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Effects of Missouri's Repeal of Its Handgun Purchaser Licensing Law on Homicides

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ABSTRACT

In the United States, homicide is a leading cause of death for young males and a major cause of racial disparities in life expectancy for men. There is intense debate and little rigorous research on the effects of firearm sales regulation on homicides. This study estimates the impact of Missouri's 2007 repeal of its permit-to-purchase (PTP) handgun law on states' homicide rates and controls for changes in poverty, unemployment, crime, incarceration, policing levels, and other policies that could potentially affect homicides. Using death certificate data available through 2010, the repeal of Missouri's PTP law was associated with an increase in annual increase in firearm homicides rates of 1.09 per 100,000 (+23%), but was unrelated to changes in non-firearm homicide rates. Using Uniform Crime Reporting data from police through 2012, the law's repeal was associated with increased annual murders rates of 0.93 per 100,000 (+16%). These estimated effects translate to increases of between 55 and 63 homicides per year in Missouri.

INTRODUCTION

Homicide is the second leading cause of death for people age 15-34 in the United States, and the leading cause of death for black males in this age group.[1] Homicide also accounts for 5 percent of the years of potential life lost (YPLL) in the U.S.,[2] and is the second leading cause of the racial disparity in life expectancy between black and white males.[3] Two-thirds of all homicides in the US are committed with firearms[1] and the firearm homicide rate in the US is 19.5 times higher than the average firearm homicide rate in other high-income countries.[4]

It has been argued that weaknesses in federal and state firearms laws contribute to the unusually high homicide rate in the U.S., especially the lack of background checks or record-keeping requirements for private, unlicensed sellers of firearms.[5] Many perpetrators of homicide have backgrounds that would prohibit them from possessing firearms as a result of prior convictions for felony crimes[6] or for misdemeanors involving domestic violence, being under a restraining order for domestic violence, young age, or other disqualifications.[7] Federal law requires background checks and record-keeping for sales by federally licensed firearms dealers, but exempts these regulations when the firearm seller is unlicensed. Fifteen states require individuals purchasing handguns from unlicensed sellers to pass background checks and 10 of these states require all handgun purchasers to acquire a permit-to-purchase (PTP) license.

PTP systems require prospective handgun purchasers to obtain a license verifying that they have passed a background check. All handgun sellers, both licensed dealers and private sellers, may only sell to those with a current PTP license. Most states with PTP handgun licensing require applicants to apply for the license directly at a law enforcement agency. In all other states, individuals wishing to purchase a handgun from a licensed dealer must complete a purchase application form. The dealer or dealer's employee submits the form to the Federal

Bureau of Investigation's (FBI) National Instant Check System (NICS), or in some cases to state police, to determine whether the applicant is prohibited from possessing firearms.

Prior research has shown that cities and states that require background checks and record-keeping for handgun sales by unlicensed sellers and stricter PTP handgun licensing laws have lower levels of guns being diverted to criminals within a year of retail sale[8] and fewer guns exported to criminals across state borders.[9] A recent study found a cross-sectional association between states having PTP handgun licensing or other forms of universal background check requirements for gun sales and lower homicide rates.[10]

Missouri repealed its PTP handgun licensing law effective August 28, 2007. Missouri's law had been in place since 1921 and required all handgun purchasers to have a valid PTP license (good for 30 days) in order to lawfully purchase a handgun from any seller, licensed or unlicensed. Applicants applied in person at their local sheriff's office which facilitated the background check. Webster and colleagues[8] reported that immediately following the repeal of Missouri's PTP handgun law there was a two-fold increase in the percentage of guns that had unusually short intervals between the retail sale and recovery by police, an indicator of firearm diversion or trafficking. [11,12] The repeal also coincided with a sharp increase in the percentage of crime guns recovered by police in Missouri that had been originally sold by in-state retailers, from 56.4 percent in 2006 to 71.8 percent in 2012.[13]

This study examines the effects of the repeal of Missouri's PTP handgun licensing law on homicide rates. Because this change eliminated mandatory background checks for handguns sold by unlicensed sellers, it is of particular relevance for debates in the U.S. Congress and in several states about proposals to extend background check requirements to all firearm sales.

METHODS

Design

The association between the repeal of Missouri's PTP handgun licensing law on homicide rates was estimated using a quasi-experimental research design with annual, state-level homicide rates. Homicide rates were age-adjusted and stratified by those committed with a firearm versus all other methods to discern the specificity of the effects of the policy change on firearm versus non-firearm homicides.

