The Impact of Gun Laws on Police Deaths[*]

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Abstract

This paper uses state-level data from 1984-1996 to examine how right-to-carry laws and waiting periods affect police deaths. Many people oppose concealed carry laws because they believe these laws jeopardize law enforcement officials who risk their lives to protect the citizenry. This paper strongly rejects this contention. States that allow law-abiding citizens to carry concealed weapons have a slightly higher likelihood of having a felonious police death and slightly higher police death rates prior to the law. After enactment of the right-to-carry laws, states exhibit a reduced likelihood of having a felonious police death rate and slightly lower rates of police deaths. States that implement waiting periods have slightly lower felonious police death rates both before and after the law. Allowing law-abiding citizens to carry concealed weapons does not endanger the lives of officers, and may help reduce their risk of being killed.

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I. INTRODUCTION

Recently gun-related public policy issues have been at the forefront of our country's attention. Tragic school shootings and children's accidental deaths have made headline news. The felonious deaths of police officers, who regularly risk their lives[1] to enforce society's rules and protect its citizens, have a particularly profound impact on society. Since 1794 more than 15,000 law enforcement officers have died.[2] Although many proposals have been set forth to reduce this violence, there is little quality evidence about how gun laws affect the lives of police officers. This paper addresses this paucity of analysis by examining how two laws–waiting periods and right-to-carry laws–affect felonious police deaths.

In examining this issue we should first understand what police believe about the laws. The International Association of Chiefs of Police (IACP), the world's oldest and largest membership organization of police executives, has made official statements about concealed weapons laws and the Brady Bill, a federally mandated background check. The IACP has over 16,000 members and represents law enforcement agencies of all sizes on the local, state, federal and international levels. At its 103rd annual conference in October

1 David Lester, Civilians Who Kill Police Officers and Police Officers Who Kill Civilians, 10 Journal of Police Science and Administration 384-387 (1982). Lester argued that the lethal assault rate against police is higher than for any other profession. On the other hand, Southwick claimed that when controlling for some basic characteristics like age and gender, the death rate of police has been declining for many years. By the 1990s, the rate for police was below the rate for manufacturing occupations and the general rate for the public. Lawrence Southwick, An Economic Analysis of Murder and Accident Risks for Police in the United States, 30 Applied Econ. 593-595 (1998).

[2]For information about slain officers see the National Law Enforcement Officers Memorial Fund http://www.nleomf.com/index1.html.

1996, the IACP passed two resolutions to oppose the federal pre-emption or liberalization of individual states' concealed carry laws.[3] In support of its resolution, the IACP stated:

> Whereas, there is an effort to liberalize states' CCW laws by enacting federal legislation, which would pre-empt current state CCW laws, with the argument that citizens wish to carry guns for self-protection, further arguing that the arming of private citizens will result in dramatically lowering the national crime rate by deterring criminals from victimizing these law-abiding citizens; and whereas, a majority of law enforcement professionals and an overwhelming majority of Americans do not support this theory…[4]

Although the IACP does not have a formal resolution on waiting periods, its Executive Committee has stated: "The IACP continues to strongly support the Brady Law."[5]

The Fraternal Order of Police, the world's largest organization of sworn law enforcement officers with more than 280,000 members, strongly endorsed the Brady Bill, and believes that the waiting period requirements should be eliminated as instant check technology becomes reliable. However, because individual state lodges have widely differing views on right-to-carry, or Shall Issue laws, the Fraternal Order of Police takes no public stand on this issue.[6] Some police organizations in states that do not have concealed carry laws have criticized such laws. For example, the Illinois and Maryland State Police have been very outspoken against concealed weapons laws and regularly

[3] Resolutions F008.a96 and F009.a96 were passed by the IACP in October 1996 at its 103rd annual conference in Phoenix, AZ.
[4] IACP Resolution F008.a96, passed in October 1996.
[5] Minutes of the IACP Executive Committee Meeting on February 11, 1995, in Alexandria, VA.

testify against concealed carry before state legislatures. One of the first and most frequently articulated criticisms of Lott and Mustard[7] was that allowing people to carry concealed weapons would drastically alter the safety of the police. Such concern received a lot of attention when Elizabeth Dole, who at that time was a candidate for the Republican nomination for President of the United States, articulated it. In May 1999 Dole stated that she strongly opposed Shall Issue laws, because she believed they endangered officers' lives.

Although the above arguments are frequently made, the extent to which officers' lives are jeopardized by concealed carry is an empirical question. Debates in gun-related public policy are often driven by anecdotal evidence–the tragic tale of a young life lost to an irresponsible use of weapons or a heroic defensive use of a firearm to preserve life. However, the debate about law enforcement safety is unusual because those who believe right-to-carry laws threaten officers' lives do not have even anecdotal evidence. Although many states have had Shall Issue laws for long periods, there are no known examples of a licensed permit holder using his weapon against an officer of the law. This lack of examples has led adherents of this belief to articulate indirect mechanisms about how officers' lives are threatened by concealed carry. For example, they argue that Shall Issue laws lead criminals to arm themselves more heavily, and these criminals direct more violence towards police officers.

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[6] Private conversation in March 2000 with Jim Pasco, who works for the Fraternal Order of Police in its legislative office in Washington, D.C. Mr. Pasco stated that the organization has a stand on every citizen firearm proposal except concealed weapons laws.

[7] John R. Lott, Jr. & David B. Mustard, Crime, Deterrence, and Right-to-Carry Concealed Handguns, 26 J. Legal Stud. (1997).

In contrast, there is at least one example of a permit holder using his weapon to assist a law enforcement officer.[8] On March 26, 1999, three Mexican drug dealers ambushed Officer Marc Atkinson of the Phoenix Police Department. Rory Vertigan, a concerned citizen with a concealed weapon permit, came to the officer's aid. Vertigan shot and wounded one suspect and tackled the driver of the getaway car and wrestled his gun away from him. Vertigan's valor was widely applauded in Phoenix police circles for allowing officers to quickly catch and arrest the men. Police Chief Harold Hurtt said that Vertigan "is one of the true heroes of our time. He realizes the officer is in trouble. Without regard for his own personal safety, he confronted these individuals, engaged in a gun battle. He put his life on the line for an officer."[9] In appreciation the police union gave him a $500 reward and a certificate for a replacement gun.

