Gun Violence in Black and White: Evidence from Policy Reform in Missouri

Morgan C. Williams, Jr.*

Department of Economics, City University of New York Graduate Center

National Bureau of Economic Research

September 15, 2017

Abstract

The role of state-level background check requirements for private firearm sales in reducing gun violence remains controversial in both the empirical literature and gun control policy debate. On August 28, 2007 the Missouri General Assembly repealed an 86 year-old "permit-to-purchase" (PTP) law requiring that handgun purchasers possess a permit, and subsequently undergo a background check, for all sales. The vast racial disparities in firearm homicide within Missouri raises important questions concerning the disproportionate impact of the repeal on Black communities throughout the state. Using generalized synthetic control estimation, this paper finds that the PTP repeal led to a modest increase in county-level gun ownership in addition to substantial evidence of increased firearm homicide in the early years of the 2007-2013 post-repeal period. In particular, state-level effects suggests that overall Black firearm homicide increases on average by an additional five deaths per 100,000 while the same rates for Black victims ages 15-24 rise by 29 deaths per 100,000. County-level estimates also show considerable increases in firearm homicide in Black communities within the more urban regions of the state. Treatment effect estimates for state-level Black firearm homicide translate into approximately an additional 260 deaths attributable to the change in the law over the 2007-2013 period.

*Morgan C. Williams, Jr. is a Ph.D. Candidate in the City University of New York Graduate Center Department of Economics and a National Bureau of Economic Research (NBER) Predoctoral Fellow in Aging and Health Research; Address: 365 Fifth Ave. Rm. 5313, New York, NY, 10016; Email: mwilliams@gradcenter.cuny.edu. I would like to thank my advisor Michael Grossman, David Jaeger, Ted Joyce, Glenn Loury, Rajiv Sethi, Dan 'O'Flaherty, Josh Angrist, David Autor, Joseph Doyle, and Van Tran for their support throughout this project. I would also like to thank the participants in David Jaeger's Brownbag Seminar, the GC Economics Department Seminar in Applied Economics, the MIT Labor Lunch Seminar, and the Columbia University Race, Ethnicity, and Migration (REM) Workshop for all of their feedback.

1 Introduction

Despite experiencing significant declines over the past twenty years, gun violence remains considerably higher in the United States relative to other western countries with significant disparities across racial groups (Grinshteyn and Hemenway (2016)). While accounting for less than 13 percent of the population, Black Americans remain disproportionately represented in both homicide offending and victimization. In 2008, the Black homicide victimization rate exceeded the corresponding rate for White Americans by six fold with Black homicide offending rates in the same year being seven times greater. Homicide alone contributes nearly a full year to the 4.7 year gap in life expectancy gap between Black and White U.S. males (Kochanek, Arias, and Anderson (2013)). U.S. gun violence remains particularly concentrated in large urban cities and metropolitan areas across the country (Glaeser and Sacerdote (1999); O'Flaherty and Sethi (2010c)).

Over the course of the twentieth century, the U.S. experienced important changes in gun control laws designed to limit the proliferation of firearms to individuals associated with criminal activity. In particular, the 1993 Brady Handgun Violence Prevention Act set a federal mandate requiring background checks for all federal firearms license (FFL) sales and left regulation of private firearm sales to states. Several states require that both unlicensed and licensed gun dealers perform background checks before making a transaction. Other states mandate that all individuals (i.e., licensed or unlicensed) seeking to make a firearm purchase must possess a permit—also known as permit-to-purchase (PTP) laws. According to the Bureau of Justice Statistics (BJS) 2005 Survey of State Procedures Related to Firearm Sales, only 16 states required some form of background check or licensing for private firearm sales. Despite the existence of significant racial disparities in firearm homicide victimization, the extent to which state-level gun control policies influence racial differences in homicide remains largely unexplored within the gun control literature.

This paper examines how the 2007 permit-to-purchase law repeal influenced racial differences in homicide within the state of Missouri. Under the former law, individuals wishing to purchase

a handgun were required to apply for a permit for all firearm sales (i.e., licensed and unlicensed). The repeal of the 86 year old PTP law effectively removed any formal screening of private firearm sales within the state. Ranking among those states leading the nation in firearm homicide, Missouri serves as an interesting case study on the effects of gun control policy on firearm homicide for several reasons. First, the PTP law repeal took place more than 10 years after the national implementation of the Brady Act which led to changes in gun control policies for FFL dealers operating in several states. Second, Missouri possesses an extensive gun culture with robust primary and secondary markets for firearms throughout the state. The post-repeal period appears to coincide with a considerable increase in a proxy for overall gun prevalence in addition to a rise in the number of crime guns in Missouri originally purchased in the state.[1] This paper argues that the removal of legally required background checks led to an exogenous increase in gun proliferation to secondary markets with estimation results mirroring the geographic distribution of recovered crime guns. Lastly, gun violence remains heavily concentrated among young Black men within the urban regions of the state such as the City of St. Louis, St. Louis County, and Kansas City (Jackson County)–accounting for nearly 80 percent of all firearm deaths in 2006. Support for stricter gun control policies in cities runs in stark contrast to the widespread support for less restrictive gun laws in rural areas of the state (Edsall (1999)).

This study addresses a key issue within the empirical literature on gun control policy concerning the selection of control units in constructing counterfactual homicide rates. Studies evaluating changes in state and federal gun laws provide fairly mixed evidence concerning their protective effects and often disagree on the selection of a suitable control group (Loftin et al. (1991); Kleck and Patterson (1993); Britt, Kleck, and Bordua (1996); Ludwig and Cook (2000); Koper and Roth

[1]Unfortunately, Section 571.093 of the Revised Statutes of Missouri precludes the sharing of permit-to-purchase a firearm application data by any Missouri county sheriff's office and states, "If any sheriff retains record of permits to obtain concealable firearms issued under former section 571.090, as repealed by senate bills nos. 62 and 41 of the ninety-fourth general assembly, then such records shall be closed to the public. No such record shall be made available for any purpose whatsoever unless its disclosure is mandated by a valid court order relating to a criminal investigation."

(2002); Levitt (2004)). Webster, Crifasi, and Vernick (2014) evaluate the state-level consequences of the PTP repeal in Missouri and report an ordinary least squares estimate of an additional 1.09 firearm homicide deaths per 100,000. While finding evidence of a slightly smaller treatment effect of 0.9716 for overall firearm homicide, this study also re-examines the effects of the PTP law repeal on various Missouri subpopulations utilizing the generalized synthetic control (GSC) estimator introduced in Xu (2017). Building on the Abadie, Diamond, and Hainmueller (2010) synthetic control (SC) methodology and the interactive fixed effects model from Bai (2009), GSC estimation relaxes several assumptions behind SC estimation which assist in constructing valid counterfactual firearm homicide trends in Missouri–namely the inclusion of multiple treatment units and the reweighting of full control group data by accounting for unobservable latent factors. Thus, GSC estimation permits a deeper analysis into the persistently high Black firearm homicide rates in Missouri (relative to other states) and provides evidence of the heterogenous impact of the PTP repeal at the county-level. These results suggests that the PTP repeal led to significant increases in Black firearm homicide of five to six additional deaths per 100,000 over the post-repeal period. In particular, firearm homicide among Black victims ages 15-24 increases on average by an additional 29 deaths over this period with substantial increases in overall Black firearm homicide in the City of St. Louis, St. Louis County, and Jackson County. The greatest impact of the PTP repeal generally takes place within the first few years of the post-repeal period and findings remains consistent with theories based on strategic complementarities in the economics of crime literature.

The paper proceeds in the following manner. Section 1.1 examines descriptive evidence concerning post-repeal changes in gun proliferation and the growing number of firearms recovered from crime scenes. Section 1.2 examines racial differences in Missouri firearm homicide trends and provides context for these trends in urban areas of the state accounting for the majority of gun violence. Section 2 describes the empirical strategy, data sources, and sample restrictions for this paper. Section 3 provides county-level estimates of the effects of the PTP repeal on gun ownership while Section 4 reports the state-level and county-level firearm homicide results. An immediate

discussion follows exploring the underlying mechanisms for the disproportionate impact of the PTP repeal on Black firearm homicide in Section 6. The paper concludes in Section 7.

1.1 Gun Ownership and the 2007 Missouri Permit-to-Purchase Law Repeal

In examining the the effects of the 2007 PTP repeal on firearm homicide within Missouri, an important question remains whether or not the repeal also led to an increase in the proliferation of firearms throughout the state. The number of background checks performed by federally licensed dealers provides some information concerning the increase in gun prevalence after the 2007 repeal. Figure 1 shows trends in National Instant Criminal Background Check System (NICS) background checks in Missouri and the U.S. by gun type. Under the former permit-to-purchase law, background checks by FFL dealers supplemented the more extensive checks conducted by local sheriffs' offices throughout the state–which included information from records on civil proceedings and previous arrests.[2] While the NICS measure only reflects the rate of background checks in (potential) sales to FFL dealers, these rates provide valuable insight into the proliferation of firearms to secondary markets (legal and illegal). Missouri experiences a sharp post-repeal increase in handgun background checks relative to the national level. Missouri FFL dealers conducted an average 719.95 handgun background checks per 100,000 residents between 1999 and 2006 before rising to 1,381.34 handgun background checks in 2007 and peaking at 3,982.92 in 2013. Similar to national trends, the rate of long gun background checks remain fairly flat until undergoing a slight increase after 2010.

While administrative data providing reliable estimates of gun prevalence largely remain absent in the U.S., the economics of crime literature offers other insightful proxies for gun ownership (Duggan (2001); Cook and Ludwig (2006)). Empirical work below the national and state-level

[2]The FBI launched NICS in 1998 as mandated by the Brady Handgun Violence Prevention Act of 1993. The FBI requires all FFLs to conduct a background check for all potential firearm or explosives purchases with intrastate private purchases being regulated by state law. NICS background checks generally take only a few minutes, but any check taking longer than three days in duration can proceed legally without further inquiry. For more information see: https://www.fbi.gov/services/cjis/nics

often utilize the fraction of suicides committed with a firearm (FSS) in estimating firearm prevalence in local private markets. Cook and Ludwig (2006) find evidence of a strong (positive) correlation between FSS and gun ownership measured in the General Social Survey relative to the correlation of the latter with *Guns and Ammo* magazine subscriptions. The authors also provide county-level evidence of a 0.173 firearm homicide elasticity with respect to lagged FSS. Moreover, the strong association between FSS and firearm homicide among victims ages 15-19 suggests that local secondary markets play an important role in driving the proliferation of firearms to underground markets.

Figure 2 shows county-level variation in FSS over the 1981-2013 study period for Jackson County, St. Louis County, and the City of St. Louis. Jackson County experiences a slight decline in FSS during the mid-2000s before rising to 43.3 percent in 2009. In St. Louis County, FSS fluctuates between 30 and 40 percent before reaching a high of 44 percent in 2012. However, the largest increase in FSS occurs within the neighboring City of St. Louis with nearly 67 percent of all suicides committed with a firearm in 2011.

This study specifically assesses the extent to which firearms become increasingly available among individuals associated with criminal activity. Table 1 provides descriptive evidence concerning the rate at which firearms tend to appear in Missouri crimes scenes relative to their purchase date. Since 2006 the average amount of time before recovery at a Missouri crime scene fell 26 percent from 11.22 years to 8.94 years in 2013 or two years below the national average. The Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) also defines unusually short “time-to-crime" rates as crimes guns recovered within two years of original purchase from a FFL dealer and interpret this measure as a sign of gun trafficking. While the Missouri time-to-crime rate stands at 23.44 percent in 2006, this measure reaches a high of 45.3 percent in 2011 before declining slightly to 39.26 percent in 2013. One interpretation of the significant decline in time-to-crime rates remains the increased value that illegal markets place on new firearms as older weapons possess greater risk of malfunction and links to previous crimes (Levitt and Venkatesh (2000)). The City of St. Louis

and Kansas City account for the vast majority of Missouri firearm traces–roughly 40 and 20 percent over the 2007-2013 post-repeal period, respectively. At the height of post-repeal gun violence, the number of traced crime guns rose 28 percent in the City of St. Louis and 39 percent in Kansas City since 2006. Overall, the ATF trace data suggests that the Missouri PTP repeal led to a substantial increase in the domestic proliferation of firearms to illegal secondary markets.

1.2 Race and Homicide in Missouri

A considerable gap exists in the rates of firearm homicide across racial groups in Missouri. Constituting roughly 11 percent of the population, Black Missourians account for approximately 66 percent of all Missouri firearm homicide deaths over the study period. Figure 3 compares Missouri firearm homicide rates to rates at the national level by racial group using vital statistics data. As one might expect, the Black firearm homicide rates in Missouri largely mirror the overall state-level trends due to the significant overrepresentation of Black Missourians in firearm homicide. The Black firearm homicide rate in Missouri peaks at 50.74 per 100,000 in 1993, or roughly twice the national rate, before declining sharply in the late 1990s. The White firearm homicide rates in Missouri slightly exceed the national rates until the late 1990s when both rates fall to less than two deaths per 100,000. Both Black and White firearm homicide rates rise in Missouri during the post-repeal period–although the increase in Black firearm rates rise considerably higher after the PTP repeal.

Mortality data also suggests that an overwhelming number of Missouri firearm homicide deaths occurs among young Black males. In 2006, Black males between the ages of 10 and 30 accounted for nearly 45 percent of *all* firearm homicide deaths in the state. Figure 4 shows racial differences in male firearm homicide within the state of Missouri. While confirming a familiar age gradient in firearm homicide, these data also show the extent of Black male overrepresentation in firearm homicide victimization across all age groups. Black firearm homicide rates are largely driven by young men ages 15-24 and rise to over 200 deaths per 100,000 in the early years of the post-

repeal period. Post-repeal White male firearm homicide remains highest among victims in the intermediate range, but rates for each of these groups never exceeds 10 deaths per 100,000 over the study period.

Table 2 provides descriptive statistics for Jackson County, St. Louis County, and the City of St. Louis which account for the majority of firearm homicide within Missouri. The first four rows show significant changes in average overall firearm homicide and Black firearm homicide in the post-repeal period for all three areas. Black firearm homicide increases roughly 23 percent in the City of St. Louis from an average 40.71 deaths per 100,00 to 49.71 over the 2007-2013 period. Similarly, Jackson County experiences a 16 percent increase in Black firearm homicide and St. Louis County a 26 percent increase. Table 2 shows pronounced socioeconomic disparities among Black and White Missourians in each area. The percentage of female-headed households stands at 20 percent in the City of St. Louis compared to 15.31 percent in Jackson County and 13.64 percent in St. Louis County. Across each of these measures Black-White disparities remain consistently higher within the City of St. Louis which also hosts one of the largest Black populations among U.S. cities. The City of St. Louis also ranks among the top 10 most racially segregated cities in the U.S. with approximately three quarters of Black residents living in a census tract where the average Black person resides. The last two rows also show a considerably higher law enforcement presence for the City of St. Louis in terms of jail incarceration and law enforcement officers per capita.

2 Empirical Strategy

2.1 Generalized Synthetic Control Estimation

The empirical strategy for this study closely follows the generalized synthetic control (GSC) methodology introduced in Xu (2017) which incorporates the interactive fixed effects model developed in Bai (2009) into the synthetic control estimation procedure from Abadie, Diamond, and Hainmueller (2010). The GSC estimator extends the synthetic control methodology in important

ways for the identification of the Missouri PTP repeal effects on firearm homicide. First, GSC estimation allows for more than one treatment unit and subsequently an analysis of the heterogenous impact of the PTP repeal at the county-level. Second, Xu (2017) also provides a parametric bootstrap procedure for the estimation of standard errors with simulations and resampling based on full control group data. Lastly, the synthetic control estimator also fails to construct an adequate counterfactual when covariates and factor loadings of the treated unit lie outside of the convex hull of the control units. During the early-1990s, the City of St. Louis often led the nation in Black firearm homicide and subsequently results in a poor pretreatment fit in constructing a synthetic control unit. With the incorporation of intercept shifts through additive fixed effects, the GSC estimator remains less susceptible to these concerns while also taking advantage of the full data on controls.