Data and Measures

We hypothesized that the policy change would affect homicide rates, but only those committed with firearms. Thus, the primary outcome measure was state-level annual firearm homicide rates, derived from death certificate and census data, age-adjusted (reference year 2000) in CDC's WISQARS (Web-based Injury Statistics Query and Reporting System) Fatal Injury Reports. [14] Seven states (HI, ME, NH, ND, SD, VT, WY) were dropped from the analyses because WISQARS suppressed the data for states and years for which there were very few firearm homicides to protect the anonymity of the data. Missouri's mean baseline rate of firearm homicides during the pre-repeal study years was approximately 4 to 5 times higher than was experienced in the 7 dropped states, and none of the dropped states were geographically close to Missouri. Within Missouri, we also used county-level cause-of-death mortality data from CDC's Wide-ranging Online Data for Epidemiologic Research (WONDER) system[15] to assess the degree to which state-wide changes in age-adjusted homicide rates differed across counties.

These data from CDC's WISARS and WONDER systems have the advantage of complete, mandatory reporting of death certificate data and the ability to easily isolate homicides

committed with firearms versus other methods. The disadvantage of these data is that they were only available through the end of 2010 at the time of this study. We also collected and analyzed state-level data on annual rates of murder and non-negligent manslaughter (which will capture virtually all homicides) from the Federal Bureau of Investigation's (FBI) Uniform Crime Reporting (UCR) system. UCR data provided two additional years of post-PTP-law-repeal data; however, the FBI has to interpolate some data for states and years, when there is incomplete reporting from local law enforcement agencies, and rates are not age-adjusted.

Although data from prior years are available, we chose 1999 as the beginning of our study period because the period 1999-2012 has been the most stable period for homicide trends in many decades. Periods of dramatic change, especially if the underlying causes for those changes cannot be easily modeled, are vulnerable to omitted variable bias in estimates of policy impact.[16]

Regression analyses used to estimate policy change effects controlled for changes in rates of unemployment, poverty, incarceration, burglary, law enforcement officers per capita, and the presence of four other types of state laws potentially most directly relevant to lethal violence for which there was significant change during the study period. These laws included so-called "Stand Your Ground" (SYG) laws, which give individuals an expanded right to use deadly force in potentially dangerous encounters with no duty to retreat, right-to-carry (RTC) laws which require law enforcement agencies to issue permits to carry concealed firearms to all legally qualified applicants, bans of unsafe handguns including so-called "Saturday Night Specials," and firearm prohibitions for young adults resulting from convictions for serious crimes adjudicated in juvenile courts. SYG laws have been enacted in many states in recent years, including in Missouri in 2007. Prior research indicated that these laws may increase homicides.[17] Early

research suggested that RTC laws may reduce homicides;[18] but the most rigorous studies show no evidence that RTC laws affect homicide rates.[19,20] Maryland's adoption of a SNS ban was associated with a reduction in firearm homicide rates;[21] but this policy has not been rigorously studied in other states nor has firearm prohibitions stemming from serious juvenile offenses.

Average annual unemployment rates (per 100 population 16 years of age and older) were obtained from the Bureau of Labor Statistics.[22] Poverty rates (per 100 population) were obtained from the Census Bureau's Current Population Survey.[23] Burglary rates (per 100,000 population) – an indicator of crime rates that should not be directly affected by gun laws – and the rates of law enforcement officers (per 100,000 population) were drawn from the FBI's UCR program.[24] Incarceration rates (per 100,000 population) are from the Sourcebook of Criminal Justice Statistics.[25] The repeal of Missouri's PTP handgun licensing law was measured as the proportion of days in a year when the state had no PTP handgun law, i.e., 0 for the years the PTP law was in place (1999-2006), 0.263 in 2007, and 1 for 2008-2012.

Analytic Methods

Pre-repeal versus post-repeal differences in mean age-adjusted homicide rates were tested for statistical significance using t-tests. To estimate the independent association between the repeal of Missouri's PTP handgun licensing law and age-adjusted homicide rates, we used generalized least-squares regression models. The models included state- and year fixed effects to control for baseline differences in states' homicide rates and yearly fluctuations that occurred nationally as well as changes in the covariates described above. Standard errors for model coefficients were adjusted to account for clustering by state and for heteroskedasticty using the Eikert-Huber-White adjustment.[26] Analyses were conducted using Stata IC v 11.0.[27]

