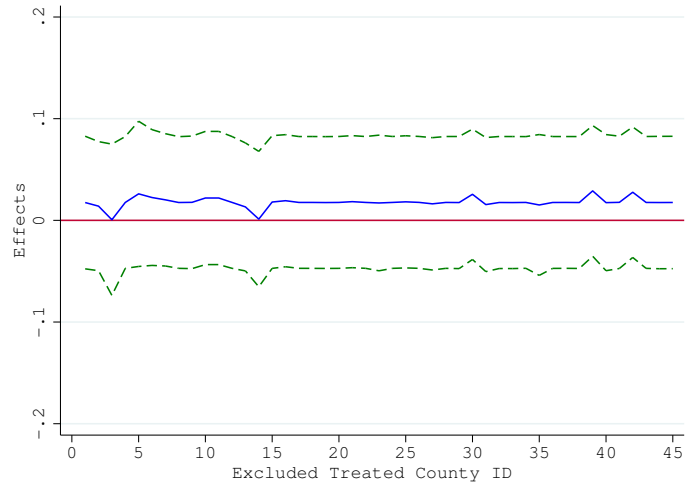
Figure 10: Leave-one-out Analysis (Violent Crimes)



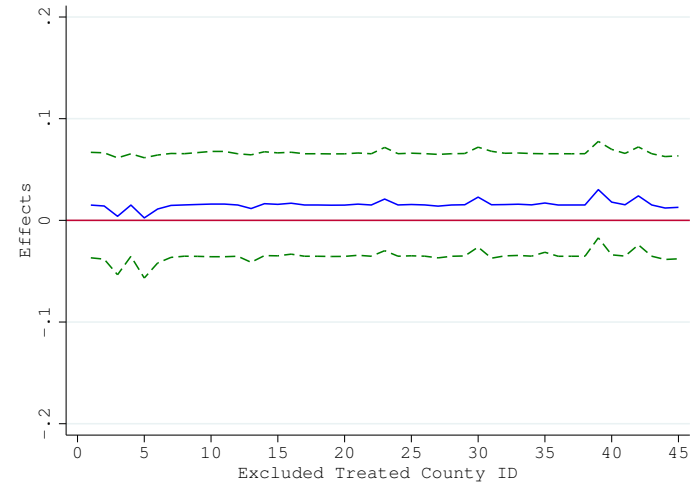
(a) Murder



(b) Rape



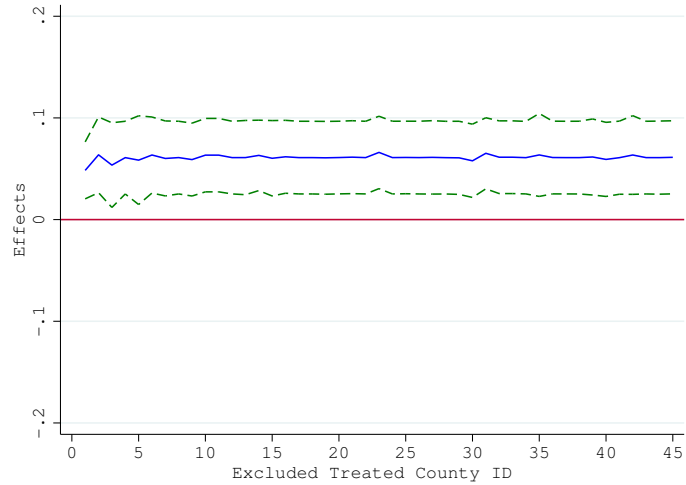
(c) Robbery



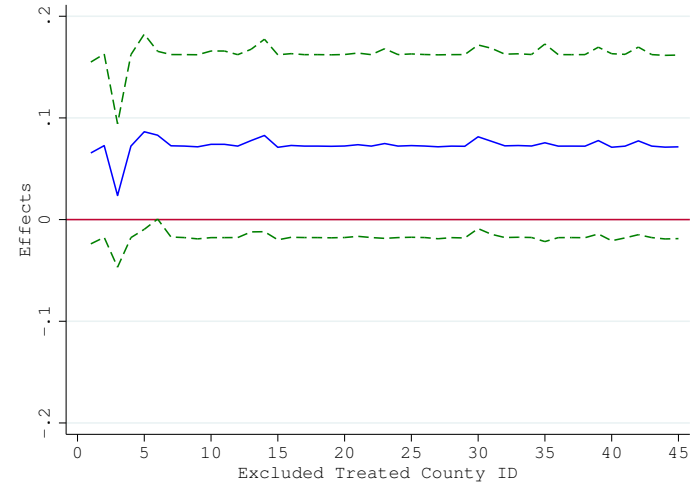
(d) Aggravated Assault

Notes: The figure show the estimate of the effect when the treated county ID in the corresponding x-axis is excluded from the regression. Only counties with successful and failed mass shootings are included in the analysis. The blue line represents the coefficient estimates, while the green dash lines represent the 95% confidence interval constructed based on standard errors cluster at the county level. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county and state-by-year fixed effects.

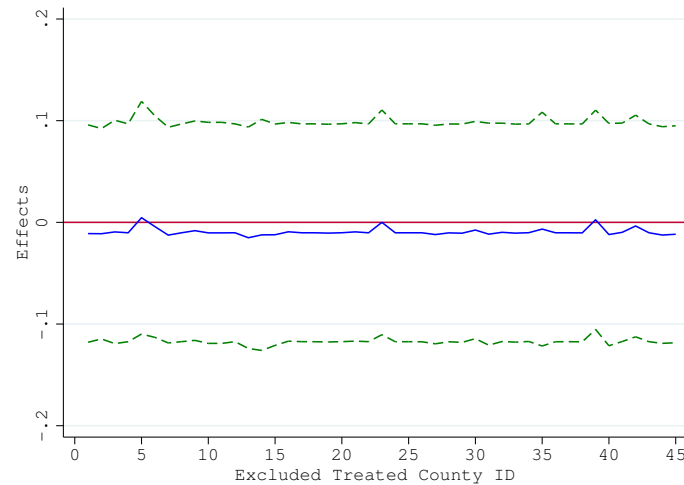