Similar to SC estimation, implementation of the GSC estimator in this case study involves finding suitable counterfactual firearm homicide trends after the repeal of the permit-to-purchase law with a crucial identifying assumption being parallel trends during pretreatment period. Let H_{st} denote the firearm homicide rate for unit s at time $t = 1, 2, \ldots, T$ with the number of pre-intervention periods given by T_0 such that $1 \leq T_0 \leq T$, X_{st} a $(k \times 1)$ vector of observed covariates, β a $(k \times 1)$ vector of unknown parameters, f_t a $(r \times 1)$ vector of unobserved common factors, λ_s a $(r \times 1)$ vector of unknown factor loadings, and ϵ_{st} unobserved idiosyncratic shocks with zero mean. GSC estimation assumes a linear factor model given by:

$$H_{st} = \alpha_{st} D_{st} + X'_{st}\beta + \lambda'_s f_t + \epsilon_{st} \tag{1}$$

where D_{st} serves as an indicator taking on a value of one if state s is exposed to the intervention at time t and zero otherwise. If $H_{st}(1)$ and $H_{st}(0)$ denote the potential outcomes, the dynamic

average treatment effect on the treated (ATT) units s at time $t > T_0$ is also given by:

$$\alpha_t = \frac{1}{N_{Treated}} \sum_s [H_{st}(1) - H_{st}(0)] \tag{2}$$

Estimating α_t involves the general causal inference exercise of finding the appropriate counterfactual for unobserved $H_{st}(0)$. Xu (2017) offers a three-step procedure in implementing the GSC estimator α_t^{GSC} while imposing a normalization and orthogonality constraints on the factors. The first step involves estimation of an interactive fixed effects model using control group data to obtain $\hat{\beta}, \hat{F}$, and $\hat{\Lambda}_{CO}$:

$$\begin{aligned} (\hat{\beta}, \hat{F}, \hat{\Lambda}_{CO}) = &\underset{\tilde{\beta}, \tilde{F}, \tilde{\Lambda}_{CO}}{\operatorname{argmin}} \sum_{s \in \text{Controls}} (H_s - X_s\tilde{\beta} - \tilde{F}\tilde{\lambda}_s)'(H_s - X_s\tilde{\beta} - \tilde{F}\tilde{\lambda}_s) \\ &s.t. \quad \tilde{F}'\tilde{F}/T = I_r \quad \text{and} \quad \tilde{\lambda_{CO}}'\tilde{\lambda_{CO}} = \text{diagonal} \end{aligned} \tag{3}$$

Using estimates from step one, step two involves minimizing the pretreatment mean squared prediction error (MSPE) in order to obtain factor loadings λ_s for each treatment unit:

$$\hat{\Lambda} = \underset{\hat{\Lambda}}{\operatorname{argmin}} \sum_{s \in \text{Controls}} (H_{s,T_0} - X_{s,T_0}\hat{\beta} - \hat{F}_{T_0}\tilde{\lambda}_s)'(H_{s,T_0} - X_{s,T_0}\hat{\beta} - \hat{F}_{T_0}\tilde{\lambda}_s) \tag{4}$$

The third step computes $\hat{H}_{st}(0)$ using $\hat{\beta}, \hat{F}, \hat{\lambda}_{CO}$ estimates from the first two steps:

$$\hat{H_{st}}(0) = x'_{st}\hat{\beta} + \hat{\lambda}'_s\hat{f}_t \tag{5}$$

An important challenge to estimating the impact of the PTP repeal on firearm homicide involves accounting for unobservable latent factors which could potentially lead to a violation of the parallel trends assumption. For example, empirical research on firearm homicide often points to the role of expanding crack cocaine markets and gang activity during the 1980s and early-1990s in driving historic rises in homicide (Levitt (2004); Fryer et al. (2013)). Not accounting for such

unobservable factors could produce biased estimation results. While previous research offers some a priori guidance in selecting the number of factors, GSC estimation also integrates a leave-one-out cross-validation procedure which chooses the number of unobservable factors r that minimizes the MSPE.

2.2 Data and Study Sample Construction

This paper utilizes data from a variety of state-level and county-level sources over the 1981-2013 study period–yielding 26 years of pre-intervention data and roughly seven years of post-intervention data.[3] All state-level age-adjusted firearm homicide, nonfirearm homicide, suicide, and firearm suicide rates (per 100,000) come from death certificate data reported in the United States Centers for Disease Control and Prevention (CDC) Web-Based Injury Statistics Query and Reporting System (WISQARS) Fatal Injury Reports while corresponding county-level data come from the CDC WONDER database.[4] State personal income per capita (logged) data comes from the Bureau of Economic Analysis (measured in 2009 dollars using the Bureau of Labor Statistics consumer price index data). Population estimates, percent living in poverty, proportions of the population non-Hispanic Black or White, percent of female-headed households, educational attainment, unemployment rates, and county-level per capita income data come from the Bureau of the Census Current Population Survey. State-level cocaine-related mortality rates (per 100,000) come from the National Center for Health Statistics (NCHS) Mortality Detail Files.[5] Index crime

[3]While additional years of post-repeal data remain available, this analysis extends the study period up until the year 2013 in order avoid concerns regarding any potential effects associated with the events surrounding the Michael Brown shooting on local law enforcement practices in the greater St. Louis area–more broadly known as the “Ferguson Effect" (Rosenfeld (2015)).

[4]The CDC suppresses data for counties and states where low homicide or suicide numbers make certain deaths identifiable. This exclusion leads to changes in the number of available controls for each analysis.

[5]Following the work in Fryer et al. (2013), cocaine-related death rates are defined as “accidental poisonings, suicides, and other deaths for which cocaine was coded as a primary or contributing factor." For cocaine-related deaths before 1989, the International Classification of Diseases 9th revision (ICD-9) codes are 8552, 3042, and 3056. ICD-9 codes 8501-8699, 9501-9529, 9620-9629, 972, 9801-9879, 3050-3054, and 3057-3059 with a secondary code of 9685 are also included. For cocaine-related deaths after 1998, the International Classification of Diseases 10th revision (ICD-10) codes are F140-F149, F190-F199, X42, X44, X62, X64, X85, Y12, and Y14 with a secondary code of T405.

data comes from the Federal Bureau of Investigation (FBI) Uniform Crime Reports (UCR).[6]

In order to avoid potential contamination among the control units, this analysis excludes any states introducing background check requirements during the study period. This restriction leads to the exclusion of California, District of Columbia, Colorado, Indiana, Maryland, Nebraska, Oregon, and Pennsylvania from the study sample. Data limitations also lead to the exclusion of Hawaii, Maine, North Dakota, New Hampshire, South Dakota, Vermont, and Wyoming from the study sample.[7] For the main state-level firearm homicide results, these restrictions lead to a study sample consisting of 33 states. The county-level sample pulls from the 200 largest U.S. counties in 2000 with complete data in estimating each outcome of interest.

3 County-Level Gun Ownership Effects

An important question remains whether the PTP repeal led to an increase in gun proliferation across local secondary firearm markets within the state of Missouri. Figure 6 provides county-level dynamic treatment effects for the impact of the PTP repeal on FSS with estimation results in Table 3. This specification controls for total suicide rates, log per capita income, percent of female-headed households, and percent of the population with less than a high school degree in addition to county and year fixed effects. Despite yielding a fairly noisy estimate,Table 3 provides modest evidence of an average seven percentage point increase in FSS across Jackson County, St. Louis County, and the City of St. Louis with Figure 6 showing increased gun proliferation peaking a few years after the repeal. Cross-validation also leads to a model specification with one estimated latent factor shown in Figure 7. While interpretation of this factor remains less straightforward, this figure

[6]The FBI UCR data comes from reports to the FBI from law enforcement agencies across the U.S. The FBI uniform crime index consists of seven crimes: murder and non-negligent manslaughter, forcible rape, robbery, burglary, larceny theft, aggravated assault, and motor vehicle theft. The FBI defines murder and nonnegligent manslaughter as the willful killing of one human being by another–excluding deaths caused by negligence, suicide, accident, justifiable homicide, attempts to murder, and assaults to murder. This definition will include nearly all homicides as opposed to the more narrow definition for firearm homicide.

[7]One exception remains the 2012 repeal of the “one-handgun-per-month" law repeal in Virginia. However, private handgun sales in Virginia do not require background checks and the results are robust to the exclusion of Virginia from the sample.

clearly shows a steady increase in FSS trends during the early 1990s before rising again after 2000.

The autonomy possessed by each sheriff's office in screening permit-to-purchase applications could imply important county-level heterogeneity in the effects of the PTP law repeal. Figures 6b-6d show considerable heterogeneity in the effects of the PTP repeal on county-level gun ownership across the three treatment units. However, these results are primarily driven by the sharp increase in FSS within the City of St. Louis. In particular, the dynamic FSS treatment effect shows a large and significant 60 percentage point increase over the 2011-2012 period. While both Jackson County and St. Louis County also experience post-repeal increases in gun prevalence, the statistical evidence remains less conclusive.

The significant expansion of secondary firearm markets within the City of St. Louis remains consistent with the substantial number of crime guns traced back to the area in the ATF firearm trace reports data. While the extent to which an increase in the FSS proxy truly reflects changes in gun ownership among individuals associated with criminal activity remains an open question, previous empirical work suggests that the measure captures both legal gun ownership and some aspects of illicit firearm ownership. The fact that survey measures often find significant racial differences in reported gun ownership and suicide remains substantially higher among White Americans might contribute to the noisy relationship between the PTP repeal and the FSS measure (Parker et al. (2017)).[8]

4 The Missouri PTP Repeal and Firearm Homicide

4.1 State-Level Effects

The 2007 permit-to-purchase law led to significant changes in Missouri firearm homicide trends with these effects varying considerably across age groups. Table 4 provides generalized synthetic control estimation results by age group while Figures 8-9 showing the corresponding dynamic

[8]Contrary to homicide trends, White Missourians make up approximately 85 percent of the state while accounting for nearly 93 percent of all suicides (Missouri Institute of Mental Health (2015))

treatment effects associated with the repeal. All state-level specifications control for (race-specific) poverty, (race-specific) unemployment, cocaine-related overdose rates, FSS, state effects, and year effects. GSC estimation yields an average treatment effect of 0.9716 with a standard error of 0.6278. The largest increase in post-repeal firearm homicide occurs among victims ages 15-24 with an additional 2.83 deaths per 100,000 and the average treatment effect decreases with age. The dynamic treatment effect results show that the greatest impact of the PTP repeal on firearm homicide occurs within the first few years of the post-repeal period. Overall firearm homicide peaks in 2008 with a significant and positive increase of 1.73 deaths per 100,000 in 2008. Similarly, firearm homicide among victims ages 15-24 at over six deaths per 100,000 from 2009-2010 and victims older than 45 experience a slight increase of 1.13 additional deaths in 2008.

Focusing on the overall firearm homicide results, the cross-validation procedure within GSC estimation yields a specification with two estimated latent factors. Figure 10 shows the estimated unobserved factors for overall firearm homicide over the study period while Figure 11 plots the estimated factor loadings for Missouri and each control state. While some caution remains necessary in providing a direct interpretation of the estimated factors, one fairly clear observation points to the importance of the crime epidemic during the early 1990s in explaining firearm homicide trends up until the early 2000s when states throughout the U.S. experienced historical declines in crime rates. Indeed, Figure 11 illustrates that states with significant racial disparities in homicide such as Illinois, New York, Louisiana, and Mississippi possess some of the largest factor loadings on the second factor. Interpretation of the first factor remains less clear, but results from both figures suggests an upward trend in firearm homicide among states with either relatively lax gun laws (e.g., Delaware and Ohio) or states with neighbors possessing less restrictive gun control laws (e.g., New Jersey).

Similar to national trends, substantial racial differences in firearm homicide exist within the state of Missouri and estimation across these groups highlight the disparate impact of the PTP repeal. Table 5 provides evidence from generalized synthetic control estimation on the varying impact of

the PTP repeal across race and age groups. The first column suggests that the overall firearm among Black victims increased significantly by an average 5.17 additional deaths per 100,000 over the post-repeal period. However, estimation results by age group also emphasizes the importance of the permit-to-purchase law for Black youth homicide. The large and significant 28.97 treatment effect among young Black firearm homicide victims ages 15-24 suggests that much of the increase in Missouri firearm homicide trends remains attributable to greater illicit access to firearms. Similarly, firearm homicide increases by an average 8.18 deaths per 100,000 for Black victims ages 25-44. White firearm homicide results also suggest a small post-repeal increase of 0.1226 for the overall rate and 0.3477 among White Missourians ages 25-44. However, the corresponding standard errors also present less conclusive statistical evidence concerning the average post-repeal effect for White Missourians.

Figures 12-15 also provide dynamic evidence of the impact of the PTP repeal across race and age groups. These results again show that the greatest impact of the PTP repeal occurs within the first few years of the post-repeal period. A sharp spike in overall Black firearm homicide occurs in 2008 and reflects an additional 12.03 deaths per 100,000. Young Black firearm homicide victims ages 15-24 account for an extensive amount of the early post-repeal gun violence and peaks at an additional 55 deaths per 100,000 by 2010. Similar treatment effect estimates for Black victims ages 25-44 range from 15.30 in 2008 to 12.5 by 2010. Limited dynamic findings for White firearm homicide victims ages 25-44 also show a smaller yet significant increase of 1.89 additional deaths during the first full year of the repeal.

In understanding the importance of unobservable factors violating any parallel trends assumption, Figure 16 shows the estimated latent factors for overall Black firearm homicide while Table 6 shows the estimated factor loadings for each state. Similar to overall trends, the second and third factors capture a strong upward trend in Black firearm homicide during the crime epidemic of the late-1980s and early-1990s. Comparing these trends with the estimated factor loadings in Table 6, the third factor also shows a modest upward trend in Black firearm homicide among states such

as Missouri, Illinois, and Louisiana. While interpretation of the first factor again remains less straightforward, one observes a similar combination of states suffering from less restrictive gun laws and substantial contemporary increases in Black firearm homicide. Overall, state-level results yield strong evidence that the permit-to-purchase law repeal led to a significant increase in firearm homicide with a disproportionate impact felt by young Black Missourians.

4.2 County-Level Heterogeneity

The overwhelming concentration of firearm homicide in urban areas of Missouri, in addition to the autonomy held by sheriffs' offices in screening permit applications before 2007, raises an important question concerning the differential impact of the PTP repeal at the county-level. Given data limitation and the state-level results highlighting the significant impact of the repeal on Black firearm homicide, Table 7 shows county-level estimation results for overall firearm homicide and Black firearm homicide–focusing specifically on Jackson County, St. Louis County, and the City of St. Louis as treatment units. These specifications remain similar to the state-level models with the Black population proportion instead of the cocaine-related mortality rates. County-level estimation reveals a slightly larger average treatment effect of 1.81 deaths per 100,000 for overall homicide. The 6.27 Black firearm homicide estimate remains slightly larger than the corresponding state-level estimate of 5.17 and remains significant–once again providing evidence showing the importance of the PTP law for gun violence in the more urban regions of the state.

The dynamic treatment effects shown in Figures 17-18 also demonstrate the higher levels of gun violence during the early years of the post-repeal period. The 2009-2010 period remains characterized by a large and significant increase of approximately four overall firearm homicide deaths. Overall gun violence within the City of St. Louis grew by nearly 10-11 additional deaths per 100,000 in the early years of the repeal. County-level Black firearm homicide estimates in Figures 19-20 show substantial increases in gun violence across all three areas with average increases of 10-11 deaths over 2008-2010 period. Both Jackson County and St. Louis County show large

early post-repeal increases well over 10 overall firearm deaths while the PTP law repeal led to an additional 17-18 Black firearm homicide deaths per 100,000 from 2008-2009. These results provide conclusive evidence that the burden of less restrictive access to firearms largely falls on urban Black communities within the state of Missouri.

5 Robustness Checks and Sensitivity Analyses

A natural question for the identification strategy utilized in this paper involves potential externalities associated with the Missouri PTP repeal. One such externality could involve gun trafficking opportunities for Missouri secondary markets in border states with more stringent gun laws. For example, the Missouri PTP repeal might have led to Missouri becoming a net exporter of firearms to secondary markets in other states–in particular those states bordering Missouri. Such a change might lead to an increase in firearm homicide rates and subsequently a heightened law enforcement presence in those states. In estimating a gravity relationship using the 2009 ATF trace data, Knight (2013) finds evidence suggesting that firearms tend to flow from secondary markets in states with weaker laws to states with tougher ones.