Also, there is an inverse relationship between the rank of the officer and the degree to which law enforcement officials support rights of law-abiding citizens to carry concealed weapons for self-protection. The line officers, who spend the most time on the street and should be most threatened by the potential risk of additional permit holders, often express the greatest support for concealed carry laws.[10] In contrast, the highest-ranking, often politically appointed officers, whose lives are least threatened, are the most vocal opponents of the law. Survey results showed 76% of street officers and 59% of managerial officers agreed that all trained, responsible adults should be able to obtain handgun-carry permits.[11]

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[8] Private conversations with members of the Phoenix Police Department.
[9] Mark Shaffer, True Hero Helps Nab Trio Security Guard Reacted to "What I Thought Was the Right Thing to Do," Ariz. Republic, Mar. 29, 1999, at A1.
[10] Private conversations police from various jurisdictions across the US.
[11] John R. Lott, Jr., More Guns, Less Crime (1998) discussed the Gun-Control Survey, Law Enforcement Technology (July-August 1991), 14-15.

Law enforcement officers from states that switched to concealed carry provide additional evidence against the contention that such laws endanger their lives. Senior Cpl. Glenn White, a patrol officer and President of the 2,350-member Dallas Police Association, lobbied against the law in 1993 and 1995 because he thought it would lead to wholesale armed conflict. However, that never happened. Said White, "All the horror stories I thought would come to pass didn't happen. No bogeyman. I think it's worked out well, and that says good things about the citizens who have permits. I'm a convert."[12] After the implementation of the Florida law, the president and the executive director of the Florida Chiefs of Police and the head of the Florida Sheriff's Association admitted that despite their best efforts to document problems arising from the law, they were unable to do so.[13] Consequently, they changed their views on the subject. Speaking on behalf of the Kentucky Chiefs of Police Association, Lt. Col. Bill Dorsey, Covington assistant police chief, concluded that after the law had been in effect for nine months: "We haven't seen any cases where a [concealed-carry] permit holder has committed an offense with a firearm."[14]

Many studies of lethal assaults against police have focused on a specific time period,[15] geographic region[16] or both.[17] If the chosen years or areas are not representative of the nation, their studies could suffer from sample selection bias.

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[12] Scott Parks, Charges against Texans with Gun Permits Rise. Law's Supporters, Foes Disagree on Figures' Meaning, Dallas Morning News, Dec. 23, 1997, at A1.

[13] Fla. Times-Union, May 9, 1988; Palm Beach Post, July 26, 1988.

[14] Kentucky State Police Trooper Jan Wuchner is also quoted as saying that he has "heard nothing around the state related to crime with a gun committed by permit holders. There has been nothing like that that I've been informed of." Terry Flynn, Gun-toting Kentuckians Hold Their Fire, Cincinnati Enquirer, June 16, 1997, at A1.

[15] A.P. Cardarelli, An Analysis of Police Killed by Criminal Action: 1961-1963, 59 J. Crim. L., Criminology & Police Sci. 447-453 (1968) provided summary statistics for police deaths between 1961-1963. Kenneth C. Meyer, et al., Ambush-related Assaults on Police: Violence at the Street

Two recent studies exploited time-series data to examine police deaths. Kaminski and Marvell, who studied police deaths from 1930-1998, concluded that the two extreme peaks of fatal assaults were during Prohibition and the 1970s.[18] Southwick, using a system of four equations to evaluate data from 1931-1993, concluded that the likelihood of being murdered was positively related to the fraction of sworn officers that are male, and negatively related to police wages.[19]

Only a few studies examined the impact of changes in laws on police deaths, and none have examined gun laws. One study argued that the implementation of a three-strikes law increased lethal assaults against police by about 25%,[20] and others maintained that neither the provision of nor the likelihood of capital punishment affect police killings.[21] Lott showed that the increased hiring of women police officers as a result of

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Level (1986) examined all 35 ambush attacks against police from Sep. 1972-August 1973. Mitchell B. Chamlin, Conflict Theory and Police Killings, 10 Deviant Behavior 353-368 (1989) used state level data for 1980-1982, and concluded that the fraction of the population that was poor, black and Latino increased the rate of police officers killed.

[16] Mona Margarita, Killing the Police: Myths and Motives, 452 Annals Am. Acad. Pol. & Soc. Sci. (November), 63-71 (1980) analyzed the criminal homicides of the NY Police Department from 1844 to 1978. She concluded that contrary to popular opinion, police are rarely killed during domestic disturbances, or are senseless victims of madmen or lunatics. Instead, they are more likely to be killed by rational robbers. Samuel G. Chapman, Cops, Killers, and Staying Alive: The Murder of Police Officers in America (1986) provided summary statistics of the circumstances of 52 incidents in which 54 police officers from Oklahoma were murdered on duty.

[17] William A. Geller & Kevin J. Karales, Shootings of and by Chicago Police: Uncommon Crises, 72 J. Crim. L. & Criminology 1813-1866 (1981). See also William A. Geller & Kevin J. Karales, Shootings of and by Chicago Police: Uncommon Crises, 73 J. Crim. L. & Criminology 331-378 (1982). This two-part series provided summary statistics of the circumstances surrounding all the Chicago police who were shot (including those not killed) between 1974-1978.

[18] Robert J. Kaminski & Thomas B. Marvell, An Analysis of Long-Term Trends in Killings of Police with a Comparison to General Homicides (Working paper, 2000).

[19] Lawrence Southwick, An Economic Analysis of Murder and Accident Risks for Police in the United States, 30 Applied Econ. 593-605 (1998).