RESULTS

From 1999 through 2007, Missouri's firearm homicide rate was relatively stable, fluctuating around a mean of 4.66 per 100,000 population per year (Figure 1). In 2008, the first full year after the permit-to-purchase licensing law was repealed, the firearm homicide rate in Missouri increased sharply to 6.23 per 100,000, a 34 percent increase from the baseline mean. For the post-repeal period of 2008-2010, the mean annual firearm homicide rate was 5.82, 24.9 percent higher than the pre-repeal mean ($t=4.38$, $df=10$, $p=.001$). Within Missouri, firearm homicide rates per 100,000 increased sharply between the pre- and post-repeal periods in each of the three large central metro counties/jurisdictions – by 30 percent in Jackson County (11.2 to 14.7), 47 percent in St. Louis County (5.0 to 7.4), 27 percent in St. Louis City (21.7 to 27.5), and 34 percent overall in the 9 Missouri counties designated as large metropolitan fringe counties (3.1 to 4.2).

This sharp increase in firearm homicide rates in Missouri beginning in 2008 was out of sync with changes during that period nationally and in states bordering Missouri (Table 1). The mean age-adjusted firearm homicide rate in the U.S. declined 5.5 percent from 4.03 per 100,000 during 1999-2007 to 3.81 for 2008-2010. The population-weighted mean firearm homicide rates across the 8 states bordering Missouri changed little between these two time periods (4.15 to 4.06, -2.2%; $p = .480$, Figure 1) and there were no statistically significant change in any specific state that bordered Missouri.

Controlling only for baseline differences across states and year effects nationally (model 1, Table 2), the repeal of Missouri's PTP handgun licensing law was associated with an increase in firearm homicide rates of 1.32 per 100,000 ($p<.001$), a 29.4 percent increase above rates projected without the repeal. After controlling for changes in rates of unemployment, poverty,

burglary, incarceration, and law enforcement officers along with other state laws, the estimated increase in annual firearm homicide rates associated with the repeal of Missouri's PTP handgun law dropped to 1.09 per 100,000 population per year ($p<.001$; 95% CI 0.81 to 1.38), a 23 percent increase.

The increase in homicide rates following the repeal of Missouri's PTP handgun licensing law occurred only for homicides committed with firearms. Following similar trends nationally, Missouri's age-adjusted rate of non-firearm homicides declined from a pre-repeal (1999 to 2007) mean of 2.19 to a post-repeal (2008 to 2010) mean of 1.88 (-14 percent). Regression analyses indicated that Missouri's repeal of its PTP handgun law was associated with no change in the age-adjusted non-firearm homicide rate (β=-0.077, $p=.446$) and an increase in annual homicide rates for all methods of 1.00 per 100,000 (Table 2, $p<.001$, 95% CI 0.66 to 1.35).

Using UCR data from police reports for 1999-2012, the difference between Missouri's annual rate for murders and non-negligent manslaughters grew from a mean of 0.60 per 100,000 for the pre-PTP-repeal period to 1.82 during the 5 years after the PTP law repeal (Table 1, $t=4.12$, $df=12$, $p=.001$). A model which only controlled for state and year fixed effects estimated a 1.34 increase in annual murder rates associated with the repeal of the PTP handgun law ($\beta=1.34$, $p=.001$, 95% CI 0.58 to 2.11); however the estimated effect of the policy change was reduced to an increase of 0.93 murders per 100,000 population per year after all covariates were included in the model (Table 2, $\beta=0.93$, $p<.001$, 95% CI 0.48 to 1.38), a 16 percent increase relative to the counterfactual.

Firearm homicide, total homicide and murder rates were positively associated with burglary rates and negatively associated with poverty rates. New unsafe handgun bans adopted in

California and Massachusetts were associated with an increase in total homicide rates (β=0.46, p=.008, 95% CI 0.12 to 0.80). No other covariate reached statistical significance at the .05 level (Supplemental Tables).

DISCUSSION

This study provides compelling evidence that the repeal of Missouri's PTP handgun licensing law, which required all handgun purchasers to pass a background check even for purchases from private sellers, contributed to a sharp increase in Missouri's homicide rate. Our estimates suggest that the law was associated with an additional 55 to 63 murders per year in Missouri between 2008 and 2012 than would have been forecasted had the PTP handgun law not been repealed.