Table 8 examines the flow of firearms originally purchased from a Missouri FFL dealer to crimes scenes within Missouri and its eight border states–with states such as Illinois, Iowa, and Nebraska each having stronger firearm laws than Missouri over the post-repeal period. While Missouri accounts for less than one third of its total firearm traces in the year before the PTP repeal, this number increases to 50.34 percent by 2013. This large increase in the domestic recovery of Missouri firearms suggests that the PTP repeal had important consequences for illegal secondary markets within the state. Moreover, none of the states bordering Missouri experience any significant changes in Missouri firearm traces within their borders over the post-repeal period. The lack of a notable increase in the trafficking of firearms to states outside of Missouri remains consistent with previous findings suggesting that social connections, and subsequently straw purchasing behavior, play a more salient role in the proliferation of firearms into criminal activity than large scale gun

trafficking operations (Cook et al. (2007); Cook, Parker, and Pollack (2015); Cook et al. (2015)).

In order to avoid potential contamination among controls, further analyses based on the state-level samples involve generalized synthetic control estimation excluding any of Missouri's border states from the control group. Carrying out the analysis in this manner leads to some changes in the magnitude of certain estimated coefficients for Black firearm homicide and pre-treatment mean squared prediction errors, but the qualitative conclusions remain the same.[9] In particular, the coefficient on overall Black firearm homicide increases to 7.34 while the corresponding estimate for Black youth ages 15-24 falls to 16.86 with a standard error of 9.47. The estimate for Black firearm homicide for victims ages 25-44 also increases to 10.14 with a standard error of 5.73 and reinforces the conclusion that the repeal's greatest impact occurs among young Black Missourians.

Table 9 assesses whether the PTP law repeal influenced nonfirearm homicide rates or any other forms of criminal activity captured in the FBI UCR data. Based on mortality data, state-level GSC estimation yields a positive estimate of 0.1140 nonfirearm deaths per 100,000 with a standard error of 0.5108. These findings suggest that post-repeal homicide within Missouri remains exclusive to firearm homicide and provides additional evidence that this violence remains attributable to greater gun proliferation within the state. The remaining rows of Table 9 show similar estimation results across the seven index crimes reported to the FBI by local law enforcement agencies. Aggravated assault, forcible rape, robbery, and motor vehicle theft all show positive post-repeal effects although each remain statistically insignificant. Estimates for burglary, larceny theft, and property crime show statistically insignificant negative effects. With an exception for the 1.23 increase in murder and non-negligent manslaughter, this study finds no conclusive statistical evidence suggesting that the PTP repeal led to an increase in any other crime rates.

[9]Results available upon request to the author.

6 Understanding the Impact of the Missouri PTP Repeal on Firearm Homicide in Black Communities

This study provides substantial evidence that the post-repeal increase in gun proliferation throughout Missouri led to a disproportionate rise in firearm homicide in urban Black communities. The average treatment effect for Black firearm homicide in Missouri translates into approximately an additional 260 Black deaths over 2008-2013 period. Results showing a substantial increase in firearm homicide among victims ages 15-24 also suggests that the former permit-to-purchase law played an important role in restricting illicit access to Missouri secondary firearm markets. While the empirical evidence from this study strongly suggests that an increase in firearm proliferation led to significant changes in Black firearm homicide in urban areas of Missouri, a critical underlying question remains as to why deregulated access to firearms would necessarily lead to greater firearm homicide within these communities. Moreover, this paper finds no conclusive evidence of a similar increase in firearm homicide among White Missourians.

Appealing to the literature on racial disparities in homicide offers several different explanations for the disproportionate increase in firearm homicide among Black Missourians. One explanation often found in the criminology and sociological literature often focuses on the role of extensive "social disorganization" in urban communities–where an intense concentration of socioeconomic disadvantage in indicators such as poverty and the number of female-headed households often produce significant racial differences in norms surrounding criminal behavior (Wilson (1987); Sampson and Wilson (1995)). As noted in Section 1.2, considerable racial disparities across several socioeconomic indicators exist within Jackson County, St. Louis, and the City of St. Louis–urban areas accounting for the majority of firearm homicide deaths in Missouri. However, disparities in socioeconomic status generally possess limited explanatory power in empirical work on homicide and changes in many of these variables remain fairly constant going into the post-repeal period (Levitt (2004); O'Flaherty and Sethi (2010a)). Moreover, structural disadvantage

theory offers little insight into why deregulating secondary firearm markets necessarily leads to a significant differential impact on firearm homicide across racial groups. In the case of Missouri, the absence of significant changes in firearm homicide within the impoverished rural areas of the state suggests that other factors might play a more salient role in driving racial disparities in gun violence.

Other work on racial differences in gun violence focuses on the importance of cultural norms or the consequences of consistent exposure to localized violence (Anderson (2000); Bingenheimer, Brennan, and Earls (2005); Braga, Papachristos, and Hureau (2010)). In his ethnographic work within urban Philadelphia, Anderson (2000) describes the role of “street" families in determining social conditions and cultural dynamics of neighborhoods shared by “decent families." He further argues that participation in activity such as drug markets by street people, in addition to a common distrust or lacking presence of institutions to enforce behavior within those markets, often push even decent people to pursue firearms in order to navigate the dangers of their environment. Using longitudinal data based on adolescents in Chicago, Bingenheimer, Brennan, and Earls (2005) find that exposure to firearm violence doubles the probability of an adult committing a serious violent offense over the two years succeeding exposure. According to local police reports, the most northern neighborhoods in the City of St. Louis historically account for an overwhelmingly disproportionate amount of crime and the majority of the gun violence during the post-repeal period. While this explanation generally predicts consistent violence in the most vulnerable urban communities in Missouri, questions still remain regarding the dynamics of gun violence over the post-repeal period.

Conceptualization of the effects of gun control legislation on racial differences in gun violence must also account for both the anticipated dangers associated with higher levels of gun proliferation and the importance of social interactions in murder. Figure 21 suggests that the post-repeal racial differences in homicide within the state of Missouri appear to be driven by a substantially larger number of firearm deaths than homicides committed by other other means–even more so than the

historic crime epidemic during the early-1990s. The economics of crime literature offers several theories based on the notion that social interactions characterized by disputes can often lead to social multipliers in violence while also explaining spatial, temporal, and group-level differences in crime (Glaeser, Sacerdote, and Scheinkman (1996); O'Flaherty and Sethi (2010a); O'Flaherty and Sethi (2010b)). In particular, O'Flaherty and Sethi (2010a) introduces a theoretical model in which strategic complementarities in violence decisions stem from the pre-emptive motive each individual possesses to strike the other party to the dispute–with their model making predictions concerning race-specific equilibrium murder rates based on various attributes of each party to the dispute.[10] Descriptive evidence within the FBI Supplementary Homicide Reports (SHR) data suggests that the increasing number of disputes appears to play a crucial role in contemporary homicide trends within Missouri. At the height of post-repeal Missouri gun violence in 2010, nearly 71 percent of reported homicides involved homicide victims killed by someone that they knew with a significant proportion of homicides driven by a dispute (Sugarmann (2013)). Moreover, a combination of increasingly violent settings and lower costs of gun investment can lead to some of the vastly different race-specific murder equilibria consistent with the results in this study. The heightened levels of Missouri gun violence during the early post-repeal years also remain consistent with the social multiplier effects at the heart of their model.

7 Conclusion

Using the 2007 repeal of the Missouri permit-to-purchase law as a natural experiment, this paper finds considerable evidence of an increase in the proliferation of firearms throughout secondary firearm markets and strong evidence of an increase in firearm homicide within Missouri. Results concerning the county-level FSS proxy show an average treatment effect of a seven percentage

[10]The authors specifically refer to these dispute attributes as "victim-contingent" and "offender-contingent" costs. Underpolicing serves as one form of victim contingent costs and some work by Chalfin and McCrary (2013) suggests that the City of St. Louis remains one of the most underpoliced cities in the country–ranking 233 out of a sample of 242 U.S. cities. An example of offender-contingent costs remains low opportunity costs in murder with an example being overrepresentation of one racial group in incarceration outcomes.

points across Jackson County, St. Louis County, and the City of St. Louis. The increase in local gun proliferation occurs at a time in which within-state firearms appear at crimes scenes more quickly and the proportion of crime guns from other states remains consistently low throughout the post-repeal period. These results mirror the geographic distribution of crime guns within the ATF firearm trace reports with the City of St. Louis showing the greatest increase in firearm proliferation through local secondary markets. This paper also provides some of the first experimental evidence on the responsiveness of FSS to deregulatory changes within secondary firearm markets.

This paper also finds evidence of a modest increase in overall firearm homicide throughout the state of Missouri with much of the gun violence driven by a disproportionate increase in firearm homicide among young Black Missourians. Statewide non-Hispanic Black firearm homicide increases by an average of 5.17 deaths per 100,000 during the post-repeal period and increases by roughly 29 deaths per 100,000 among Black youth ages 15-24. This analysis yields no statistical evidence of a corresponding increase among non-Hispanic White Missourians. Furthermore, these changes in firearm homicide occur in the absence of any significant changes in nonfirearm homicide and other reported crimes not involving murder. Thus, this paper provides new evidence concerning the differential impact of state-level gun control laws on firearm homicide across racial groups.

Considerable heterogeneity also exists in the effects of the permit-to-purchase law repeal on firearm homicide across counties and cities in the state of Missouri. Black firearm homicide increases by an average 6.27 deaths per 100,000 across Jackson County, St. Louis County, and City of St. Louis. County-level results suggests that the largest increase occurred within the City of St. Louis with an increase in Black firearm homicide rates of 7.97 deaths followed by 5.92 deaths in Jackson County and 4.91 deaths in St. Louis County. Similar to the state-level findings, these results suggest that the adverse effects of the PTP repeal fall disproportionately on urban Black communities within the state of Missouri.

The heightened levels of Missouri gun violence led to the introduction of several interventions by law enforcement agencies, prosecutors, and other parties interested in reducing firearm homicide.

The introduction of Shotspotter technology, strategic law enforcement presence through “hot spot" policing, ATF undercover storefront operations, and special judicial proceedings for gun-related crimes all serve as contemporary policies aimed at reducing gun violence in Missouri with mixed results (Mares and Blackburn (2012); Rosenfeld et al. (2014); Inspector General (2016)). The increase in gun violence in the Greater St. Louis area also led to the opening of anonymous hotlines to handle disputes and other civic interventions by nongovernmental organizations (McKinstry (2017)). To the extent that the rise in Missouri gun violence remains attributable to an increasing number of disputes being settled with firearms by youths, the implementation of interventions based on cognitive behavioral therapy have shown promise among similar demographics in other parts of the country suffering from intense gun violence (Heller et al. (2017)).

While several aspects of Missouri gun violence exhibits similar characteristics and patterns observed in other states, one must exhibit caution in generalizing the experiences of Missouri to other states. The effects of deregulatory efforts within private firearm markets in other states will depend on the extensiveness of gun culture, the nature of gun trafficking, law enforcement efforts, and other salient determinants of gun violence.

References

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller (2010). “Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California’s Tobacco Control Program”. In: *Journal of the American Statistical Association* 105.490, pp. 493–505.

Abadie, Alberto and Javier Gardeazable (2003). “The Economic Costs of Conflict: A Case Study of the Basque Country”. In: *The American Economic Review* 93.1, pp. 113–132.

Acemoglu, Daron, James A. Robinson, and Rafael J. Santos (2013). “The Monopoly of Violence: Evidence From Colombia”. In: *Journal of European Economic Association* 11.1, pp. 5–44.

Akerlof, George and Janet L. Yellen (1994). “Gang Behavior, Law Enforcement, and Community Values”. In: *Canadian Institute for Advanced Research*.

Anderson, Elijah (2000). *Code of the Street: Decency, Violence, and the Moral Life of the Inner City*. WW Norton and Company.

ATF (2006-2013). *Firearm Trace Reports*. Tech. rep. Department of Justice: Bureau of Alcohol, Tobacco, Firearms, and Explosives.

Azrael, Deborah, Philip J. Cook, and Matthew Miller (2004). "State and Local Prevalence of Firearms Ownership: Measurement, Structure, and Trends". In: *Journal of Quantitative Criminology* 20.1, pp. 43–62.

Bai, Jushan (2009). "Panel Data Models with Interactive Fixed Effects". In: *Econometrica* 77.4, pp. 1229–1279.

Becker, Gary S., Kevin M. Murphy, and Micahel Grossman (2006). "The Market for Illegal Goods: The Case of Drugs". In: *Journal of Political Economy* 114.1, pp. 38–60.

Benson, Bruce L. and Paul R. Zimmerman, eds. (2010). *Handbook on the Economics of Crime*. Edward Elgar Publishing.

Bingenheimer, Jeffrey B., Robert T. Brennan, and Felton J. Earls (2005). "Firearm Violence Exposure and Serious Violent Behavior". In: *Science* 308.5726, pp. 1323–1326.

Brabner-Smith, John (1934). "Firearm Regulation". In: *Law and Contemporary Problems* 1.4, pp. 400–414.

Braga, Anthony A., Andrew Papachristos, and David M. Hureau (2010). "The Concentration and Stability of Gun Violence at Micro Places in Boston, 1980-2008". In: *Journal of Quantitative Criminology* 26.1, pp. 33–53.

Britt, Chester L., Gary Kleck, and David J. Bordua (1996). "A Reassessment of the D.C. Gun Law: Some Cautionary Notes on the Use of Interrupted Time Series Designs for Policy Impact Assessment". In: *Law and Society Review* 30.2, pp. 361–380.

Case, Anne and Angus Deaton (2015). "Rising Morbidity and Mortality in Midlife Among White Non-Hispanic Americans in the 21st Century". In: *Proceedings of the National Academy of Sciences* 112.49, pp. 15078–15083.

Chalfin, Aaron and Justin McCrary (2013). “The Effect of Police on Crime: New Evidence from U.S. Cities, 1960-2010”. In: *NBER Working Paper Series, Working Paper 18815*.

Cook, Philip J. (1983). “The Influence of Gun Availability on Violent Crime Patterns”. In: *Crime and Justice* 4.1, pp. 49–89.

Cook, Philip J. and James Blose (1981). “State Programs for Screening Handgun Buyers”. In: *Annals of the American Academy of Political and Social Science* 455, pp. 80–91.

Cook, Philip J. and Jens Ludwig (2006). “The Social Costs of Gun Ownership”. In: *Journal of Public Economics* 90.1, pp. 379–391.

Cook, Philip J., Stephanie Molliconi, and Thomas B. Cole (1995). “Regulating Gun Markets”. In: *The Journal of Criminal Law and Criminology* 86.1, pp. 59–92.

Cook, Philip J., Susan T. Parker, and Harold A. Pollack (2015). “Sources of Guns to Dangerous People: What We Learn by Asking Them”. In: *Preventive Medicine* 79, pp. 28–36.

Cook, Philip J., Jens Ludwig, Sudhir Venkatesh, and Anthony A. Braga (2007). “Underground Gun Markets”. In: *The Economic Journal* 117, F588–F618.

Cook, Philip J., Richard J. Harris, Jens Ludwig, and Harold A. Pollack (2015). “Some Sources of Crime Guns in Chicago: Dirty Dealers, Straw Purchasers, and Traffickers”. In: *Journal of Criminal Law and Criminology* 104.4, pp. 717–760.

Cooper, Alexia and Erica L. Smith (2011). *Homicide Trends in the United States, 1980-2008*. Tech. rep. NCJ 236018. Bureau of Justice Statistics.

Department, Public Information (2000-2014). *Report to the Community*. Tech. rep. City of St. Louis Police Department.

Duggan, Mark (2001). “More Guns, More Crime”. In: *Journal of Political Economy* 109.5, pp. 1086–1114.

Edsall, Thomas B. (1999). *Missouri Voters Defeat Ballot Measure to Allow Concealed Handguns*.

Ehrlich, Isaach and Tetsuya Saito (2010). “Taxing Guns vs. Taxing Crime: An Application of the “Market for Offenses Model"”. In: *NBER Working Paper Series, Working Paper 16009*.

Fox, James A. and Marc L. Swatt (2009). "Multiple Imputation of the Supplementary Homicide Reports, 1976-2005". In: *Journal of Quantitative Criminology* 25.1, pp. 51–77.