20 Carlisle E. Moody, Thomas B. Marvell, & Robert J. Kaminski, Unintended Consequences: Three-Strikes Laws and the Killing of Police Officers (Working paper, 2000).

21 William C. Bailey, Capital Punishment and Lethal Assaults against Police, 19 Criminology 608-625 (1982). William C. Bailey & Peterson, Ruth D., Murder, Capital Punishment, and Deterrence: A Review of the Evidence and an Examination of Police Killings, 50 J. Soc. Issues

new hiring requirements significantly increased assaults on police officers.[22] The only paper that examined the role of guns is Southwick, who in a time-series analysis at the national level, showed that the number of guns in civilian hands decreases the police fatality rate.[23]

This paper is the first to determine how changes in gun-control laws affect felonious police deaths. Specifically it examines the relationship between waiting periods and laws that allow law-abiding citizens to carry concealed weapons. I focus on these laws because they are two of the most frequently cited in the policy arena. The remaining portion of this paper is organized as follows. Section II outlines the data, describes the empirical model and discusses the theoretical determinants of police deaths, focusing on the impact of concealed weapons laws and waiting periods. Section III presents the empirical results and Section IV concludes the analysis.

II. DATA AND EMPIRICAL MODEL

The Federal Bureau of Investigation provided the total number of officers feloniously killed and the number feloniously killed with handguns.[24] In its annual publication the FBI summarizes each incident, provides detailed information about the victim and offender (if known), explains the circumstances (date, time, location, type of

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53-74 (1994). William C. Bailey & Ruth D. Peterson, Police Killings and Capital Punishment: The Post-Furman Period, 25 Criminology 1-25 (1987).

[22] John R. Lott, Jr., Does a Helping Hand Put Others at Risk? 38 Econ. 239-277 (2000).

[23] Lawrence Southwick, An Economic Analysis of Murder and Accident Risks for Police in the United States, 30 Applied Econ. 596-597 (1998).

[24] US Department of Justice, Uniform Crime Reports: Law Enforcement Officers Killed and Assaulted (1977-1997). The report also showed that the number of accidental deaths, which are excluded from felonious police deaths, ranged from a low of 47 (1996) to a high of 79 (1989) between 1988 and 1997. The general long-term trend in accidental police deaths is similar to the trend in accidental deaths for the entire nation, which has decreased steadily.

weapons) and whether the incident has been cleared. The data are collected through the Uniform Crime Reporting (UCR) program. Contributors submit preliminary data on any officer killed in the line of duty within their jurisdictions. When the national program receives notification of a line-of-duty death, it obtains additional details about the incident's circumstances from the victim officer's employing agency, and gives the local agency information about the federal programs that provide benefits to survivors of nonfederal law enforcement officers killed in the line of duty.[25]

A. Trends in Felonious Police Deaths

Figure 1 shows the total number of police deaths and deaths from handgun use from 1977-1996. Both numbers generally decrease from the late 1970s through the mid-1980s and remain relatively constant for the following years, when there was a large increase in the number of states with Shall Issue laws.

Figure 2 displays the total felonious police death rates (per million people) for states with and without Shall Issue laws, and Figure 3 shows the same rate for states with and without waiting periods.[26] States that allow people to carry concealed weapons have lower police death rates for twelve of the twenty years.[27] The rates in Shall Issue states are generally lower early in the sample, are higher for a few years in the middle of the sample and are similar in the 90s. The average death rate is lower in Shall Issue states (0.28 compared with 0.31). Figure 3 shows that states with waiting periods have lower

[25] For more information about the details and procedures of the program, see US Department of Justice, Uniform Crime Reports: Law Enforcement Officers Killed and Assaulted (1977-1997).
[26] The rates in Figures 2 and 3 include the data for each state classified as having either a Shall Issue or waiting period law in the given year. Therefore, the lines reflect changing compositions of states over time.
[27] Shall Issue states also have lower handgun death rates for eleven of the twenty years.

felonious police death rates than states without such laws in 14 of the 20 years, and lower average rates (0.26 versus 0.34).

B. Empirical Model

To determine the impact of gun laws on felonious police deaths and to control for other variables that affect these deaths, I model annual police deaths at the state level as a determinant of many characteristics:

$$y_{it} = \alpha + \beta_1 \log(POP_{it}) + \beta_2 \log(FTEP_{it}) + \beta_3 LAWS_{it} + \beta_4 POL_{it} +$$

$$\beta_5 CRIME_{it} + \beta_6 X_{it} + T_t + S_i + \varepsilon_{it} \qquad (1)$$

The dependent variable, y_{it}, is one of six variables that measure police deaths: whether a state has a police death (and death by handgun), total police deaths per 1,000,000 population (and deaths from a handgun) and total police deaths per 100,000 police officers.

At the most basic level, some fraction (f) of state i's population at time t (POP_{it}) may kill a police officer ($FTEP_{it}$).[28] Therefore, the expected number of felonious police deaths is $f * POP_{it} * FTEP_{it}$, which is log linear in population and the number of full-time-equivalent police officers, as shown in equation (1).

$LAWS_{it}$ indicates the status of state i's right-to-carry and waiting period legislation at time t. It includes dummy variables that indicate whether the state has a Shall Issue[29] law or a waiting period.[30] However, most specifications will not use the

[28] Police officers are measured in full-time equivalency units.