Figure 11: Leave-one-out Analysis (Property Crimes)



(a) Larceny



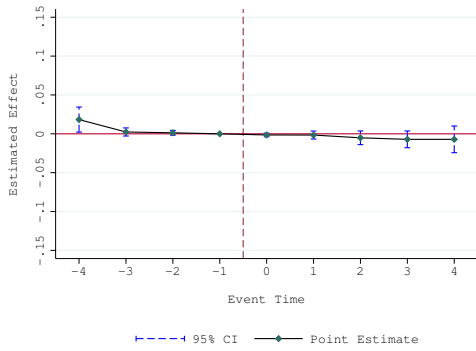
(b) Burglary



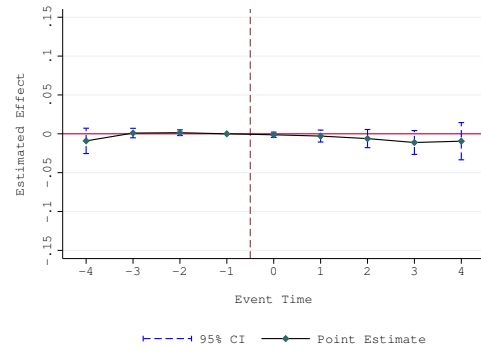
(c) Motor Vehicle Theft

Notes: The figure show the estimate of the effect when the treated county ID in the corresponding x-axis is excluded from the regression. Only counties with successful and failed mass shootings are included in the analysis. The blue line represents the coefficient estimates, while the green dash lines represent the 95% confidence interval constructed based on standard errors cluster at the county level. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county and state-by-year fixed effects.

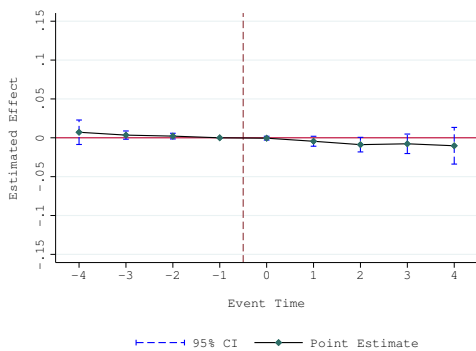
Figure 12: The Effect of Mass Shooting on Counties Demographics (Successful + Failed Mass Shootings Counties)