Fryer, Roland G., Paul S. Heaton, Steven D. Levitt, and Kevin M. Murphy (2013). "Measuring Crack Cocaine and Its Impact". In: *Economic Inquiry* 51.3, pp. 1651–1681.

Gaviria, Alejandro (2000). "Increasing Returns and the Evolution of Violent Crime: The Case of Colombia". In: *Journal of Development Economics* 61, pp. 1–25.

Glaeser, Edward L. and Spencer Glendon (1998). "Who Owns Guns? Criminals, Victims, and the Culture of Violence". In: *The American Economic Review* 88.2, pp. 458–462.

Glaeser, Edward L. and Bruce Sacerdote (1999). "Why is There More Crime in Cities?" In: *Journal of Political Economy* 107.6, S225–S258.

— (2003). "Sentencing in Homicide Cases and the Role of Vengeance". In: *Journal of Legal Studies* 32.2, pp. 363–382.

Glaeser, Edward L., Bruce Sacerdote, and Jose A. Scheinkman (1996). "Crime and Social Interactions". In: *The Quarterly Journal of Economics* 111.2, pp. 507–548.

Grinshteyn, Erin and David Hemenway (2016). "Violent Death Rates: The U.S. Compared with Other High-Income Countries,2010". In: *The American Journal of Medicine* 129.3, pp. 266–273.

Heller, Sara B., Anuj K. Shah, Jonathan Guryan, Jens Ludwig, Sendhil Mullainathan, and Harold A. Pollack (2017). "Thinking, Fast and Slow? Some Field Experiments to Reduce Crime and Dropout in Chicago". In: *The Quarterly Journal of Economics* 132.1, pp. 1–54.

Inspector General, Office of the (2016). *A Review of ATF's Undercover Storefront Operations*. Tech. rep. U.S. Department of Justice.

Kalesan, Bindu, Sowmya Vasan, Matthew E Mobily, Marcos D. Villarreal, Patrick Hlavacek, Sheldon Teperman, Jeffrey A. Fagan, and Sandro Galea (2014). "State-Specific, Racial and Ethnic Heterogeneity in Trends of Firearm-Related Fatality Rates in the USA from 2000 to 2010." In: *BMJ Open* 4.9 e005628.

Kleck, Gary (2004). “Measures of Gun Ownership Levels for Macro-Level Crime and Violence Research”. In: *Journal of Research in Crime and Deliquency* 41.1, pp. 3–36.

Kleck, Gary and E. Britt Patterson (1993). “The Impact of Gun Control and Gun Ownership on Violence Rates”. In: *Journal of Quantitative Criminology* 9.3, pp. 249–287.

Kleck, Gary and Shun-Yung Kevin Wang (2009). “The Myth of Big-Time Gun Trafficking and the Overinterpretation of Gun Tracing Data”. In: *The UCLA Law Review* 56, pp. 1233–1294.

Knight, Brian (2013). “State Gun Policy and Cross-State Externalities: Evidence from Crime Gun Tracing”. In: *American Economic Journal: Economic Policy* 5.4, pp. 200–229.

Kochanek, Kenneth D., Elizabeth Arias, and Robert N. Anderson (2013). *How Did Cause of Death Contribute to Racial Differences in Life Expectancy in the United States in 2010?* NCHS Data Brief 125. Hyattsville, MD: National Center for Health Statistics.

Koper, Christopher S. and Jeffrey A. Roth (2002). “The Impact of the 1994 Federal Assault Weapons Ban on Gun Markets: An Assessment of Short-Term Primary and Secondary Market Effects”. In: *Journal of Quantitative Criminology* 18.3, pp. 239–266.

Leigh, Andrew and Christine Neill (2010). “Do Gun Buybacks Save Lives? Evidence from Panel Data”. In: *American Law and Economics Review*, pp. 1–49.

Leovy, Jill (2015). *Ghettoside: A True tory of Murder in America*. New York: Spiegel and Grau.

Levitt, Steven D. (2004). “Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six that Do Not”. In: *Journal of Economic Perspectives* 18.1, pp. 163–190.

Levitt, Steven D. and Sudhir Venkatesh (2000). “An Economic Analysis of a Drug-Selling Gang’s Finances”. In: *The Quarterly Journal of Economics* 115.3, pp. 755–789.

Loftin, Colin, David McDowall, Brian Wiersema, and Talbert J. Cottey (1991). “Effects of Restrictive Licensing of Handguns on Homicide and Suicide in the District of Columbia”. In: *The New England Journal of Medicine* 325.23, pp. 1615–1620.

Ludwig, Jens and Philip J. Cook (2000). "Homicide and Suicide Rates Associated with Implementation of the Brady Handgun Violence Prevention Act". In: *Journal of the American Medical Association* 284.5, pp. 239–254.

Lynch, James P. and John P. Jarvis (2008). "Missing Data and Imputation in the Uniform Crime Reports and the Effects on National Estimates". In: *Journal of Contemporary Criminal Justice* 24.1, pp. 69–85.

Mares, Dennis and Emily Blackburn (2012). "Evaluating the Effectiveness of Acoustic Gunshot Location System in St. Louis, MO". In: *Policing* 6.1, pp. 26–42.

Marvell, Thomas B. and Carlisle E. Moody (1997). "The Impact of Prison Growth on Homicide". In: *Homicide Studies* 1.3, pp. 205–233.

McKinstry, Erin (2017). *Most St. Louis Shootings Take Place in Forgotten Neighborhoods. Meet the People Working to Change That.* URL: https://www.thetrace.org/2017/09/trump-administration-jeff-sessions-gun-violence-strategy-st-louis/.

Missouri Institute of Mental Health (2015). *Suicide in Missouri: Where We Stand*. Brief 1 (Revised). University of Missouri, St. Louis.

Moody, Carlisle E. (2010). "Handbook on the Economics of Crime". In: ed. by Bruce L. Benson and Paul R. Zimmerman. Edward Elgar Publishing Limited. Chap. Firearms and Homicide.

O'Flaherty, Brendan and Rajiv Sethi (2008). "Racial Stereotypes and Robbery". In: *Journal of Economic Behavior and Organization* 68.3, pp. 511–524.

— (2010a). "Homicide in Black and White". In: *Journal of Urban Economics* 68.3, pp. 215–230.

— (2010b). "The Economics of Crime: Lessons for and from Latin America". In: ed. by Rafael Di Tella, Sebastian Edwards, and Ernesto Schargrodsky. University of Chicago Press. Chap. Peaceable Kingdoms and War Zones: Preemption, Ballistics, and Murder in Newark.

— (2010c). "The Racial Geography of Street Vice". In: *Journal of Urban Economics* 67.3, pp. 270–286.

Parker, Kim, Juliana Horowitz, Ruth Igielnik, Baxter Oliphant, and Anna Brown (2017). *America's Complex Relationship with Guns: An In-Depth Look at the Attitudes and Experiences of U.S. Adults*. Tech. rep. Pew Research Center.

Rosenfeld, Richard (2015). *Was There a "Ferguson Effect" on Crime in St. Louis?* Tech. rep. The Sentencing Project.

Rosenfeld, Richard, Joshua Williams, Gregg Horton, and David Mueller (2014). *Peering Into the Black Box: The Criminal Justice System's Response to Gun-Related Felonies in St. Louis*. Tech. rep. Regional Justice Information Services.

Sampson, Robert J. and William Julius Wilson (1995). "Towards a Theory of Race, Crime, and Urban Inequality". In: ed. by John Hagan and Ruth D. Peterson. Stanford, CA: Stanford University Press. Chap. 2, pp. 37–56.

Sheppard, Edward H. (1969). "Control of Firearms". In: *Missouri Law Review* 34.3, pp. 376–396.

Sugarmann, Josh (2013). *Black Homicide Victimization in the United States*. Tech. rep. Violence Policy Center.

Webster, Daniel, Cassandra K. Crifasi, and Jon S. Vernick (2014). "Effects of the Repeal of Missouri's Handgun Purchaser Licensing Law on Homicides". In: *Journal of Urban Health* 91.2, pp. 293–302.

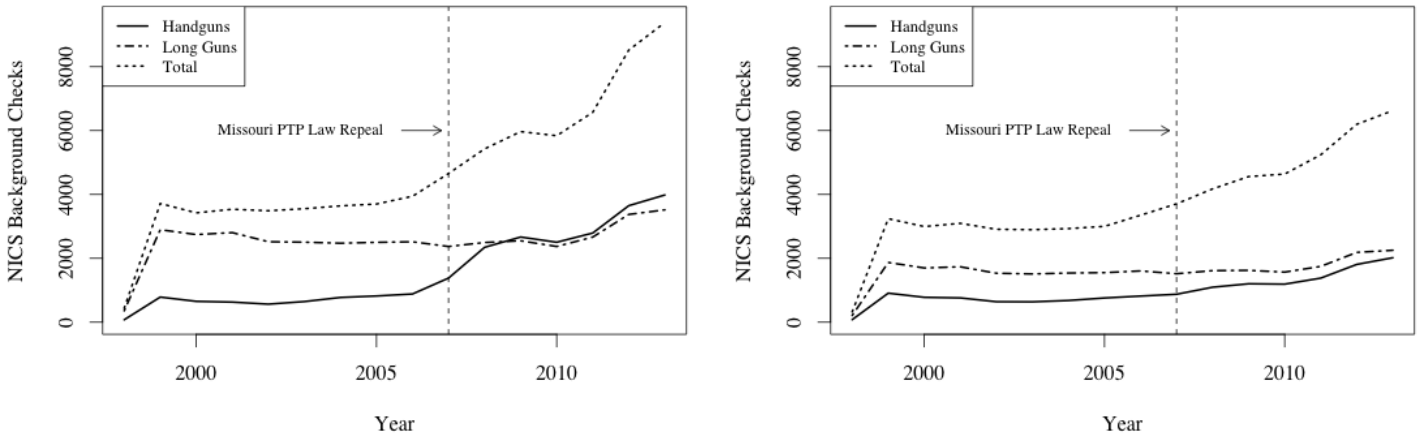
Webster, Daniel W., Jon S. Vernick, and Maria T. Bulzacchelli (2009). "Effects of State-Level Firearm Seller Account- Ability Policies on Firearms Trafficking". In: *Journal of Urban Health* 86.4, pp. 525–537.

Wilson, William Julius (1987). *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. University of Chicago Press.

Xu, Yiqing (2017). "Generalized Synthetic Control Method: Causal Inference with Interactive Fixed Effects Models". In: *Political Analysis* 25.1, pp. 57–76.

Zimring, Franklin E. (1975). "Firearms and Federal Law: The Gun Control Act of 1968". In: *Journal of Legal Studies* 4.1, pp. 133–198.

8 Appendix



(a) Missouri

(b) U.S.

Figure 1: FFL Background Checks Per 100,000 by Gun Type: Missouri v. U.S.

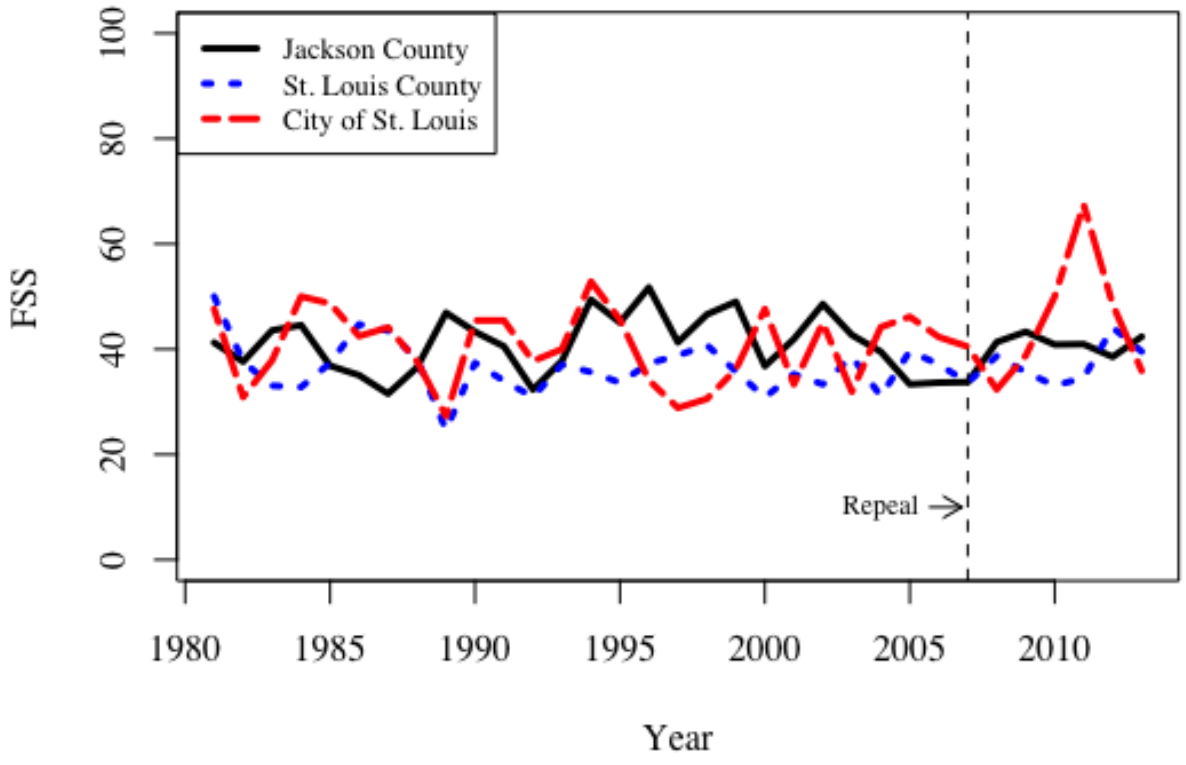
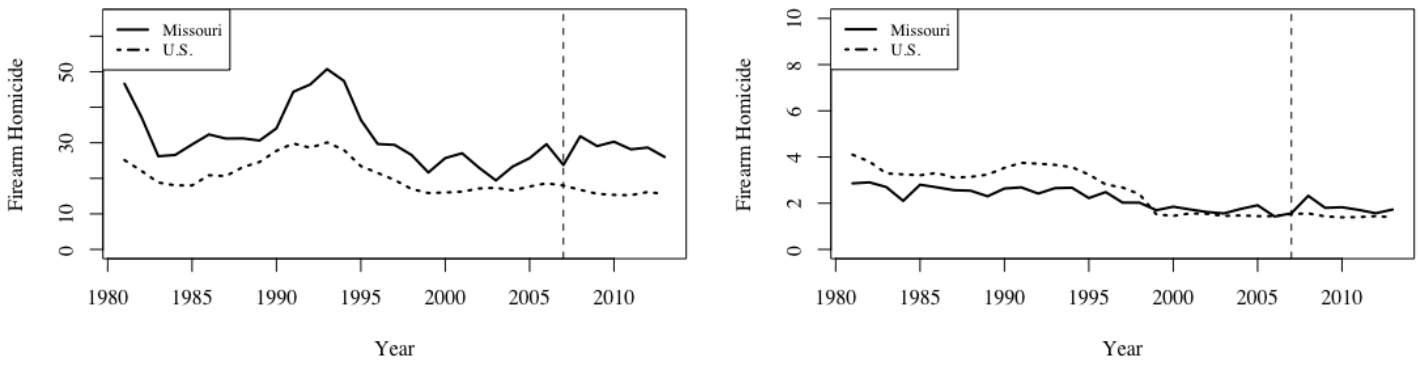


Figure 2: Missouri Fraction of Suicides Committed with a Firearm (FSS): 1981-2013

Table 1: Missouri Firearm Time-to-Crime Rates: 2006-2013

Year	< 3 Months	3-7 Months	7-12 Months	1-2 Years	2-3 Years	≥ 3 Years	Average	U.S. Average
2006	71	89	78	159	123	1698	11.22	10.17
2007	106	95	88	166	150	1725	10.68	10.33
2008	222	174	125	159	131	1562	10.30	10.39
2009	203	173	204	319	136	1484	9.34	10.77
2010	227	213	194	386	251	1698	9.25	10.94
2011	233	191	201	347	260	1504	8.66	11.20
2012	243	153	190	323	238	1566	8.93	11.12
2013	169	189	229	325	271	1830	8.94	11.08

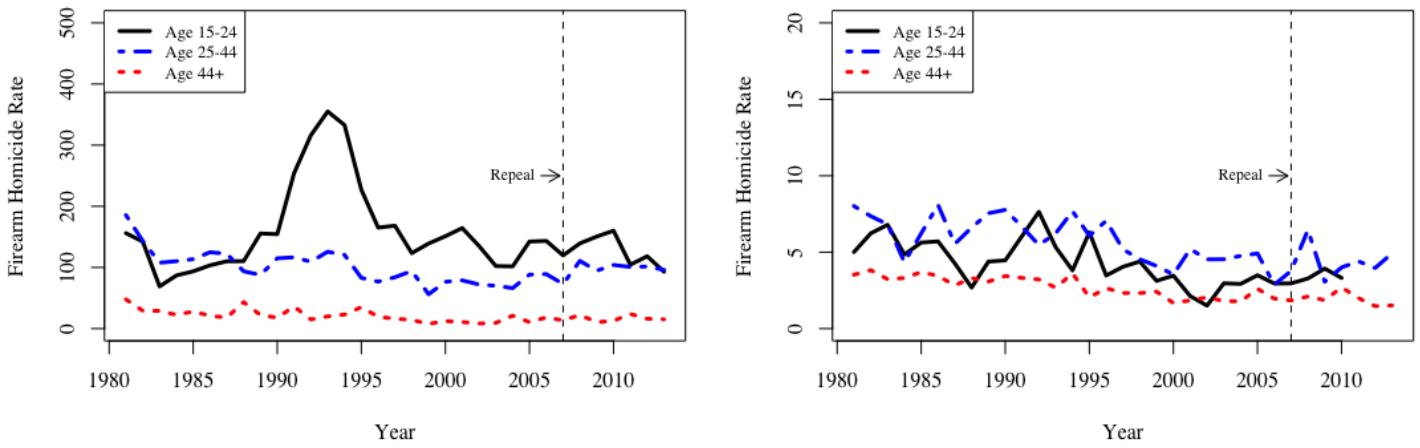
Source: Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Firearm Tracing System



(a) Black

(b) White

Figure 3: Firearm Homicide Rates Per 100,000 by Race: Missouri v. U.S.