[29] The Shall Issue dates are taken from Clayton E. Cramer & David B. Kopel, "Shall Issue": The New Wave of Concealed Handgun Permit Laws, 62 Tenn. L. Rev., no. 3 (Spring): 679-758 (1995). Eight states (Alabama, Connecticut, Indiana, New Hampshire, North Dakota, South

simple dummy variable, but instead will use trends that measure the before and after periods from when the Shall Issue and waiting period laws went into effect. If allowing law-abiding citizens to carry concealed weapons raises the cost of attacking others, such laws could reduce the number of violent offenders and violent encounters, which might have positive spillovers that lower police deaths.[31] Furthermore, if criminals are less likely to use guns after the passage of right-to-carry laws, these laws could further reduce police deaths.[32] In contrast, if right-to-carry laws lead to greater uses of guns against officers, such laws could increase police deaths. If the existence of and length of waiting

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Dakota, Vermont and Washington) had Shall Issue laws since 1977. Maine became Shall Issue in (1985), Florida (1987), Virginia (1988), Georgia (1989), Pennsylvania (1989) and West Virginia (1989), Idaho (1990), Mississippi (1991), Oregon (1990), Montana (1991), Alaska (1995), Arizona (1995), Tennessee (1995), Wyoming (1995), Arkansas (1996), Kentucky (1996), Louisiana (1996), Nevada (1995), North Carolina (1996), Oklahoma (1996), South Carolina (1996), Texas (1996) and Utah (1996).

There is some discussion about the accuracy of the Maine and Virginia dates. Maine passed a series of laws relating to concealed carry. To test whether classifying Maine and Virginia in this manner affected the results, I ran additional regressions that used the other potential dates. Lott and Mustard (1997) used the 1985 date for Maine because Cramer and Kopel indicated it was the best date to use when classifying the changes in laws as binary variables. Virginia presents some confusion because the counties near DC refused to grant permits even after the Shall Issue law was passed. Consequently, the laws were strengthened over time and citizens filed complaints against these counties to force them to obey the law. The results of the empirical work in this paper were robust to using the other possible enactment dates for Shall Issue laws.

[30] The waiting period dates are taken from John R. Lott, Jr., More Guns, Less Crime (1998). A state was defined as having a waiting period when either a state or federal waiting period applied. When the Brady Bill was passed, states that did not have their own waiting period and did not have instant check capacity became subject to the federal period. Eleven states (Alabama, California, Washington DC, Maryland, Massachusetts, Minnesota, New Jersey, New York, Pennsylvania, Rhode Island and Washington) had waiting periods since 1977. The other states adopted waiting periods in the following years: Alaska (1994), Arkansas (1994), Connecticut (1994), Georgia (1994), Hawaii (1988), Indiana (1983), Iowa (1979), Kansas (1994), Kentucky (1994), Louisiana (1994), Maine (1994), Maryland (1979), Michigan (1994), Mississippi (1994), Montana (1994), Nebraska (1994), Nevada (1994), New Mexico (1994), North Dakota (1994), Ohio (1994), Oklahoma (1994), Oregon (1989), South Dakota (1994), Tennessee (1994), Texas (1994), Vermont (1994), West Virginia (1994) and Wyoming (1994).

[31] John R. Lott, Jr. and David B. Mustard, Crime, Deterrence, and Right-to-Carry Concealed Handguns, 26 J. Legal Stud. (1997).

[32] David E. Olson & Michael Maltz, Magic Bullets, Deterrence, and Gun Laws (Working paper, 2000) argued that after Shall Issue laws were passed, the relative share of murders that arise from guns fell while the relative share of non-gun murders rose.

periods reduce the number of guns obtained by those who should not have them, waiting periods should reduce the likelihood that people will use them against police. However, if waiting periods make it more costly for people to use the guns for self-defense, the underlying level of violence may increase, including violence towards police officers. Therefore, because both Shall Issue laws and waiting periods could increase or decrease police deaths, the expected total effect is uncertain.

POL_{it} includes direct public expenditures and police salaries per full-time-equivalent police officer.[33] Expenditures proxy for officer training and technological investments in the police force such as protective armor and the type of weapons they carry, which should decrease the likelihood of being killed. The anticipated coefficient on payroll variable is less clear. Because higher-paid police typically spend less time in situations that could be life threatening, higher police pay may imply that there are fewer officers who potentially face dangerous situations. However, payroll information also proxies the age and experience of police officers, which may be related to their ability to diffuse potentially dangerous situations. Further complicating the effect is that if police who patrol in higher-risk areas must be paid compensating wages, the relationship

[33] US Department of Justice, Justice Expenditure and Employment Extracts (1984-1995). Expenditures and payroll data are expressed in terms of real 1983 dollars. In private conversations with Sue Lindgren of the Bureau of Justice Statistics, she stated that BJS has not made public the data for 1987, 1989 and 1996. To obtain data for 1987 and 1989 I average the preceding and following year figures. The 1996 data are unavailable because the BJS is currently transforming the way it obtains employment, expenditure, and payroll information. Historically it gathered this information in October of a given year, but changed its collection date to April. The last year of October collection was 1995, and BJS waited until April 1997 to collect the data again, thus skipping 1996. For 1996 data I extrapolate the growth rate between 1994-1995 and apply that to 1995-1996.

between payrolls and deaths would be positive.[34] Consequently, the expected effect is ambiguous.

$CRIME_{it}$ contains four crime-related variables for state i at time t–violent and property crimes and violent and property arrests, all of which are per full-time-equivalent police officer.[35] The FBI defines these crime categories.[36] Police should be more at risk when there are many crimes and arrests per police officer.

X_{it} is a vector of population and income control variables that includes the percent of the population that is male, black, and neither white nor black, the fraction of the population in various age cohorts, personal income, unemployment transfers, income maintenance, and retirement transfers. All variables measured in dollar figures are real per capita measures, denominated in 1983 dollars. T_t and S_i are vectors of time and state fixed effects that control for differences over time and across states, respectively.

Table 1 shows the summary statistics.[37] The data are state-level and include 51 observations (50 states and Washington, DC) per year for 13 years (1984-1996), for a total of 663 observations.[38] I begin in 1984, because the changes in right-to-carry laws

[34] Lawrence Southwick, An Economic Analysis of Murder and Accident Risks for Police in the United States, 30 Applied Econ. 601-604 (1998).