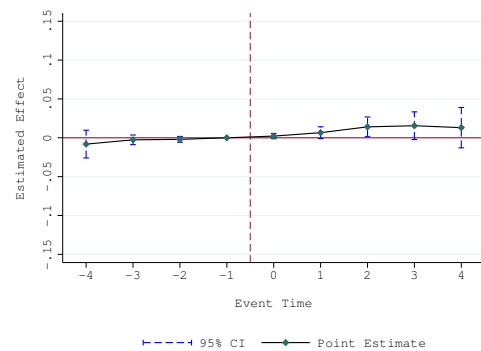
(a) < 15 Years Old



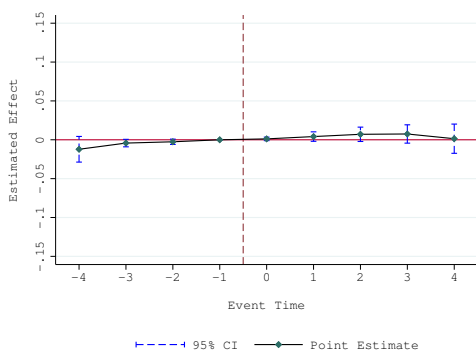
(b) 15-24 Years Old



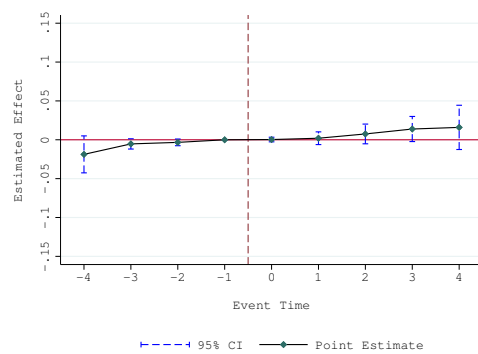
(c) 25-39 Years Old



(d) 40-54 Years Old

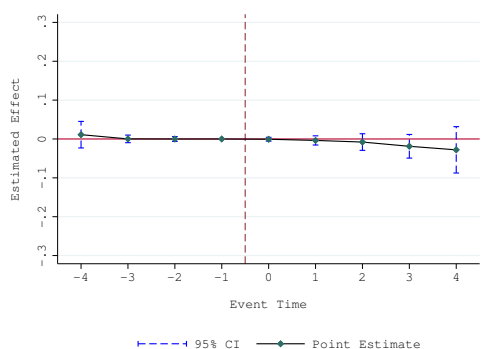


(e) 55-69 Years Old

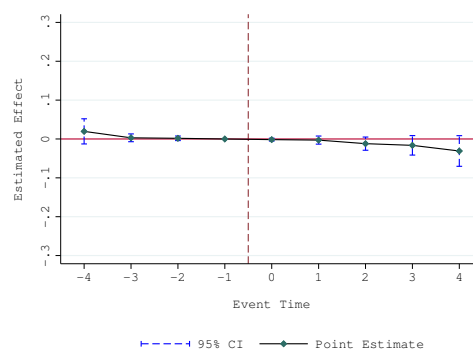


(f) > 69 Years Old

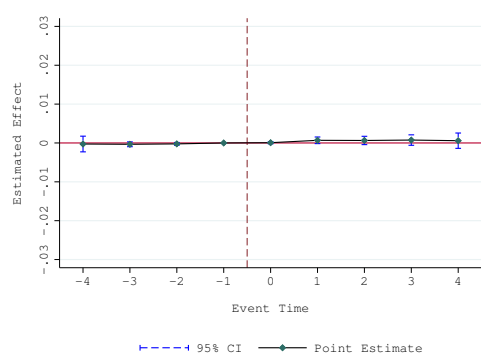
Continued – The Effect of Mass Shooting on Counties Demographics