(a) Black Males

(b) White Males

Figure 4: Missouri Male Firearm Homicide Rates by Race and Age-Group

Table 2: Missouri County-Level Descriptive Statistics, 2006

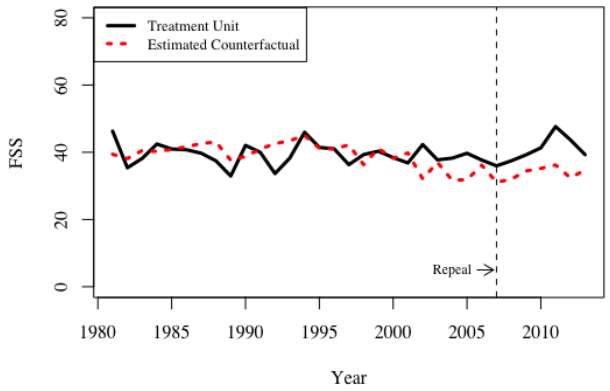
Variables	Jackson County	St. Louis County	City of St. Louis
Firearm Homicide Rate (Per 100,000)			
Pre-Repeal (2000-2006)	11.51	5.16	21.07
Post-Repeal (2007-2013)	13.47	7.09	25.29
Black Firearm Homicide Rate (Per 100,000)			
Pre-Repeal (2000-2006)	34.50	17.97	40.47
Post-Repeal (2007-2013)	40.17	22.63	49.71
Unemployment Rate (%)			
Black	10.78	7.69	16.66
White	3.38	3.52	7.05
Poverty (%)			
Black	20.22	17.72	32.06
White	6.91	4.34	13.03
Ln(Income Per Capita)			
Black	9.83	9.91	9.56
White	10.26	10.52	10.18
Black (%)	23.67	21.60	50.01
Female-Headed Households (%)	15.31	13.64	20.14
Jail Incarceration Rate (Per 100,000)	203.20	138.34	752.17
Law Enforcement Officers (Per 100,000)	304.30	258.27	466.37

Notes: Data on firearm homicide are age-adjusted and come from the National Center for Health Statistics (NCHS) mortality detail files. Law enforcement officer data come from the FBI Uniform Crime Reports (UCR). Jail incarceration data come from the Bureau of Justice Statistics (BJS) Annual Survey of Jails and Census of Jails. Other demographic data come from the Bureau of the Census. All descriptive statistics pertain to the year 2006 unless stated otherwise.

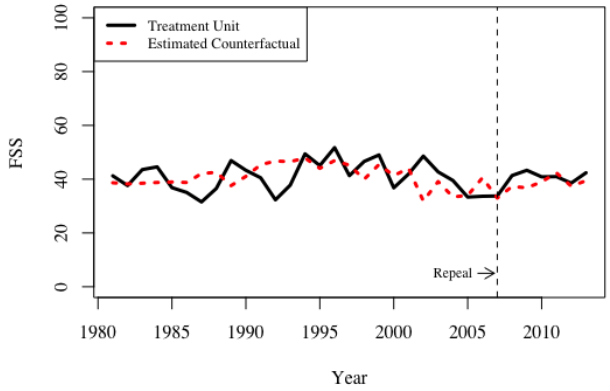
Table 3: Missouri County-Level PTP Repeal FSS Results

Variables	FSS
PTP Repeal	6.94
	(4.48)
Total Suicide Rate	1.24
	(0.1048)
Ln(Income Per Capita)	8.00
	(5.32)
Female-Headed Households (%)	1.30
	(0.5520)
Education: Less Than High School	0.2602
	(0.2535)
Treatment Units	3
Control Units	163
Unobserved Factors	1
MSPE	50.76

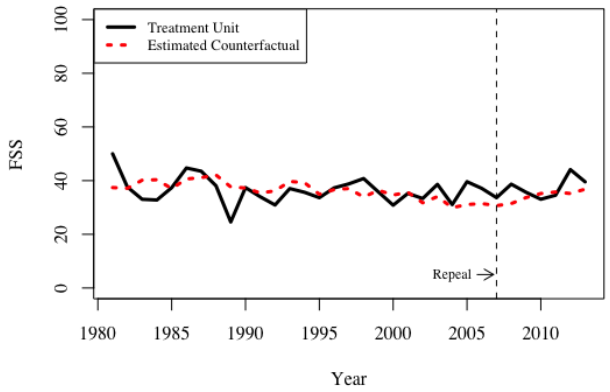
Notes: Data on (crude) total suicide rates are presented per 100,000 individuals in the population. Estimation includes county and year fixed effects. Standard errors are presented in parentheses and clustered at the county-level with bootstraps based on a sample of $N = 2,000$.



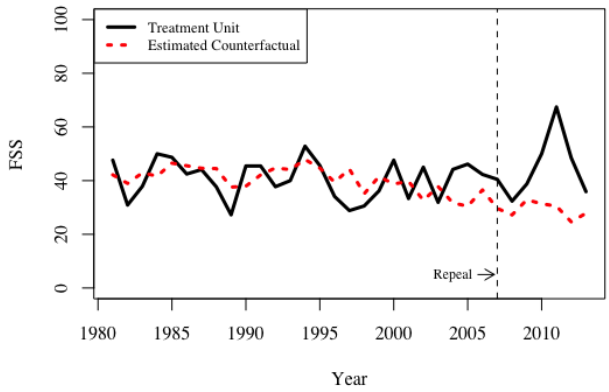
(a) FSS: All Counties



(b) FSS: Jackson County



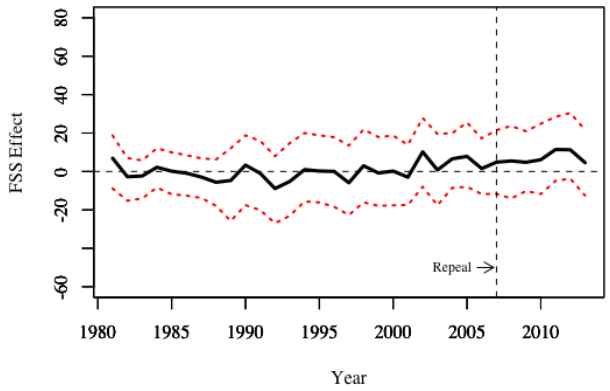
(c) FSS: St. Louis County



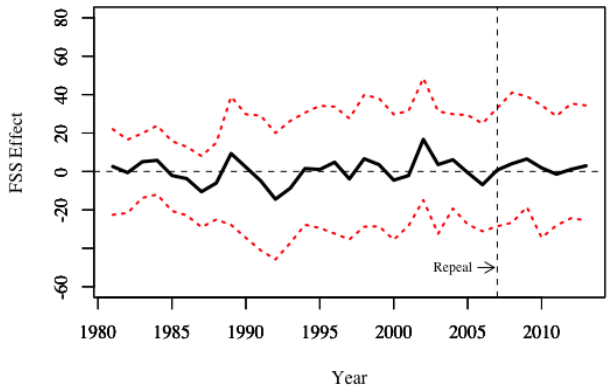
(d) FSS: City of St. Louis

Figure 5: Missouri County-Level FSS Results

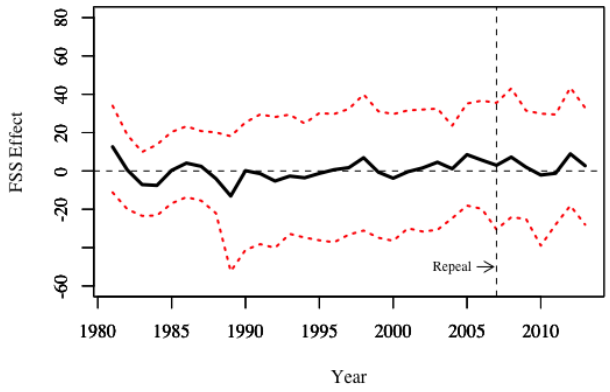
Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for overall suicide rates, log per capita income, percent of female-headed households, educational attainment less than high school, county effects, and year fixed effects.



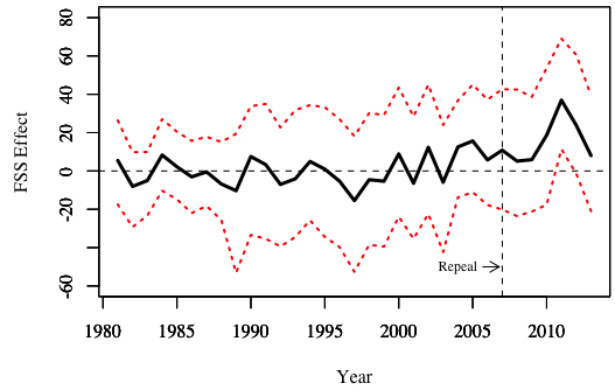
(a) FSS: All Counties



(b) FSS: Jackson County



(c) FSS: St. Louis County



(d) FSS: City of St. Louis

Figure 6: Missouri County-Level FSS Effects

Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for overall suicide rates, log per capita income, percent of female-headed households, educational attainment less than high school, county effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the county-level based on a sample of $N = 2,000$.

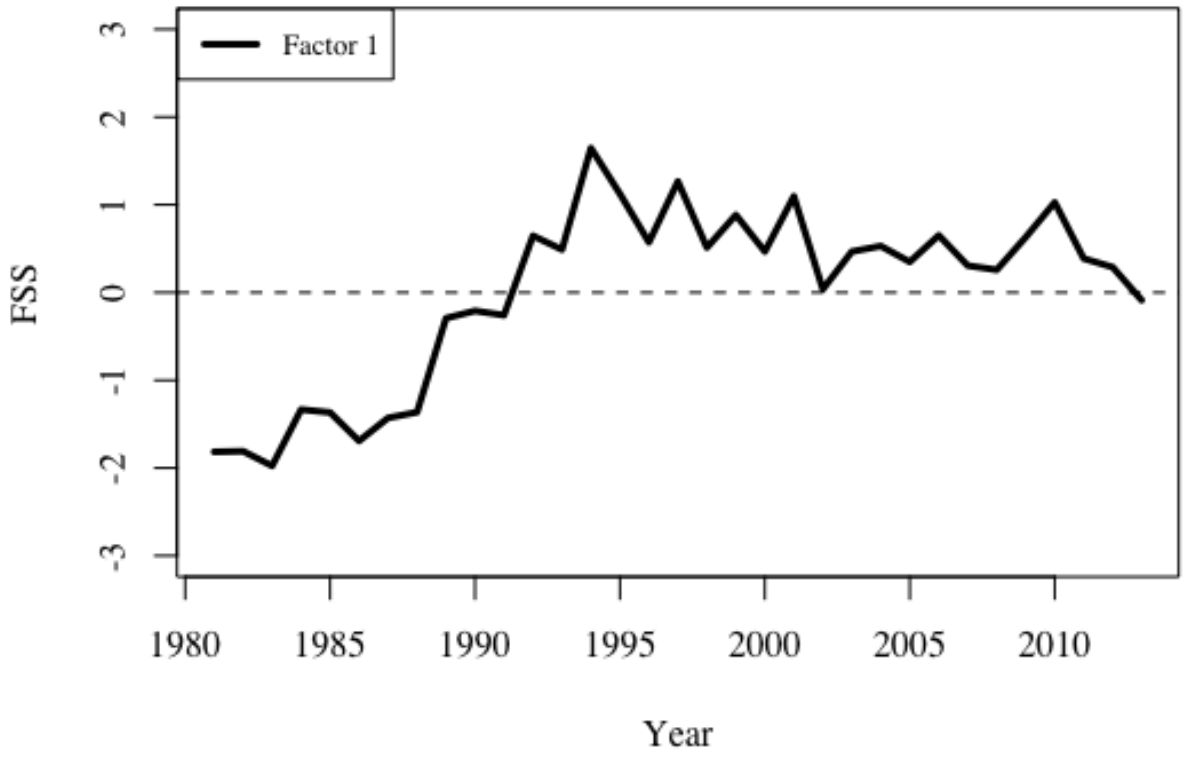


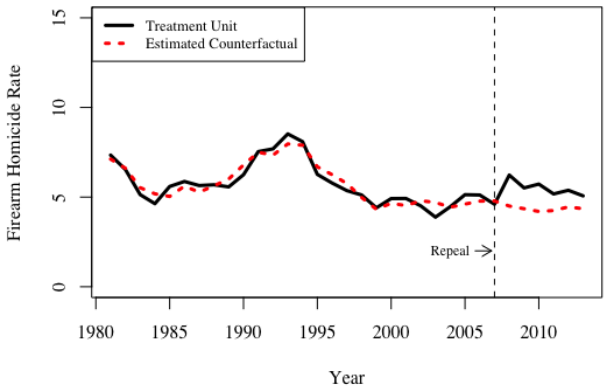
Figure 7: Missouri PTP Repeal and County-Level Gun Ownership: Estimated Latent Factors

Notes: Estimated latent factor comes from generalized synthetic control estimation controlling for overall suicide rates, log per capita income, percent of female-headed households, educational attainment less than high school, county effects, and year fixed effects. Model specification based on cross-validation results minimizing the mean squared prediction error (MSPE) over the pretreatment period.