[35] Police deaths may be a function of other types of arrests, rather than just arrests for the Index I crimes. When police deaths are discussed, arrests for four other crimes receive prominent attention: drugs, intoxication, family and weapons offenses. Because the FBI has only state-level data on these arrests for six years, I do not report the results. The unreported regressions using the six-year sample with the additional arrest variables show that the number of family crime arrests positively affects the death rate while the other arrests are not statistically different from zero.

[36] Violent crime is the sum of murder, rape, robbery and aggravated assault. Property crime is the sum of burglary, larceny and auto theft.

[37] All dollar values are expressed in terms of real 1983 dollars.

[38] I use state-level data, because there are very few felonious police deaths and most state-level observations are 0. Therefore, nearly all the county-level observations would be zero, and there would be almost no variation in the data.

generally occur after 1984, and 1984 is the first year the FBI provides state-level arrest data.

III. RESULTS

A. The Likelihood of a Having a Felonious Police Death

Because felonious police deaths occur infrequently,[39] it is initially important to determine what types of states are more likely to experience a police death. Table 2 shows the fixed-effect[40] logit regression results that indicate the likelihood that a state has a police death.[41] In the first two columns dummy variables for the state laws are used to estimate the average effect before and after the law. The last two columns use before and after trends to more accurately estimate the laws' impacts. Column 1 shows that the coefficient estimates on both the Shall Issue and waiting period variables are positive and insignificant. Table 2 displays only the results for the gun laws, the primary variables of interest. The results for the other variables are listed in the Appendix.[42] The results for handgun deaths in Column 2 show that the Shall Issue dummy estimate is slightly smaller

[39] Table 1 shows that 52% of states have a police death and only 44% have a police death as a result of a handgun in a given year.

[40] The state population and the coefficient estimate on the state fixed effects have a correlation coefficient of between 0.3 and 0.4, depending on the specification. When the states with more than 10 million people are excluded, the correlation drops in half. The District of Columbia, Georgia, New York and Texas typically have the largest positive coefficient estimates, while Delaware, Iowa, Minnesota, Oregon, Vermont, Washington and Wisconsin generally have the most negative coefficient estimates.

[41] For each variable the coefficient estimates are listed first. The second number (in parentheses) is the standard error. The last number [in brackets] is the marginal effect of the variable, calculated for incremental changes from the mean.

[42] The estimates for the population and full-time-equivalent police officers are both positive, as expected, with the latter being statistically significant at the .10 level. States with more officers are significantly more likely to have an officer killed. The percent of the population that is age 10-19, 30-39, 40-49, over 65, and black also are significant among the control variables.

and the impact of the waiting period is negative. However, neither of the coefficient estimates is smaller than its respective standard errors.

The first two columns are biased because they use only the dummy variables for the laws, and ignore the trends before and after the law went into effect.[43] If the death rate increased significantly before the law and decreased slightly afterwards, the average rate after the law could be higher than before, but the law would still have lowered deaths. The last two columns control for this problem by replicating the results from the first two regressions and replacing the dummy variables with before and after trends for the laws. Both the qualitative and quantitative results for the two latter columns are very similar to the results from the first two columns for the majority of variables, but results on the gun laws change dramatically. The before trends for the Shall variable are positive while the corresponding after trends are negative. The after trend for the Shall Issue law is statistically significant at the .05 level. Consequently, when I control for the bias generated by the dummy variables, right-to-carry laws reduce the likelihood that a state will have a felonious police death. The waiting period variables are negative both before and after the change, but neither is significant. Further evidence of the impact of gun laws is shown in testing whether the before and after trend variables differ from each other. These tests indicate that the increasing trend in felonious police deaths before the Shall Issue laws are passed is significantly different from the decreasing trend after the law was passed. There is no such difference in the waiting period trends. The coefficients on the gun laws for police deaths by handgun (Col. 4) are the same sign, but are no longer statistically significant.

[43] John R. Lott, Jr., More Guns, Less Crime (1998).

The basic results of the gun laws were robust to many specification changes in the police variables[44] and the waiting period.[45] However, the effect of concealed carry laws to reduce the likelihood that a state will have a police death is understated in Table 2, which uses unweighted regressions. Since Ehrlich,[46] who pioneered regression analysis of crime data, crime-rate regressions have typically weighted the results by population size, because unweighted estimates produce heteroscedasticity where the magnitude of the error terms is inversely correlated with the population size. Low-population states exhibit greater variance in police death rates, because they have relatively low rates, and small changes in the number of deaths generate large percentage changes. Weighted regressions provide stronger support for the assertion that right-to-carry laws lower the likelihood that a state will have a felonious police. For example, when the regression in column 3 of Table 2 is run using weights, the Shall-before trend increases from 0.049 to 0.166 and the Shall-after trend changes from –0.311 to –0.356. Consequently, the difference between the trends increases, and the after effect is more negative. In contrast, the waiting period trends are relatively unaffected when weights are used.[47] Because this difference is so sharp for the concealed-carry effect, the remaining results report both results.

B. Felonious Police Death Rates–Tobit Regressions

[44] The results for the gun-law variables in all the tables are robust to using alternative specifications of the arrest, crime, expenditure and pay variables (measuring them in totals or totals per population instead of fractions per full-time-equivalent police).

[45] I re-ran columns 1 and 2, replacing the length of the waiting period in days and the length of the period squared, for the waiting period dummy variable. The coefficients for these variables were not statistically significant in either case.

[46] Isaac Ehrlich, Participation in Illegitimate Activities: A Theoretical and Empirical Investigation, 81 Journal of Political Economy, 545-546 (1973).

[47] The coefficient estimate for the waiting period before variable changed from –0.048 to –0.010, and the estimate on the after variable changed from –0.167 to –0.162.