Our analyses ruled out several alternative hypotheses to explain the relatively large and highly statistically significant increase in firearm homicides in Missouri following the repeal of its PTP handgun licensing law. We controlled for changes in unemployment, poverty, policing levels, incarceration rates, trends in crime reflected in burglary rates, national trends in homicide rates, and several kinds of other laws that could affect homicides. That Missouri's sharp increase in firearm homicides was unique within the region, specific to firearms, and was observed in metropolitan jurisdictions across Missouri, suggests that unmeasured unique local circumstances (e.g., gang activity, changes in social norms) are unlikely to have biased our estimates of the impact of the policy change. Estimates of the effects of the repeal of Missouri's PTP handgun law were similar for firearm homicides and total homicides using death certificate data for 43 states through 2010, and for murders and non-negligent manslaughters using police reports for

all 50 states through 2012. This suggests that the data source and time period studied are unlikely to have biased the findings.

Causal inferences from quasi-experimental studies can be strengthened with empirical evidence supporting the proposed causal chain between the intervention, mediators, and the outcomes under study. Handgun purchaser licensing and universal background checks are hypothesized to affect homicide rates by reducing gun diversions to criminals and other prohibited groups. The evidence that Missouri's increase in firearm homicides was fueled by the state's repeal of its PTP law is bolstered by data indicating that the repeal was immediately followed by a two-fold increase in the percentage of crime guns that were recovered by police soon after the guns' retail sales and an unusually large increase in the percentage of Missouri's crime guns that had been purchased from Missouri gun dealers.[9] These finding are consistent with prior research showing that states that regulated handgun sales by unlicensed sellers had fewer guns diverted to criminals shortly after in-state retail sales,[8] and that states with the most comprehensive handgun sales laws including PTP licensing requiring direct interface with law enforcement have proportionately fewer guns used in crime that were originally sold by in-state retailers.[28,29] Having a large percentage of crime guns originate from out-of-state sales, as was the case prior to Missouri's repeal of its PTP law, is indicative of a restricted supply of guns available to criminals from in-state sources. Restrictions from local suppliers increases prices in the underground gun market and attracts suppliers from states with fewer legal impediments to gun diversion.[30,31]

The weakening of Missouri's gun laws may have also contributed to gun trafficking to border states that regulate handgun sales by all sellers via PTP licensing. The number of guns sold in Missouri and later recovered by police in Illinois and Iowa, two border states with

handgun purchaser licensing laws, increased 37 percent (from 133 to 182) from 2006 (just before Missouri's PTP law was repealed) to 2012 when the overall number of crime guns recovered by police in those states actually declined by 6 percent.[12]

A potential threat to the validity of our estimate of the impact of the repeal of Missouri's PTP law is confounding by the simultaneous adoption of a Stand Your Ground Law in Missouri. Controlling for the effects of SYG laws across all states, our estimate of the effect of the repeal of Missouri's PTP law on homicide rates declined slightly, but was still substantial and statistically significant at $p<.001$. A separate analysis of justifiable homicide data from the FBI's Uniform Crime Reports revealed that there were approximately 3 additional justifiable homicides per year in Missouri following the adoption of the state's Stand Your Ground law above pre-SYG-law levels – less than 1 percent of the total number of gun homicides during 2008-2010.

Critics could question the use of a relatively short pre-repeal baseline period used for this study. Using more longitudinal observations can potentially produce more accurate forecasts of the counterfactual in interrupted time-series impact studies. However, the period from 1985 through 1998 included dramatic increases and decreases in U.S. homicide rates. Experts believe these changes were driven by factors that could not be directly measured (e.g., dynamics of the crack cocaine market, changes in social norms)[32] and thus controlled for statistically, and these unmeasured forces appear to have been uneven across states. [19] Such conditions pose considerable challenges for deriving unbiased estimates of policy impacts. By limiting the analyses to the relatively stable period of 1999-2012, we minimized the potential for omitted variable bias that would have likely been introduced by including data from this earlier time period.

The generalizability of our findings to other states with PTP handgun laws is unknown. Data from a recent cross-sectional study indicated that PTP licensing laws and universal background check requirements were associated with lower homicide rates after controlling for other population risk factors;[9] however, the lack of longitudinal data weaken causal inference from that study. We caution, however, that passage of a PTP handgun licensing law with mandatory background checks and record-keeping for all handgun sales may not result in as immediate and large a reduction in firearm homicides as occurred in reverse when Missouri's law was repealed. Although our findings indicate that Missouri benefited from the protective effects of its PTP law before the law's repeal, the beneficial effects of new laws of this type may be more gradual as enforcement practices are put in place, awareness of the law increases, and the stock of guns available in the underground market is depleted. Additional methodologically rigorous research of the impact of other laws of this type is warranted.