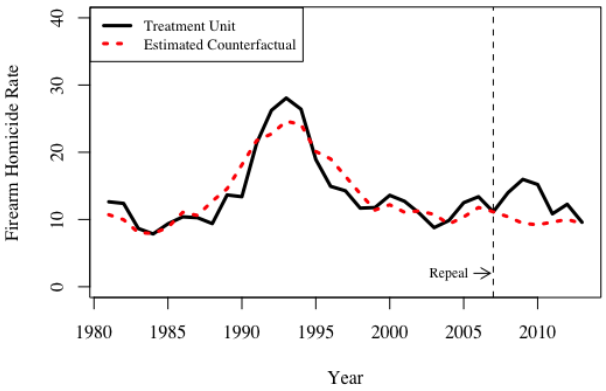
Table 4: Missouri PTP Repeal Firearm Homicide Results

Variables	All Age	Age 15-24	Age 25-44	Age 45+
PTP Repeal	0.9716	2.83	1.14	0.2599
	(0.6278)	(2.47)	(1.75)	(0.2169)
Poverty Rate	-0.0292	-0.1536	0.0590	-0.0106
	(0.0159)	(0.0887)	(0.0663)	(0.0134)
Unemployment Rate	-0.0390	-0.4834	-0.1223	0.0419
	(0.0372)	(0.1975)	(0.1214)	(0.0285)
Cocaine-Related Overdose Rate	0.0356	0.1597	0.0543	0.0089
	(0.0221)	(0.1219)	(0.0721)	(0.0110)
FSS	0.0122	0.0116	0.1083	0.0094
	(0.0372)	(0.0592)	(0.0417)	(0.0107)
Treatment Units	1	1	1	1
Control Units	33	26	29	25
Unobserved Factors	2	1	0	1
MSPE	0.2497	6.80	0.4841	0.1376

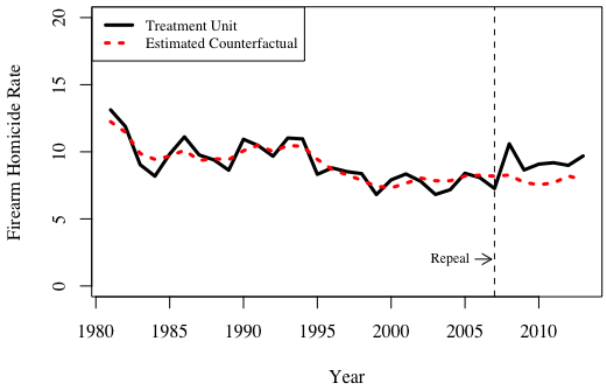
Note: Data on cocaine-related overdose and all firearm homicide rates are presented per 100,000 individuals in the population. Estimation includes state and year fixed effects. Standard errors are presented in parentheses and clustered at the state-level with bootstraps based on a sample of $N = 2,000$.



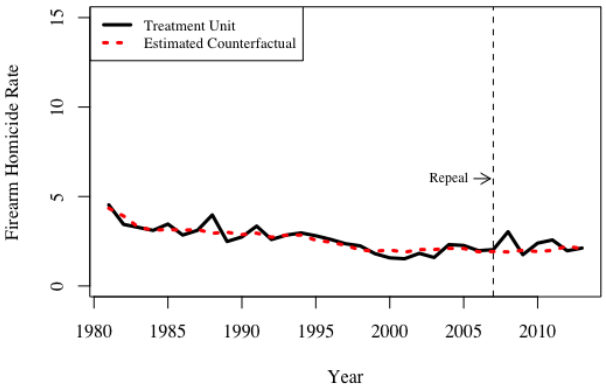
(a) Firearm Homicide: Overall



(b) Firearm Homicide: 15-24



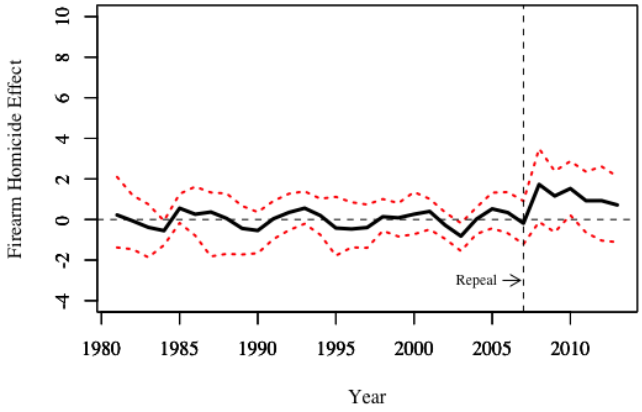
(c) Firearm Homicide: 25-44



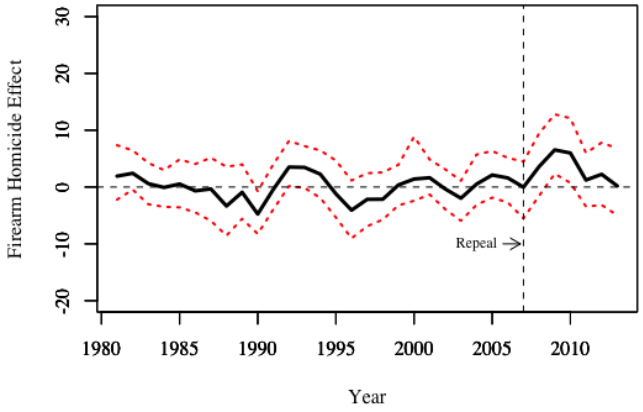
(d) Firearm Homicide: 45 and Older

Figure 8: Missouri Firearm Homicide Results

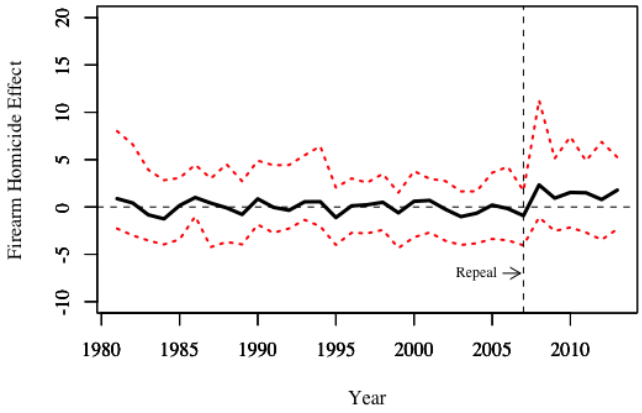
Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for poverty rate, unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects.



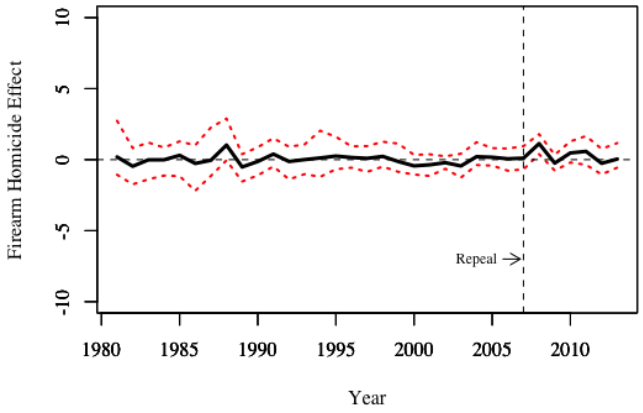
(a) Firearm Homicide: Overall



(b) Firearm Homicide: 15-24



(c) Firearm Homicide: 25-44



(d) Firearm Homicide: 45 and Older

Figure 9: Missouri Firearm Homicide Effects

Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for poverty rate, unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the state-level based on a sample of $N = 2,000$.

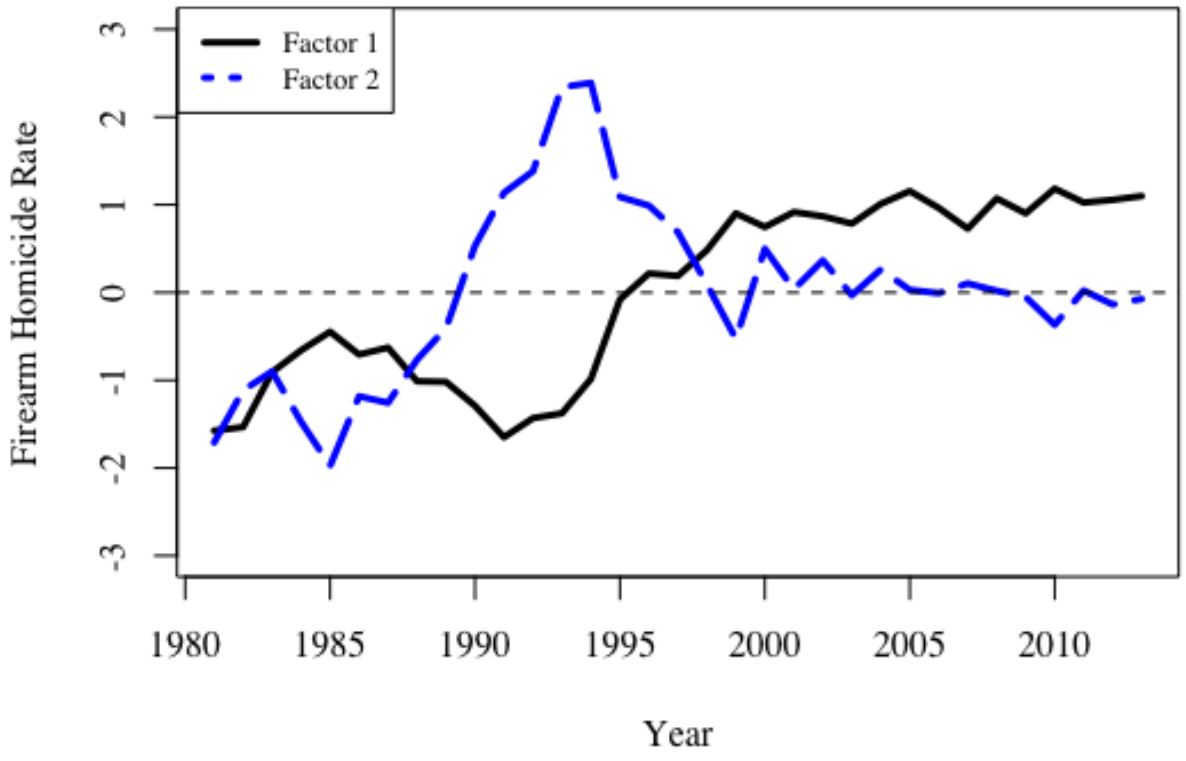


Figure 10: Missouri PTP Repeal and Firearm Homicide: Estimated Latent Factors

Notes: Estimated latent factor comes from generalized synthetic control estimation controlling for poverty rate, unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Model specification based on cross-validation results minimizing the mean squared prediction error (MSPE) over the pretreatment period.

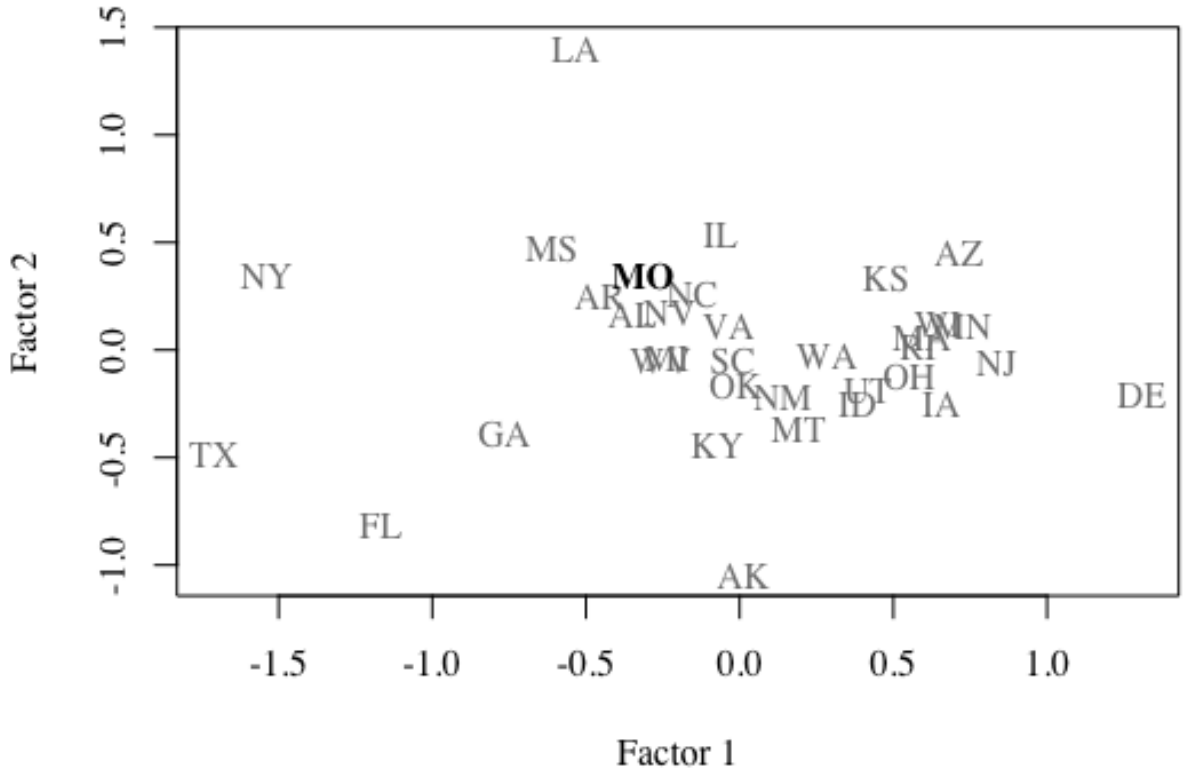


Figure 11: Missouri PTP Repeal and Firearm Homicide: Factor Loadings

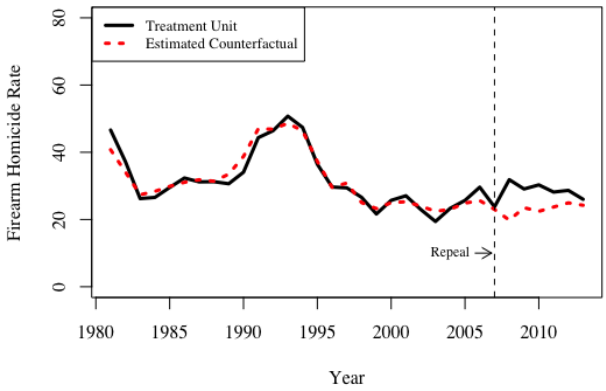
Notes: Estimated factor loadings come from generalized synthetic control estimation controlling for poverty rate, unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Model specification based on cross-validation results minimizing the mean squared prediction error (MSPE) over the pretreatment period.

Table 5: Missouri PTP Repeal Firearm Homicide Results by Race and Age

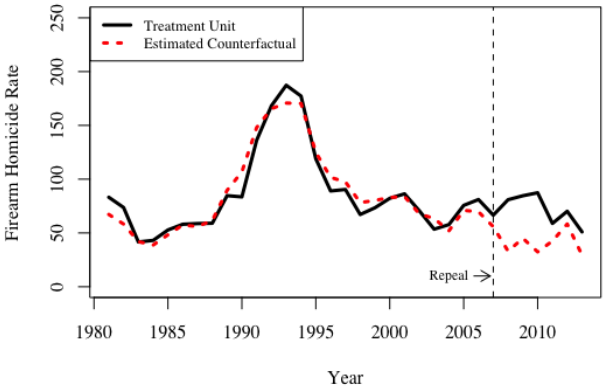
Variables	Black	White	Black (15-24)	Black (25-44)	White (25-44)
PTP Repeal	5.17	0.1226	28.97	8.18	0.3477
	(3.19)	(0.1728)	(11.68)	(5.97)	(0.6255)
Poverty Rate[1]	0.0416	0.0205	0.9003	0.0947	-0.0064
	(0.1508)	(0.0546)	(0.4384)	(0.3605)	(0.1660)
Unemployment Rate[1]	-0.0859	-0.0536	-0.3242	-0.0014	-0.0624
	(0.2162)	(0.0502)	(0.7152)	(0.4923)	(0.1676)
Cocaine-Related Overdose	0.1103	0.0132	-0.0958	0.5267	0.0560
	(0.1163)	(0.0096)	(0.4151)	(0.3052)	(0.0294)
FSS	0.0060	0.0132	0.2233	0.1902	0.0311
	(0.0440)	(0.0063)	(0.1621)	(0.1226)	(0.0185)
Treatment Units	1	1	1	1	1
Control Units	24	28	20	22	21
Unobserved Factors	3	2	2	1	1
MSPE	18.62	0.0500	459.65	50.93	0.2610

Note: Data on cocaine-related overdose and all firearm homicide rates are presented per 100,000 individuals in the population. Estimation includes state and year fixed effects. Standard errors are presented in parentheses and clustered at the state-level with bootstraps based on a sample of $N = 2,000$.

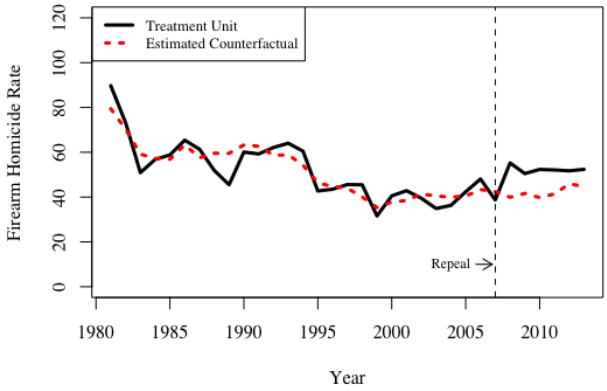
[1] Poverty and unemployment rates are race-specific when appropriate.