To analyze felonious police death rates, I use Tobit and Poisson regressions, because the dependent variable is censored at zero, and conventional regression methods bias the results because they fail to account for the qualitative difference between the zero observations and continuous observations. The Tobit method has been used to address similar problems like whether right-to-carry laws lower mass public shootings.[48] Table 3 presents the Tobit results, showing both the weighted and unweighted results for each specification. [49] Columns 1-4 measure death rates by felonious police deaths per million residents, and columns 5-8 measure death rates per the number of full-time-equivalent police officers. Columns 1-2 and 5-6 display results for total police deaths, and the other columns show the results for handgun death rates.

Column 1 shows that states that enact both concealed carry laws and waiting periods have statistically significantly lower total felonious police death rates after the law was passed. The probabilities that there are differences in the Shall Issue and waiting period before and after trends are .19 and .34, respectively. However, when the weighted regressions are used for this specification in Column 2, the concealed carry results become stronger and the waiting period results are relatively unaffected. The before-Shall estimate is large and positive, the after-Shall estimate is negative and statistically significant at the .05 level, and the F-test for their difference is significant. In contrast, in the weighted regressions the after trend for the waiting period is cut in half, and the F-test for their difference remains insignificant.

[48] John R. Lott, Jr. & William M. Landes, Multiple Victim Public Shootings, Bombings, and Right-to-Carry Concealed Handguns (Working paper, 1998).

[49] The regressions in Tables 3 and 4 use the same population and income control variables as the Table 2 regressions but do not report the results for these variables. The Tobit regressions in Table 3 are run with a lower-limit for left censoring.

Column 3, which examines felonious handgun deaths, shows the same signs of the gun-law coefficients, but the results are slightly weaker. The only statistically significant result is that states with waiting periods have lower death rates prior to the enactment of the laws. Column 4, a weighted regression of column 3, shows no statistically significant results.

Column 5 uses the ratio of handgun deaths per police officer as a dependent variable. States with concealed weapons laws are more likely to have high felonious death rates before the law is implemented and low felonious death rates after the law is implemented, a result significant at .10. The waiting period trends are both negative, and the after effect is statistically significant at .10. The probability of rejecting the F-test for the differences in the Shall Issue and waiting period variables is 0.12 and 0.48, respectively. In column 6 when the column 5 regressions are re-run with weights, the right-to-carry results are made stronger and the waiting period results are substantially mitigated. The before-Shall trend is much more positive, the after-Shall trend continues to be negative and significant, and the before and after differences are significant at 0.02. In contrast, the waiting period after trend is no longer significant.

Column 7 measures handgun deaths per police officer and uses unweighted regressions. The before and after trends for both variables are negative, but only the before waiting period trend is statistically significant. The weighted results in column 8 once again strengthen the results of the concealed carry laws as the before-Shall trend is positive, the after-Shall trend is negative, and the difference between the before and after trends is significant. Neither of the waiting period trends is significant, and they do not differ from each other.

All eight specifications in Table 3 strongly reject the contention that concealed carry laws increase the felonious death rate of police officers. Instead, states that implement Shall Issue laws generally have slightly higher death rates before the laws are implemented and slightly lower rates after the laws are implemented, and the after trend is statistically significant in half the specifications. Furthermore, the before and after trends in the Shall variable are statistically different in three specifications. Concealed carry laws certainly do not jeopardize the lives of police officers, and there is moderate evidence that passing such laws likely saves officers' lives. In contrast, the before and after trends for waiting periods are negative in every specification, with the after trend being significant in these specifications. However, the before and after trends for waiting periods never differ from each other.

C. Felonious Police Death Rates–Poisson Regressions

Plassmann and Tideman argued that a generalized Poisson process is even more appropriate for count data with a low number of instances per observation,[50] which is clearly the case in this situation. Table 4 examines the robustness of the Table 3 results by using the Poisson process to estimate all eight regressions. In the first four columns, which measure total and handgun deaths as a fraction of the states' populations, there are no statistically significant results. The coefficient estimates for both the before and after waiting period trends are always negative. The before trend for the Shall Issue variables is positive for two specifications and negative for two. The after trend for the Shall Issue variables is always negative.

[50] Florenz Plassmann & T. Nicolaus Tideman, Geographical and Temporal Variations in the Effects of Right-to-Carry Laws on Crime (Working paper, 2000).

Columns 5-8 measure the death rates per full-time-equivalent police officers. In every specification the time trends before and after the waiting period and after the Shall issue law are negative and statistically significant. The before and after Shall trends are different in two of the specifications, and the before and after trends for the waiting period differ in one specification.

One concern about using the Poisson model is that it assumes that the mean of the dependent variable is equal to the variance, which is not true in this case (see Table 1). To determine whether the results are affected by this assumption, I used the negative binomial model, which relaxes this restriction. The qualitative results are robust to this alternative specification.[51]

IV. CONCLUSION

This is the first study to examine how felonious police deaths are affected by changes in waiting periods and laws that allow law-abiding citizens the right to carry concealed weapons for self-defense. Although some political officials oppose Shall Issue laws because they believe the laws endanger the officers' lives, there is no evidence for such assertions. After controlling for an array of factors, I conclude that states that enact concealed carry laws have a slightly higher likelihood of having a felonious police death and slightly higher rates of felonious police deaths prior to the law's passage. After passage of the right-to-carry laws, states exhibit a reduced likelihood of having a

[51] For regressions of the total death rate per population, the coefficient estimate on the Shall Issue before trend is positive (0.021) and is negative on the Shall Issue after trend (-0.105). Both the waiting period before (-0.033) and after (-.042) trends are negative. For regressions of the rate of deaths due to handguns per population, the coefficient estimate on the Shall Issue before trend is positive (0.097) and is negative on the Shall Issue after trend (-0.105). Both the waiting period

felonious police death rate and slightly lower rates of police deaths. These results are statistically significant in about half of the specifications. Furthermore, the before and after trends in the Shall variable are statistically different in about half of the specifications. Furthermore, those who believe allowing private citizens to carry concealed weapons will endanger the lives of law enforcement officials do not even have anecdotal evidence to support them. To date we have no examples of law-abiding citizens with concealed weapons permits assaulting police officers. In contrast, there is at least one example of such a citizen coming to the aid of an officer.