Acknowledgements

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References

[1] National Center for Injury Control and Prevention. Leading Causes of Death, Web-based Injury Statistics Query and Analysis System (WISQARS). Accessed October 1, 2013 http://webappa.cdc.gov/sasweb/ncipc/leadcaus10_us.html

[2] National Center for Injury Control and Prevention. Years of Productive Life Lost. Web-based Injury Statistics Query and Analysis System (WISQARS). Accessed October 1, 2013. http://www.cdc.gov/injury/wisqars/years_potential.html

[3] Kochanek KD, Arias E, Anderson RN. How Did Cause of Death Contribute to Racial Differences in Life Expectancy in United States in 2010? NCHS Brief No. 125, National Centers for Health Statistics, Centers for Disease Control and Prevention, July 2013. http://www.cdc.gov/nchs/data/databriefs/db125.pdf

[4] Richardson EG, Hemenway D. Homicide, suicide, and unintentional firearm fatality: Comparing the United States versus other high-income countries, 2003. *J Trauma* 2011;70:238-43.

[5] Webster DW, Vernick JS. *Reducing Gun Violence in America: Informing Policy with Evidence and Analysis.* Baltimore: Johns Hopkins University Press, 2013.

[6] Cook PJ, Ludwig J, Braga AA. Criminal records of homicide offenders. *JAMA* 2005;294: 598-601.

[7] Vittes KA, Vernick JS, Webster DW. Legal status and source of offenders' firearms in states with the least stringent criteria for gun ownership. *Injury Prevention* 2013;19:26-31.

[8] Webster DW, Vernick JS, Bulzacchelli MT. Effects of state-level firearm seller accountability policies on firearms trafficking. *Journal of Urban Health* 2009;86:525-537.

[9] Webster DW, Vernick JS, McGinty EE, Alcorn T. "Preventing the Diversion of Guns to Criminals through Effective Firearm Sales Laws." Pages 109-122 in *Reducing Gun Violence in America: Informing Policy with Evidence and Analysis*, Daniel W. Webster and Jon S. Vernick, Eds. Baltimore, MD: Johns Hopkins University Press, 2013.

[10] Fleegler EW, Lee LK, Monteaux MC, Hemenway D, Mannix R. Firearm legislation and firearm-related fatalities in the United States. *JAMA Intern Med* 2013;173: 732-40.

[11] Cook PJ, Braga AA. Comprehensive firearms tracing: strategic and investigative uses of new data on firearms markets. *Arizona Law Rev.* 2001;43: 277-309.

[12] Braga AA, Wintemute GJ, Pierce GL, Cook PJ, Ridgeway G. Interpreting the empirical evidence on illegal gun market dynamics. *J Urban Health* 2012;89: 779-93.

[13] Bureau of Alcohol, Tobacco, Firearms and Explosives. Firearms Trace Data. Data accessed online August 29, 2013. http://www.atf.gov/content/About/about-ATF/statistics/firearms-trace-data-2012.

[14] Data downloaded from National Center for Injury Prevention and Control, Fatal Injury Reports. Web-based Injury Statistics Query and Reporting System (WISQARS), Centers for Disease Control and Prevention, Accessed February 1, 2013.

[15] Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2010 on CDC WONDER Online Database, released 2012. Data are from the Multiple Cause of Death Files, 1999-2010, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Data accessed June 12, 2013.

[12] Biglan A, Ary D, Wagenaar AC. The value of interrupted time-series experiments for community intervention research. *Prevention Science* 2000;1: 31-49.

[17] Cheng C, Hoekstra M. Does strengthening self-defense law deter crime or escalate violence? Evidence from castle doctrine. *J Human Resources* 2013;48:821-53.

[18] Lott JR Jr. *More Guns, Less Crime: Understanding Crime and Gun Control Laws, 2nd Edition.* Chicago: University of Chicago Press, 2000.

[19] Aneja A, Donohue JJ III, Zhang A. Right-to-carry gun laws and the NRC report: Lessons from the empirical evaluation of law and policy. *Amer Law and Economics Rev* 2011;13:565-632.

[20] National Research Council. *Firearms and Violence: A Critical Review of the Research.* Committee to Improve Research Information and Data on Firearms. Charles F. Wellford, John V. Pepper, and Carol V. Petrie, eds. Washington, DC: The National Academies Press, 2005.

[21] Webster DW, Vernick JS, Hepburn LM. Effects of Maryland's law banning Saturday night special handguns on homicides. *Amer J Epidemiology* 2002;155:406-12.