(a) Black Firearm Homicide: Overall



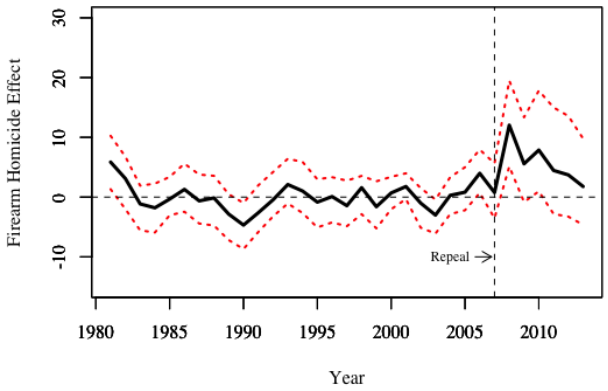
(b) Black Firearm Homicide: 15-24



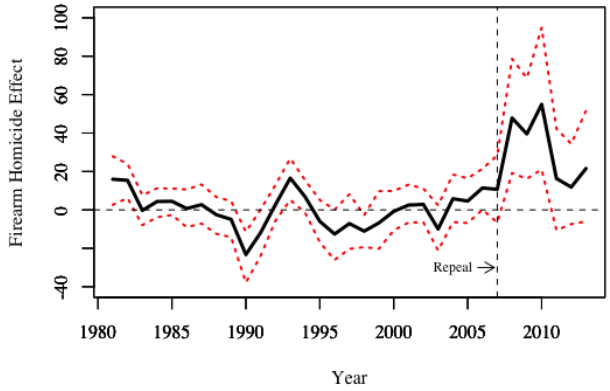
(c) Black Firearm Homicide: 25-44

Figure 12: Missouri Black Firearm Homicide Results

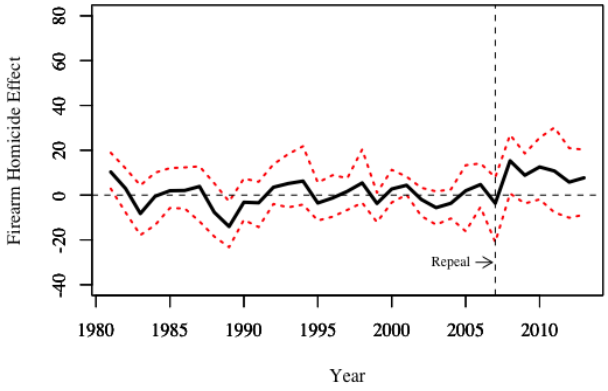
Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects.



(a) Black Firearm Homicide: Overall



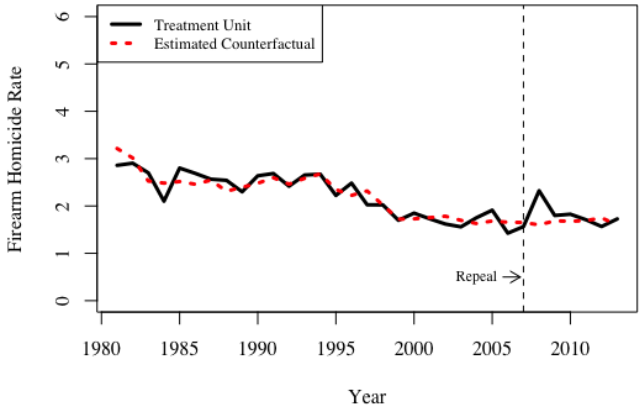
(b) Black Firearm Homicide: 15-24



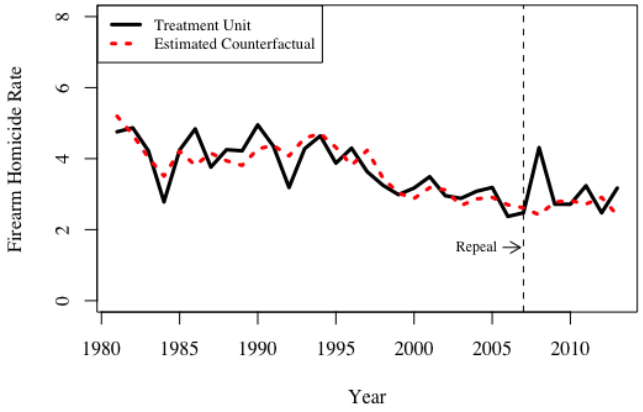
(c) Black Firearm Homicide: 25-44

Figure 13: Missouri Black Firearm Homicide Effects

Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the state-level based on a sample of $N = 2,000$.



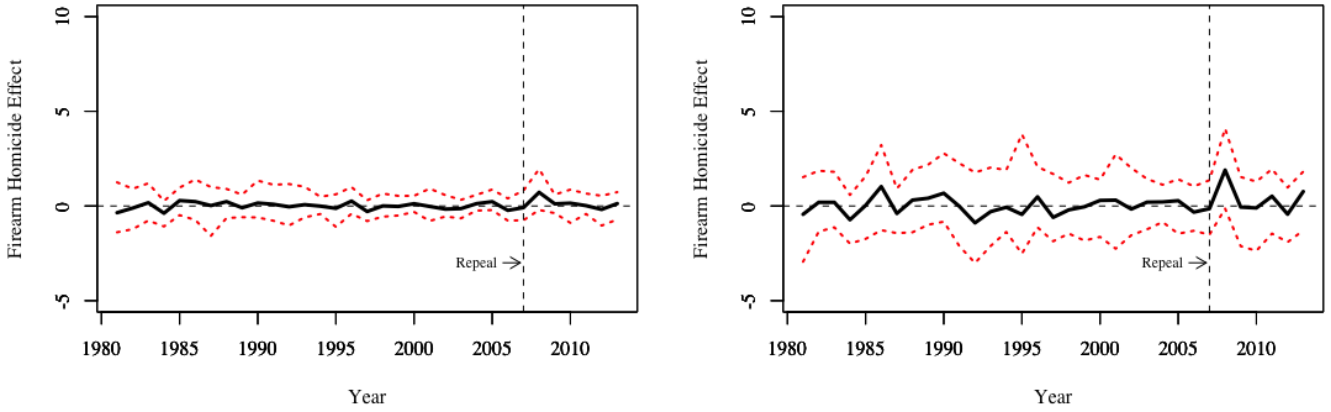
(a) White Firearm Homicide: Overall



(b) White Firearm Homicide: 25-44

Figure 14: Missouri White Firearm Homicide Results

Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for White poverty rate, White unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects.



(a) White Firearm Homicide: Overall

(b) White Firearm Homicide: 25-44

Figure 15: Missouri White Firearm Homicide Results

Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for White poverty rate, White unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the state-level based on a sample of $N = 2,000$.

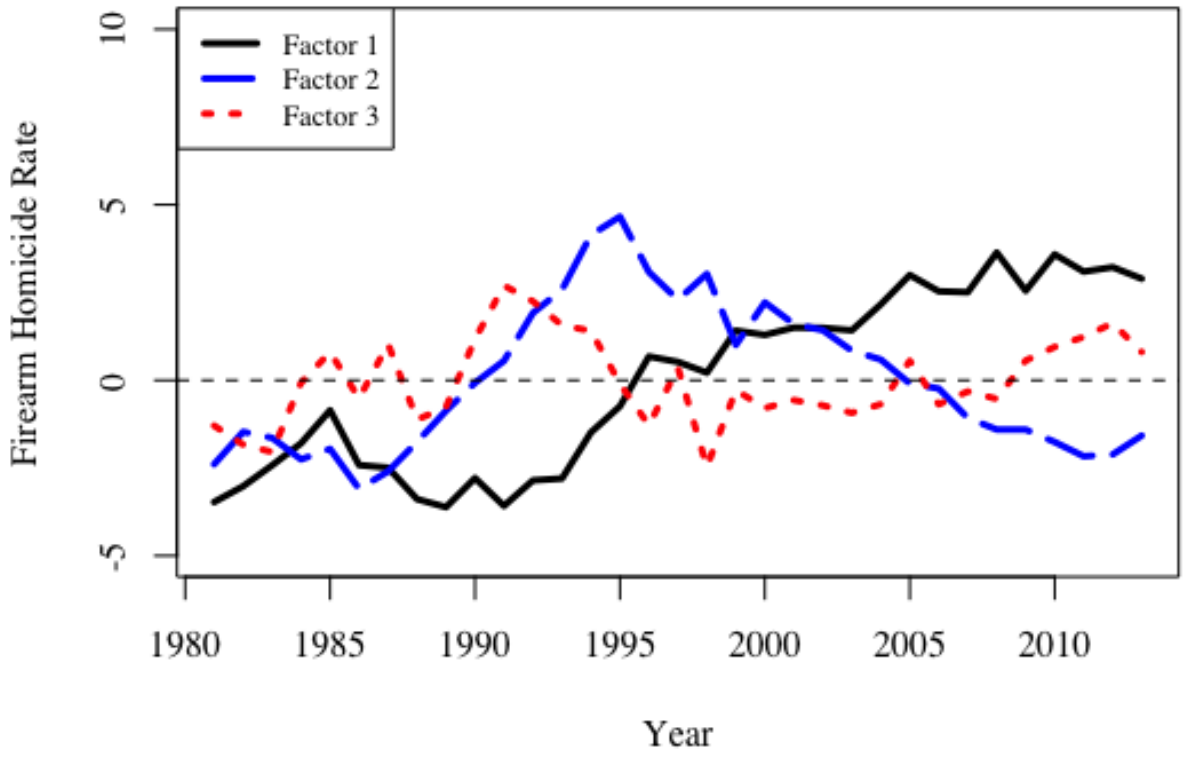


Figure 16: Missouri PTP Repeal and Black Firearm Homicide: Estimated Latent Factors

Notes: Estimated latent factors come from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Model specification based on cross-validation results minimizing the mean squared prediction error (MSPE) over the pretreatment period.

Table 6: Missouri PTP Repeal and Black Firearm Homicide: State-Level Factor Loadings

State	Factor 1	State	Factor 2	State	Factor 3
1. Delaware	2.41	1. Kansas	2.45	1. **Missouri**	2.06
2. New Jersey	1.98	2. Wisconsin	1.57	2. Illinois	1.05
3. Kentucky	0.8189	3. Minnesota	1.49	3. Louisiana	0.9978
4. South Carolina	0.8131	4. Arizona	1.13	4. Wisconsin	0.9582
5. Ohio	0.7962	5. Louisiana	0.9941	5. Arkansas	0.6211
6. Massachusetts	0.7316	6. Illinois	0.8459	6. Texas	0.5980
7. Oklahoma	0.6384	7. Nevada	0.8123	7. Oklahoma	0.5444
8. Wisconsin	0.3430	8. **Missouri**	0.5659	8. Ohio	0.4395
9. Virginia	0.2422	9. Virginia	0.2253	9. Massachusetts	0.3921
10. North Carolina	0.1716	10. North Carolina	0.0941	10. Michigan	0.3653
11. Minnesota	0.1194	11. Mississippi	-0.0278	11. New York	0.3630
12. Kansas	0.0809	12. Arkansas	-0.0823	12. New Jersey	0.0894
13. Arizona	0.0087	13. Massachusetts	-0.1619	13. Mississippi	0.0891
14. Illinois	0.0001	14. Kentucky	-0.2145	14. Kansas	-0.0316
15. Mississippi	-0.0300	15. Alabama	-0.3586	15. Minnesota	-0.0770
16. Alabama	-0.0679	16. New York	-0.4922	16. Virginia	-0.1667
17. Louisiana	-0.1266	17. South Carolina	-0.5148	17. Delaware	-0.2527
18. Arkansas	-0.3732	18. Ohio	-0.7548	18. Alabama	-0.2783
19. Georgia	-0.5176	19. Oklahoma	-0.8101	19. North Carolina	-0.3411
20. Michigan	-0.8873	20. New Jersey	-0.8251	20. South Carolina	-0.3443
21. New York	-0.9011	21. Delaware	-0.8341	21. Georgia	-0.5811
22. Florida	-1.23	22. Georgia	-0.9152	22. Florida	-0.5928
23. Nevada	-1.41	23. Michigan	-1.16	23. Kentucky	-1.09
24. **Missouri**	-1.59	24. Texas	-1.19	24. Arizona	-1.37
25. Texas	-2.02	25. Florida	-1.84	25. Nevada	-3.45

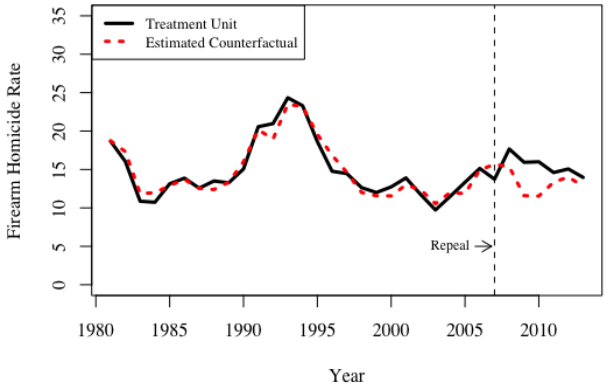
Notes: Estimated factor loadings come from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, cocaine-related overdose rate, FSS, state effects, and year fixed effects. Model specification based on cross-validation results minimizing the mean squared prediction error (MSPE) over the pretreatment period.

Table 7: Missouri County-Level PTP Repeal Firearm Homicide Results

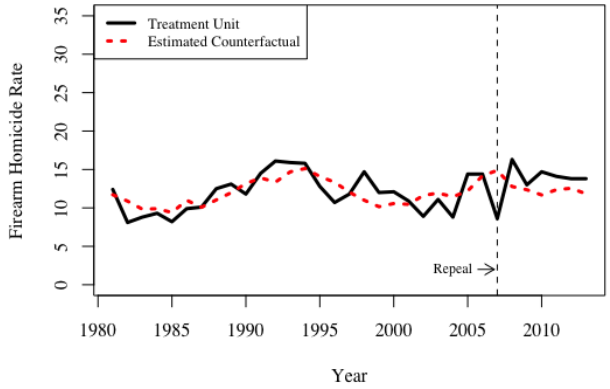
Variables	Firearm Homicide	Black Firearm Homicide
PTP Repeal	1.81	6.27
	(1.47)	(3.22)
Poverty Rate[1]	0.0178	-0.0688
	(0.1735)	(0.5212)
Unemployment Rate[1]	-0.2410	0.4782
	(0.0888)	(0.6485)
Percent Black	0.0775	-0.3047
	(0.1425)	(0.4811)
FSS	0.0070	-0.0709
	(0.0078)	(0.0445)
Treatment Units	3	3
Control Units	33	14
Unobserved Factors	4	4
MSPE	16.56	63.34

Note: All firearm homicide rates are presented per 100,000 individuals in the population. Estimation includes county and year fixed effects. Standard errors are presented in parentheses and clustered at the county-level with bootstraps based on a sample of $N = 2,000$.

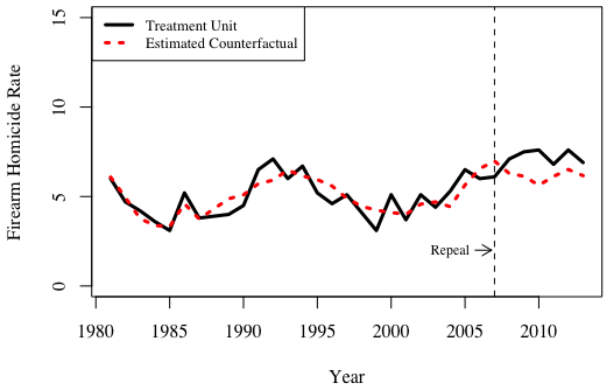
[1] Poverty and unemployment rates are race-specific when appropriate.