(a) Share of Blacks



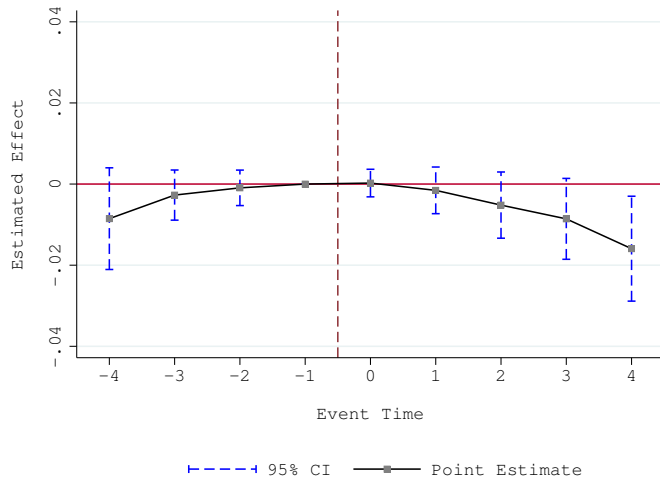
(b) Share of Hispanics



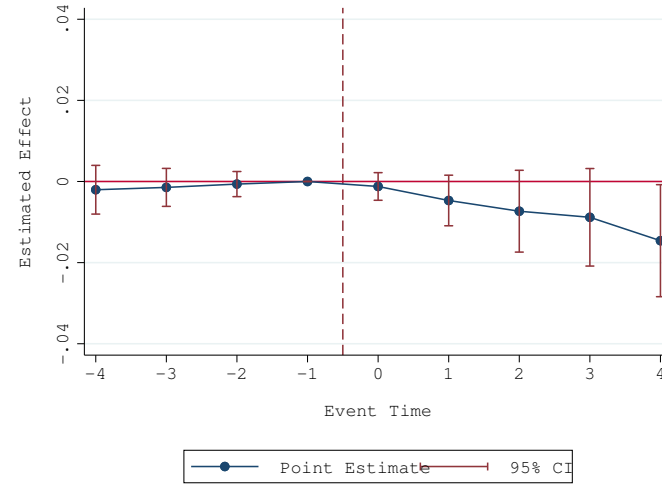
(c) Share of Female

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. Counties demographics data are obtained from Annual County Resident Population Estimates by Age, Sex, Race, and Hispanic Origin. All regressions are weighted by county population averaged over the analysis period (2000-2019) and include controls for county and state-by-year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

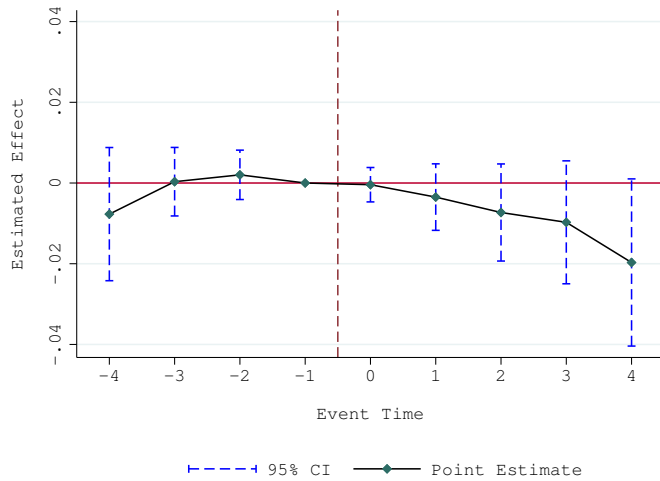
Figure 13: Effect of Mass Shooting on Natural Log of Jobs per Capita