[22] Bureau of Labor Statistics. Local Area Unemployment Statistics. U.S. Department of Labor, accessed April 15, 2013 http://www.bls.gov/lau/home.htm

[23] United States Census Bureau and Bureau of Labor Statistics. Current Population Survey. Historical Poverty Data. Accessed June 8th, 2013.
http://www.census.gov/hhes/www/poverty/data/historical/hstpov21.xls

[24] Federal Bureau of Investigation. Annual reports: *Crime in the United States, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010*. U.S. Department of Justice. http://www.fbi.gov/about-us/cjis/ucr/ucr-publications#Crime

[25] Hindelang Criminal Justice Research Center. *Sourcebook of Criminal Justice Statistics*. University of Albany, School of Criminal Justice, Albany, NY. Accessed April 15, 2013. http://www.albany.edu/sourcebook/index.html

[26] Hayes AF, Cai L. Using heteroskedasity-consistent standard error estimators in OLS regression: an introduction and software implementation. *Behavior Research Methods* 2007;37: 709–22.

[27] StataCorp. *Stata Statistical Software Release 11*. College Station, TX: StataCorp LP, 2009.

[28] Webster DW, Vernick JS, Hepburn LM. The relationship between licensing, registration and other state gun sales laws and the source state of crime guns. *Injury Prevention* 2001;7: 184-9.

[29] Knight, Brian G. State Gun Policy and Cross-State Externalities: Evidence from Crime Gun Tracing. National Bureau of Economic Research working paper 17469. Sept., 2011. http://www.nber.org/papers/w17469.

[30] Braga AA, Cook PJ, Kennedy DM, Moore MH. The illegal supply of firearms. In: Tonry M, ed. *Crime and Justice: A Review of Research*, Vol. 29. Chicago: University of Chicago Press; 2002: 229-62.

[31] Pierce GL, Braga AA, Hyatt RR, Koper CS. The characteristics and dynamics of illegal firearms markets: implications for supply-side enforcement strategy. *Justice Q.* 2004;21: 391-422.

[27] Blumstein A, Rosenfeld R. Explaining recent trends in U.S. homicide rates. *J Criminal Law & Criminology* 1998;88: 1175-1216.

Figure
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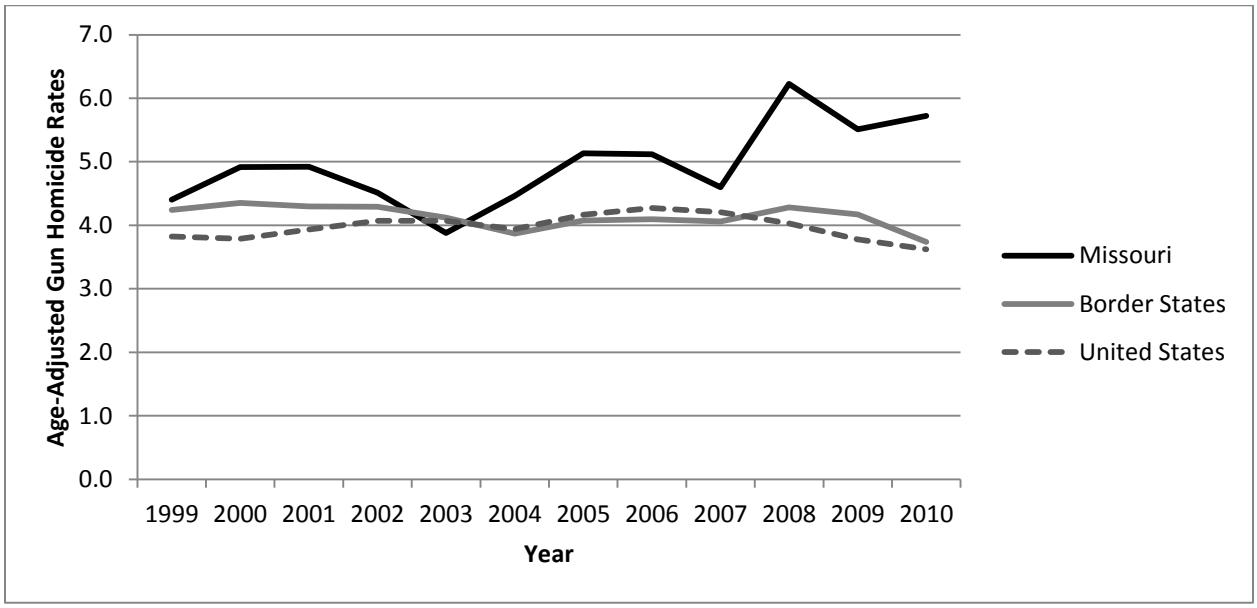
Figure 1. Age-adjusted firearm homicide rates in Missouri, states bordering Missouri (population-weighted averages), and the United States, 1999-2010.