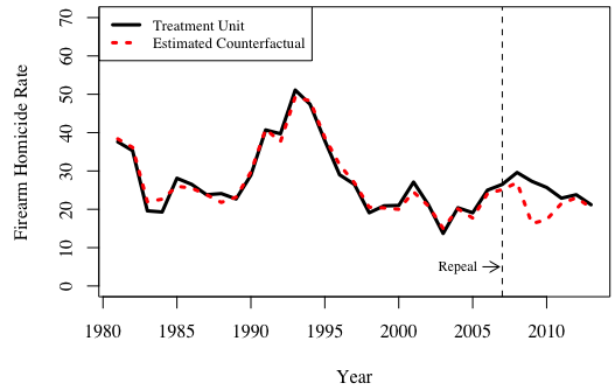
(a) Firearm Homicide: All Counties



(b) Firearm Homicide: Jackson County



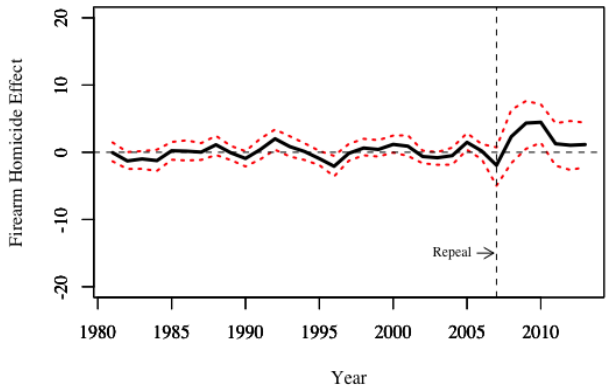
(c) Firearm Homicide: St. Louis County



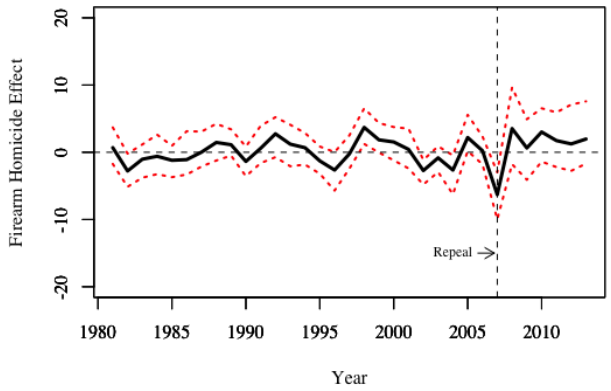
(d) Firearm Homicide: City of St. Louis

Figure 17: Missouri County-Level Firearm Homicide Results

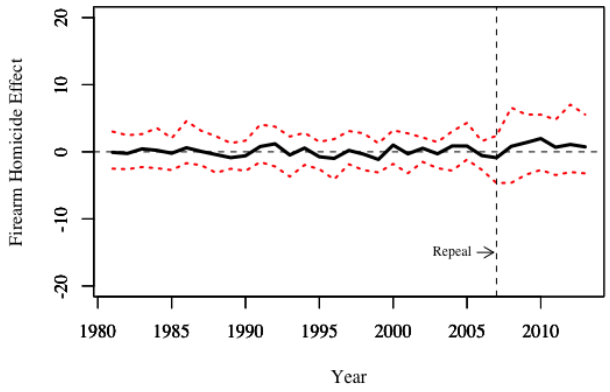
Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for poverty rate, unemployment rate, Black percent of the population, FSS, county effects, and year fixed effects.



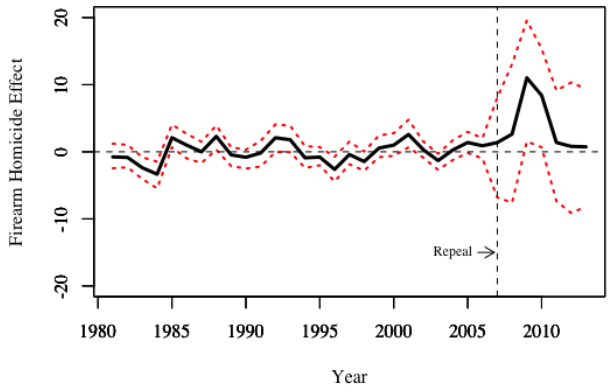
(a) Firearm Homicide: All Counties



(b) Firearm Homicide: Jackson County



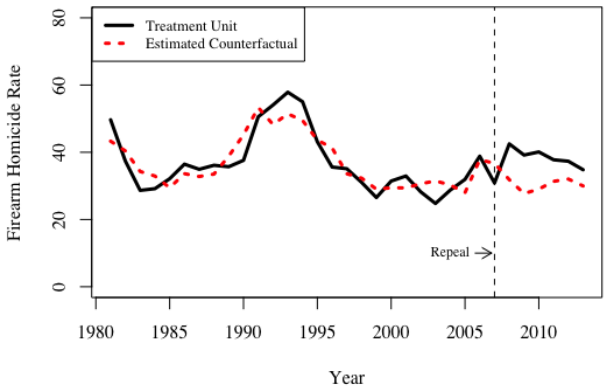
(c) Firearm Homicide: St. Louis County



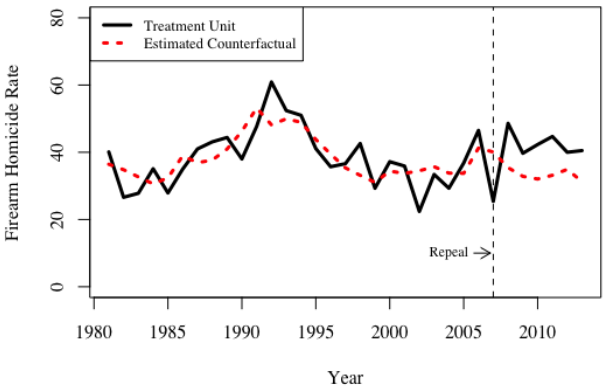
(d) Firearm Homicide: City of St. Louis

Figure 18: Missouri County-Level Firearm Homicide Effects

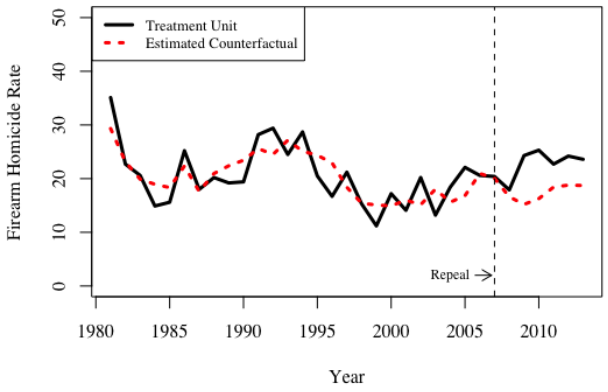
Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for poverty rate, unemployment rate, Black percent of the population, FSS, county effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the county-level based on a sample of $N = 2,000$.



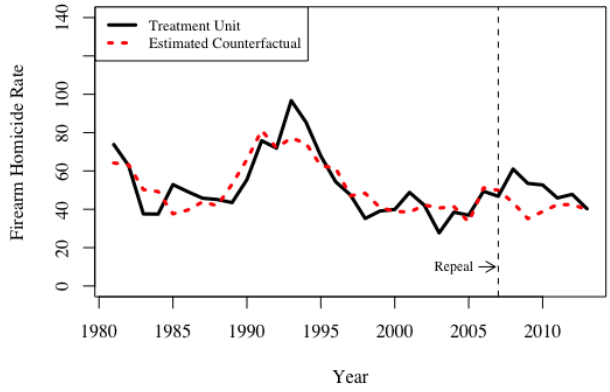
(a) Black Firearm Homicide: All Counties



(b) Black Firearm Homicide: Jackson County



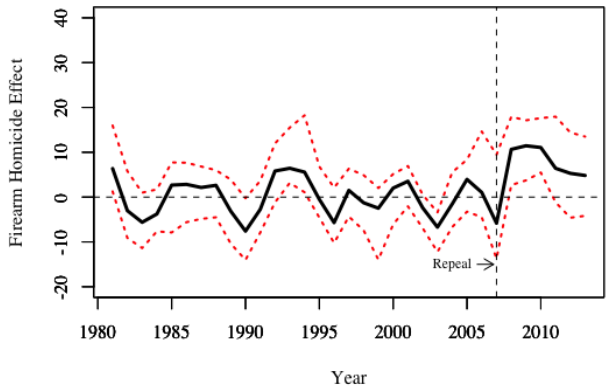
(c) Black Firearm Homicide: St. Louis County



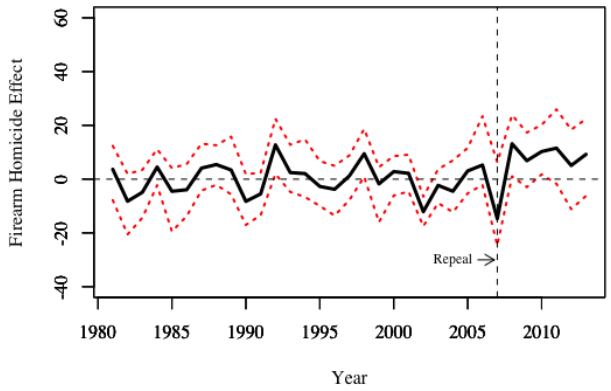
(d) Black Firearm Homicide: City of St. Louis

Figure 19: Missouri County-Level Black Firearm Homicide Results

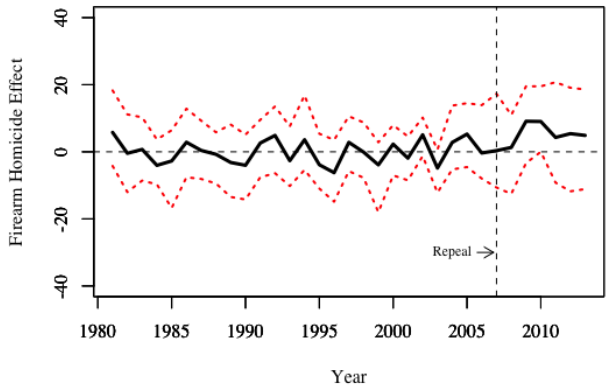
Notes: Figure includes estimated counterfactuals from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, Black percent of the population, FSS, county effects, and year fixed effects.



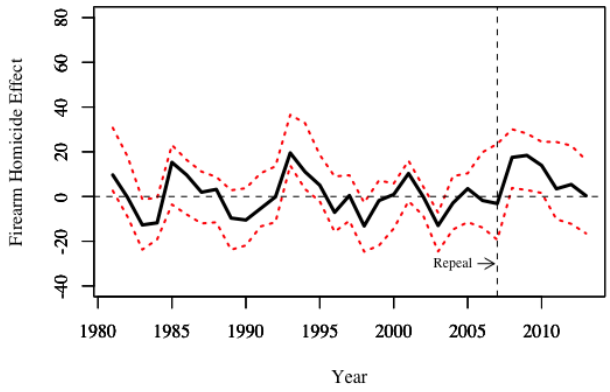
(a) Black Firearm Homicide: All Counties



(b) Black Firearm Homicide: Jackson County



(c) Black Firearm Homicide: St. Louis County



(d) Black Firearm Homicide: City of St. Louis

Figure 20: Missouri County-Level Black Firearm Homicide Effects

Notes: Figure includes treatment effects from generalized synthetic control estimation controlling for Black poverty rate, Black unemployment rate, Black percent of the population, FSS, county effects, and year fixed effects. Dashed lines represent 95 percent confidence intervals with bootstrapped standard errors clustered at the county-level based on a sample of $N = 2,000$.

Table 8: Missouri Firearm Trace Recovery in Border States: 2006-2013 (%)

Year	Missouri	Arkansas	Illinois	Iowa	Kansas	Kentucky	Nebraska	Oklahoma	Tennessee
2006	30.65	1.75	0.63	1.26	7.18	0.00	0.94	0.64	0.00
2007	33.33	0.96	0.84	0.60	7.99	0.00	0.78	0.37	0.00
2008	35.64	0.94	0.86	1.39	6.92	0.00	1.18	1.18	0.00
2009	40.43	0.93	1.08	1.45	6.33	0.00	0.00	0.66	0.00
2010	41.19	1.65	1.00	1.08	8.31	0.00	1.06	0.73	0.00
2011	48.24	0.90	1.43	1.30	6.71	0.00	1.12	1.09	0.00
2012	47.96	0.76	1.37	1.49	6.98	0.36	1.45	0.53	0.00
2013	50.34	1.05	1.69	1.49	6.50	0.00	1.87	1.06	0.00

Source: Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Firearm Tracing System

Table 9: Missouri PTP Repeal: Robustness Check Results

Outcomes	PTP Repeal
Non-Firearm Homicide Rate: CDC	0.1140
	(0.5108)
Murder Rate and Non-Negligent Homicide: UCR	1.23
	(0.6053)
Aggravated Assault Rate: UCR	34.18
	(38.05)
Forcible Rape Rate: UCR	1.81
	(2.87)
Robbery Rate: UCR	0.9267
	(10.51)
Burglary Rate: UCR	-10.13
	(61.25)
Larceny Theft Rate: UCR	-130.70
	(241.10)
Property Crime Rate: UCR	-211.60
	(312.80)
Motor Vehicle Theft Rate: UCR	0.16
	(138.4)

Note: Specifications include poverty, unemployment rate, cocaine-related overdose rate, and fraction of suicides committed with a firearm. Estimation includes geographic unit (i.e., county-level or state-level) and year fixed effects. Standard errors are presented in parentheses and clustered at the geographic level (i.e., county-level or state-level) with bootstraps based on a sample of $N = 2,000$.

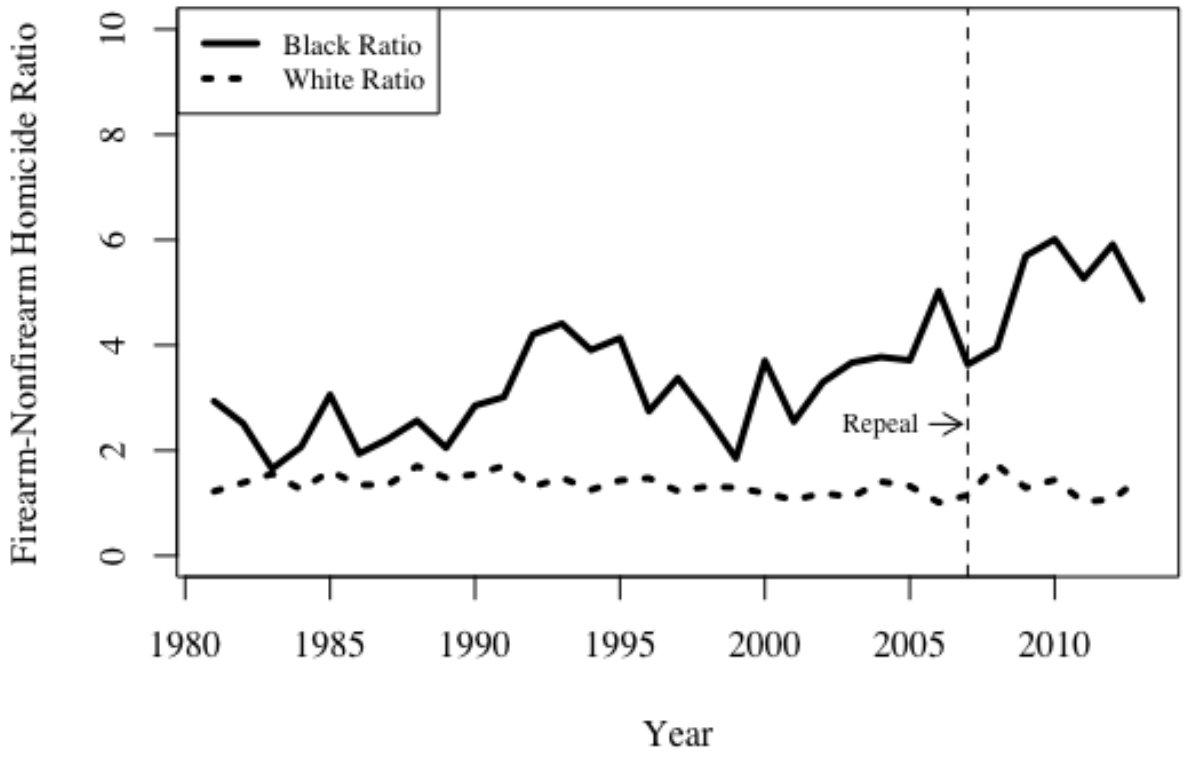


Figure 21: Missouri Firearm-Nonfirearm Homicide Ratios by Race: 1981-2013