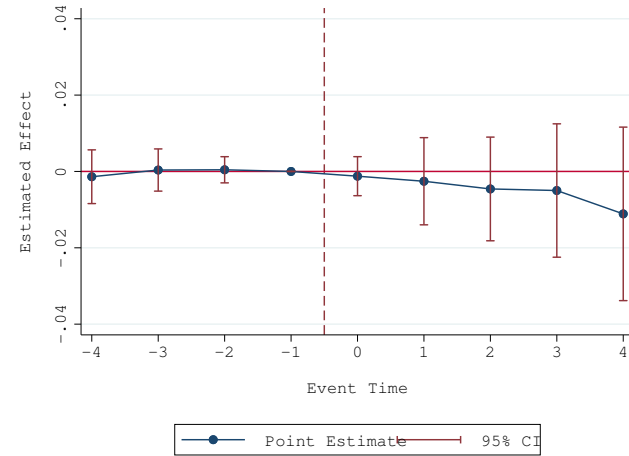
(a) All Counties



(b) (All Counties) De Chaisemartin and d'Haultfoeuille (2020a) Estimator



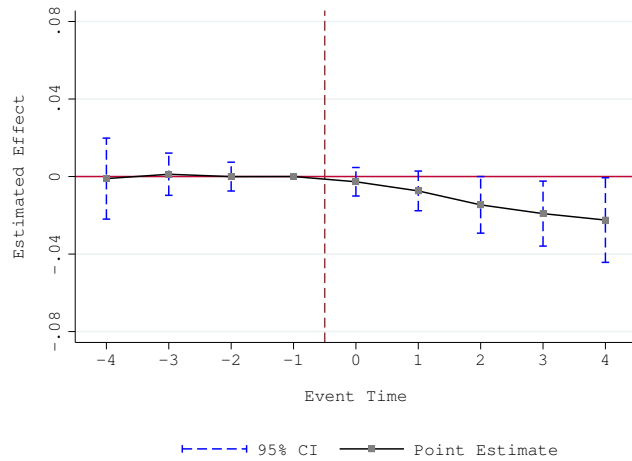
(c) Successful + Failed Mass Shooting Counties



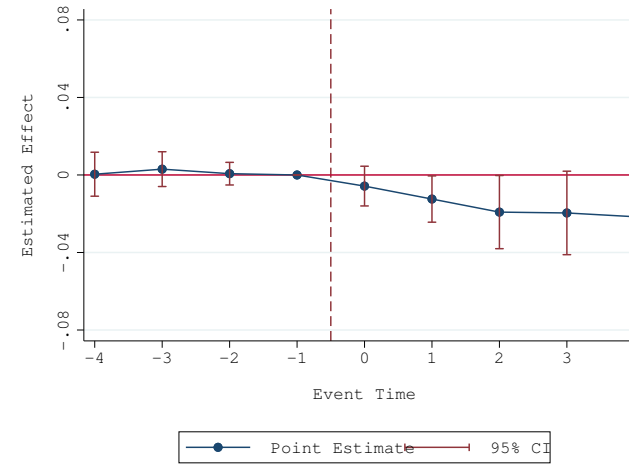
(d) (Successful+Failed Counties) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. The jobs per capita data are obtained from Quarterly Census of Employment and Wages. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2019) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county and state-by-year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

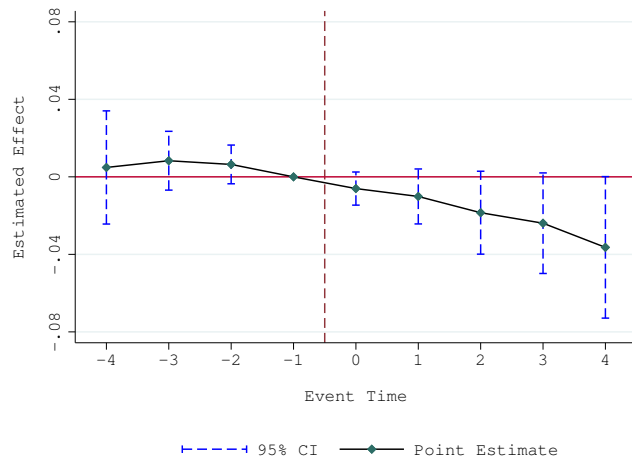
Figure 14: Effect of Mass Shooting on Natural Log of Earnings per Capita