Table
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Table 1. Mean firearm homicide rates before (1999-2007) and after Missouri repealed its permit-to-purchase handgun licensing requirement for handgun sales by licensed and unlicensed sellers (2008-2010).

	mean before Missouri's PTP handgun law repealed 1999-2007	**mean after Missouri's PTP handgun law repealed 2008-2010**	**% change**	**Probability 2 means are equal**
Missouri	4.67	5.82	+24.9	.001
Population-weighted mean for states bordering Missouri	4.15	4.06	-2.2	.480
Arkansas	5.12	5.23	+2.1	.691
Illinois	5.10	4.77	-6.6	.335
Iowa	0.93	1.00	+7.8	.627
Kansas	3.95	3.85	-3.4	.757
Kentucky	3.26	3.29	+1.0	.898
Nebraska	1.75	2.28	+30.0	.096
Oklahoma	3.80	3.93	+3.5	.618
Tennessee	5.42	5.23	-3.5	.553

Table 2. Estimates of effect of the repeal of Missouri's permit-to-purchase handgun law from generalized least squares regression models on states' age-adjusted firearm, non-firearm, and all-cause homicide rates, 1999-2010 and murder and non-negligent manslaughter rates, 1999-2012.

Outcome variable	**β**	**robust S.E.**	**P value**	**95% CI for β**
Firearm homicide rates, 1999-2010 R^2 within = .208, R^2 overall = .948	1.09	0.14	<.001	0.81 to 1.38
Non-firearm homicide rates, 1999-2010 R^2 within = .162, R^2 overall = .583	-0.08	0.10	.446	-0.28 to 0.12
Total homicide rates, 1999-2010 R^2 within = .177, R^2 overall = .943	1.00	0.18	<.001	0.66 to 1.35
Murder and non-negligent manslaughter rates, 1999-2012 R^2 within = .183, R^2 overall = .908	0.93	0.23	<.001	0.48 to 1.38

All models controlled for rates of unemployment, poverty, burglary, incarceration, law enforcement officers, "Stand Your Ground" laws, right-to-carry laws, bans of Saturday night special (junk) handguns, and firearm prohibitions of young adults with prior serious criminal offenses adjudicated in juvenile courts. Estimates for each of these covariates can be found in the Supplemental Tables.

Figure
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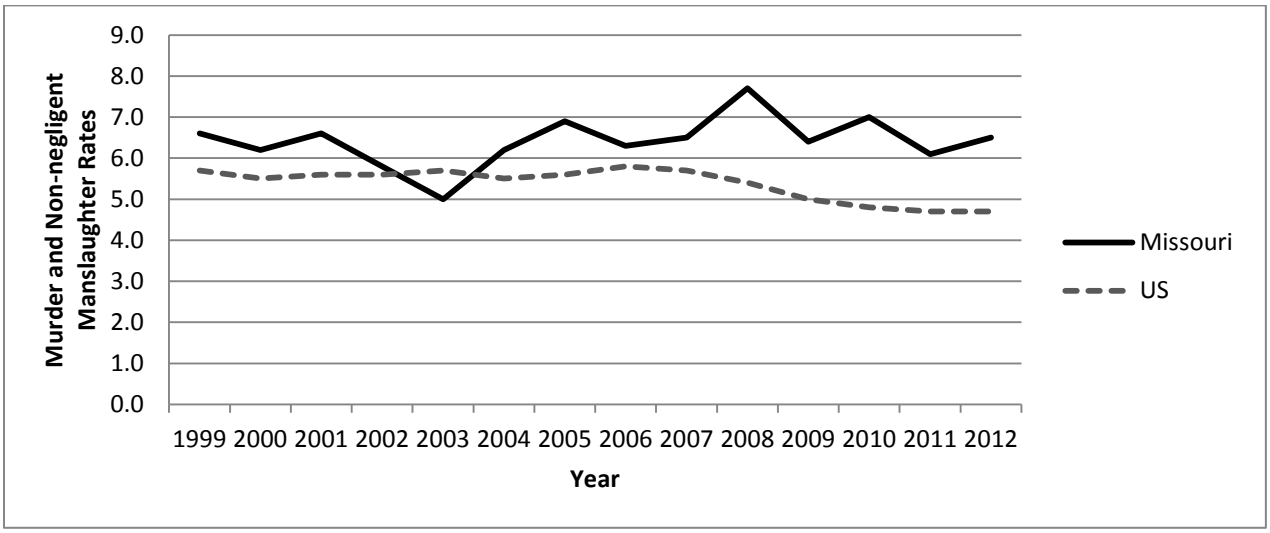
Supplemental Figure 1. Murder and Non-negligent Manslaughter rates in Missouri and the United States, 1999-2012.