States that implement waiting periods typically have slightly lower probabilities of having a felonious police death and slightly lower death rates of law enforcement officials before the law is implemented. After the law the states continue to experience lower felonious death rates. However, the before and after trends for waiting periods are rarely different from each other.

These results are robust across different estimation procedures using logit, Tobit, Poisson and negative binomial regressions. Last, this paper confirms that using only a dummy variable to show the average before and after effects of laws can substantially bias the results, and including time trends before and after the passage of the law can correct this bias.

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before (-0.055) and after (-.057) trends are negative. None of the four coefficient estimates are significant at the .10 level.

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Table 1
Summary Statistics

Variable	Mean	St. Dev.	Min.	Max.	Num.
Police Death Variables					
Total Deaths	1.28	1.83	0	12	663
Deaths by Handgun	0.89	1.38	0	10	663
Death in State	0.52	0.50	0	1	663
Death by Handgun in State	0.44	0.50	0	1	663
Deaths per million pop.	0.03	0.05	0	0.51	663
Handgun deaths per mill. pop.	0.02	0.04	0	0.51	663
Deaths per 100,000 full-time-equivalent officers	10.69	16.82	0	132.63	663
Handgun deaths per 100,000 full-time-equivalent officers	6.84	12.06	0	101.21	663
Police Variables					
Full-Time-Equivalent (FTE) Police Employment	13,617	16,388	1,082	93,675	663
Real Expenditure (000s) per FTE Officer	41.31	11.43	21.65	86.67	663
Real Pay (000s) per FTE Officer	2.43	0.64	1.32	4.93	663
Gun Law Variables					
Presence of Shall Issue	0.30	0.46	0	1	663
Presence of Waiting Period	0.39	0.48	0	1	663
Crime and Arrest Variables (per full-time-equivalent police officer)					
Violent Crime	1.89	0.85	0.24	4.04	663
Property Crime	17.34	5.11	7.53	97.06	663
Violent Arrests	0.63	0.31	0.05	2.22	638
Property Arrests	2.66	1.05	0.28	6.55	638
Population Variables					
Population	4.9 mil.	5.3 mil.	454,000	31.8 mil.	663
Population per square mile	354.44	1,353.44	0.96	10,372	663
% Female	51.06	0.95	47.17	53.68	663
% Black	10.79	12.04	0.26	68.34	663
% Population under 9	14.85	1.62	10.61	23.54	663
% Population 10-19	14.58	1.41	9.48	20.14	663
% Population 20-29	15.92	1.88	11.85	22.66	663
% Population 30-39	16.49	1.29	13.39	22.35	663
% Population 40-49	12.64	1.64	8.64	17.73	663
% Population 50-64	13.22	1.02	9.36	16.13	663
% Population > 65	12.33	2.13	2.99	18.54	663
% Population Black	10.79	12.04	0.26	68.34	663
% Population White	83.15	14.54	27.44	99.07	663
% Population Neither W nor B	6.07	10.49	0.44	67.47	663
Real Per Capita Variables					
Personal Income	13,647	2,350	8,704	21,808	663
Income Maintenance	174.35	64.38	55.70	472.12	663
Unemployment Compensation	63.40	37.65	10.73	282.35	663
Retirement Compensation	160.50	55.66	107.25	547.99	663

Note: The base year for all dollar denominated variables is 1983.

Table 2
Logit Regressions

Variables	Felonious Police Death	Felonious Police Death-Handgun	Felonious Police Death	Felonious Police Handgun-Death
Shall Issue Dummy	0.525	0.488		
	(0.533)	(0.539)		
	[0.015]	[0.019]		
Time Trend for Years			0.049	0.047
Before Shall			(0.098)	(0.096)
			[0.009]	[-0.006]
Time Trend for Years			-0.311**	-0.168
After Shall			(0.133)	(0.134)
			[-0.010]	[-0.001]
Waiting Period Dummy	0.140	-0.254		
	(0.538)	(0.571)		
	[0.010]	[-0.042]		
Time Trend for Years			-0.048	-0.117
Before Waiting Period			(0.074)	(0.078)
			[-0.013]	[-0.013]
Time Trend for Years			-0.167	-0.102
After Waiting Period			(0.106)	(0.113)
			[-0.021]	[-0.010]
F-Statistic for differences in Shall Issue variables			5.37**	1.86
Probability > F for Shall Issue Before/After Variables			0.021	0.173
Test for differences in Waiting Period variables			1.03	0.01
Probability > F for Waiting Before/After Variables			0.310	0.904
Time Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Chi-Squared	26.84	30.02	34.39	33.48

Notes: ***, **, * designates significant at 0.01, 0.05 and 0.10 levels, respectively.

The first number in each row is the coefficient estimate from the logit regression. The second number (in parentheses) is the standard error. The third number [in brackets] is the estimate of the marginal probability evaluated at the mean for each variable.