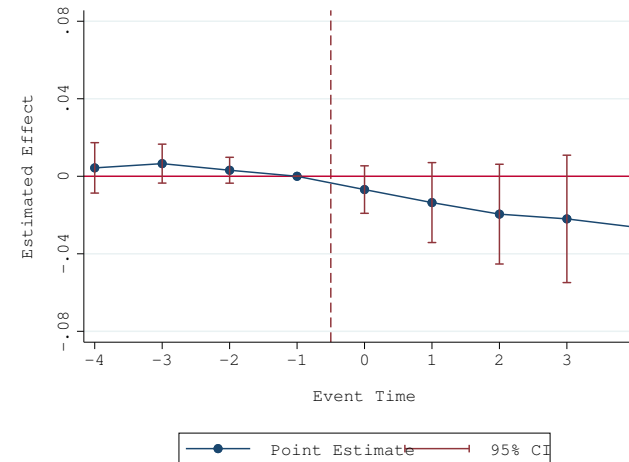
(a) All Counties



(b) (All Counties) De Chaisemartin and d'Haultfoeuille (2020a) Estimator



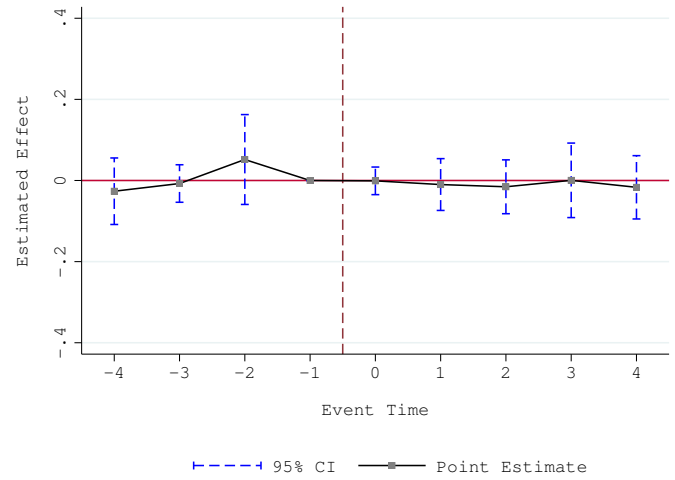
(c) Successful + Failed Mass Shooting Counties



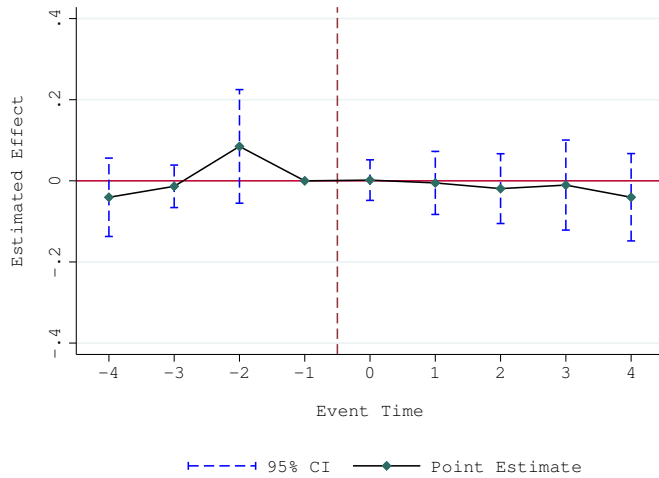
(d) (Successful+Failed Counties) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. The earnings per capita data are obtained from Quarterly Census of Employment and Wages. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2019) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county and state-by-year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.

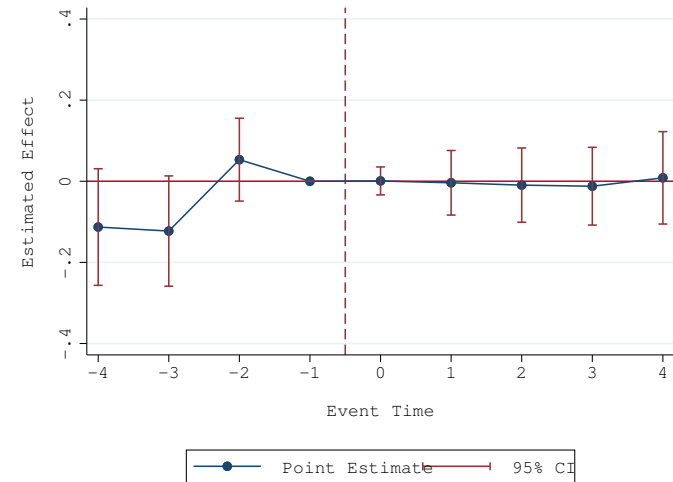
Figure 15: Effect of Mass Shooting on Natural Log of Officers per 100,000



(a) All Counties



(b) Successful+Failed Mass Shooting Counties



(c) (Successful+Failed Counties) De Chaisemartin and d'Haultfoeuille (2020a) Estimator

Notes: The mass shootings data are obtained from Mother Jones. Information on counties with failed mass shootings are from FBI Active Incident Shooter Report. All coefficients are relative to the year prior to mass shooting. All regressions are weighted by county population averaged over the analysis period (2000-2017) and include controls for population share of blacks, population share of hispanics, population share of female, share of population aged less than 15, 15 to 24, 25 to 39, 40 to 54, 55 to 69, and above 69, county fixed effects, and state-by-year fixed effects. 95% confidence intervals constructed with standard errors clustered at the county level are provided in the figure.