Table
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Supplemental Table 1. Estimates from generalized least squares regression models on states' age-adjusted firearm homicide rates, 1999-2010.

Covariate	**β**	**Robust S.E.**	**P value**	**95% CI for β**
Missouri's PTP Repeal	1.09	0.14	<.001	0.81 to 1.38
Unemployment Rate	0.01	0.03	.739	-0.05 to 0.07
Burglary Rate	0.002	0.0008	.003	0.001 to 0.004
LEOs Per Capita	-.002	.003	.508	-.008 to .004
Incarceration Rate	-.0005	.0009	.567	-.002 to .004
Percent Poverty	-.061	.027	.026	-.115 to -.007
Stand Your Ground Laws	0.20	0.17	.245	-0.14 to 0.54
Juvenile Offense Restrictions	-0.03	0.36	.923	-0.74 to 0.68
Saturday night Special Bans	0.24	0.13	.072	-0.02 to 0.49
Right-to-Carry Laws	0.24	0.22	.286	-0.12 to 0.67

Supplemental Table 2. Estimates from generalized least squares regression models on states' age-adjusted non-firearm homicide rates, 1999-2010.

Covariate	**β**	**Robust S.E.**	**P value**	**95% CI for β**
Missouri's PTP Repeal	-0.08	0.10	.446	-0.02 to 0.12
Unemployment Rate	.006	0.0203	.757	-.034 to .046
Burglary Rate	.001	0.0006	.09	-.0001 to .002
LEOs Per Capita	.003	0.002	.281	-.002 to .007
Incarceration Rate	.001	0.001	.221	-.0007 to .003
Percent Poverty	-.032	0.019	.100	-0.07 to .006
Stand Your Ground Laws	0.01	0.10	.952	-0.19 to 0.20
Juvenile Offense Restrictions	0.26	0.29	.367	-0.31 to 0.83
Saturday night Special Bans	0.27	0.14	.047	.004 to 0.54
Right-to-Carry Laws	0.22	0.12	.076	-0.02 to 0.12

Supplemental Table 3. Estimates from generalized least squares regression models on states' age-adjusted total homicide rates, 1999-2010.

Covariate	**β**	**Robust S.E.**	**P value**	**95% CI for β**
Missouri's PTP Repeal	1.00	0.18	<.001	0.66 to 1.35
Unemployment Rate	-.0057	.358	.870	-.076 to .064
Burglary Rate	.003	.001	<0.001	.002 to .005
LEOs Per Capita	-.0003	.0003	.385	-.008 to .0003
Incarceration Rate	.0004	.0015	.810	-.0026 to 0.0033
Percent Poverty	-0.075	0.0297	.011	-0.133 to -0.017
Stand Your Ground Laws	0.109	0.193	.573	-0.27 to 0.488
Juvenile Offense Restrictions	0.128	0.172	.829	-1.038 to 1.29
Saturday night Special Bans	0.46	0.17	.008	0.12 to 0.80
Right-to-Carry Laws	0.40	0.25	.112	-0.09 to 1.35

Supplemental Table 4. Estimates from generalized least squares regression models on states' murder and non-negligent manslaughter rates, 1999-2012.

Covariate	**B**	**Robust S.E.**	**P value**	**95% CI for β**
Missouri's PTP Repeal	0.93	0.23	<.001	0.47 to 1.38
Unemployment Rate	-.066	.043	.129	-.150 to .020
Burglary Rate	.078	.005	.109	-.002 to .017
LEOs Per Capita	-.019	.002	.268	-.005 to .001
Percent Poverty	-.086	.038	.002	-.160 to -.012
Stand Your Ground Laws	0.533	0.529	.314	-.504 to 1.57
Juvenile Offense Restrictions	0.853	0.996	.392	-1.10 to 2.80
Saturday night Special Bans	0.576	0.298	.053	-.008 to 1.16
Right-to-Carry Laws	0.677	0.48	.154	-0.25 to 1.61