Table 3
Tobit Regressions

Variables	Total Deaths per million population	Total Deaths per million population	Handgun Deaths per million pop.	Handgun Deaths per million pop.	Total Deaths per FTE Police	Total Deaths per FTE Police	Handgun Deaths per FTE Police	Handgun Deaths per FTE Police
Time Trend for Years	-0.001	0.0003	-0.002	1.8 e-5	0.003	0.336	-0.202	0.254
Before Shall	(0.003)	(0.0015)	(0.003)	(0.001)	(1.027)	(0.568)	(0.842)	(0.444)
Time Trend for Years	-0.006*	-0.004**	-0.003	-0.002	-2.354*	-1.482**	-1.002	-0.756
After Shall	(0.004)	(0.002)	(0.003)	(0.001)	(1.280)	(0.638)	(1.041)	(0.494)
Time Trend for Years	-0.003	-0.001	-0.003*	-0.001	-1.140	-0.532	-1.346*	-0.511
Before Waiting Period	(0.002)	(0.001)	(0.002)	(0.001)	(0.771)	(0.416)	(0.658)	(0.324)
Time Trend for Years	-0.006*	-0.003*	-0.004	-0.001	-2.123*	-1.019	-1.172	-0.374
After Waiting Period	(0.003)	(0.002)	(0.003)	(0.002)	(1.245)	(0.070)	(1.036)	(0.550)
Constant	0.651	4.329	1.304	2.634	-494.897	1047.581	-296.501	440.364
	(3.110)	(2.145)	(2.873)	(1.778)	(1093.697)	(801.087)	(927.030)	(629.814)
F-Statistic for differences in Shall Issue variables	1.72	3.41	0.07	0.83	2.39	5.20	0.41	2.86
Probability > F for Shall Issue Before/After Variables	0.190	0.066*	0.797	0.361	0.123	0.023**	0.521	0.098*
Test for differences in Waiting Period variables	0.92	0.97	0.01	0.03	0.51	0.39	0.02	0.05
Probability > F for Waiting Before/After Variables	0.337	0.326	0.922	0.856	0.477	0.530	0.881	0.822
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighted by Population	No	Yes	No	Yes	No	Yes	No	Yes

Notes: ***, **, * designates significant at 0.01, 0.05 and 0.10 levels, respectively.
The first number in each row is the coefficient estimate from the regression. The second number (in parentheses) is the standard error.
The same income and population control variables used in Table 2 were included in these regressions but are not reported.

Table 4
Poisson Regressions

Variables	Total Deaths per million population	Total Deaths per million population	Handgun Deaths per million pop.	Handgun Deaths per million pop.	Total Deaths per FTE Police	Total Deaths per FTE Police	Handgun Deaths per FTE Police	Handgun Deaths per FTE Police
Time Trend for Years Before Shall	0.005	0.003	-0.015	-0.007	0.003	0.004	-0.012	-0.006
	(0.222)	(0.220)	(0.274)	(0.270)	(0.011)	(0.011)	(0.014)	(0.014)
Time Trend for Years After Shall	-0.109	-0.083	-0.039	-0.031	-0.103***	-0.086***	-0.049**	-0.040**
	(0.315)	(0.305)	(0.379)	(0.369)	(0.016)	(0.016)	(0.020)	(0.019)
Time Trend for Years Before Waiting Period	-0.046	-0.047	-0.075	-0.058	-0.052***	-0.048***	-0.083***	-0.056***
	(0.180)	(0.176)	(0.231)	(0.224)	(0.009)	(0.009)	(0.012)	(0.012)
Time Trend for Years After Waiting Period	-0.072	-0.045	-0.041	-0.023	-0.086***	-0.054***	-0.061***	-0.036*
	(0.306)	(0.305)	(0.398)	(0.396)	(0.016)	(0.016)	(0.020)	(0.020)
F-Statistic for differences in Shall Issue variables	0.11	0.06	0.00	0.00	34.79***	25.58***	2.60	2.37
Probability > F for Shall Issue Before/After Variables	0.743	0.799	0.955	0.955	0.000	0.000	0.107	0.124
Test for differences in Waiting Period variables	0.01	0.00	0.01	0.01	3.95**	0.13	0.94	1.13
Probability > F for Waiting Before/After Variables	0.938	0.995	0.938	0.937	0.047	0.722	0.332	0.287
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighting by Population	No	Yes	No	Yes	No	Yes	No	Yes

Notes: ***, **, * designates significant at 0.01, 0.05 and 0.10 levels, respectively.
The first number in each row is the coefficient estimate from the regression. The second number (in parentheses) is the standard error.
The same income and population control variables used in Table 2 were included in these regressions but are not reported.

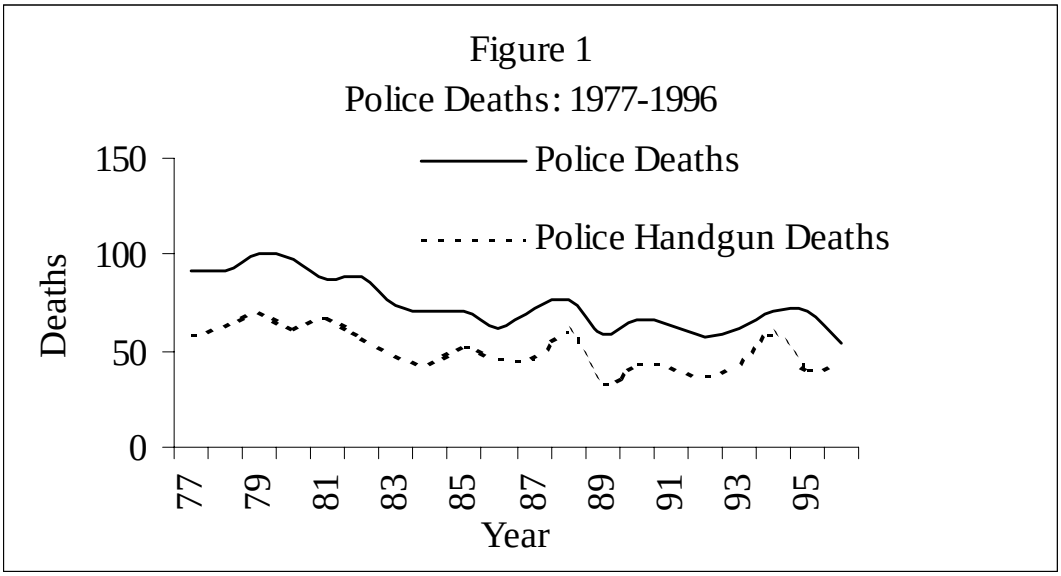


Figure 1
Police Deaths: 1977-1996
Police Deaths
Police Handgun Deaths
150
100
50
0
Deaths
77
79
81
83
85
87
89
91
93
95
Year

Figure 2
Police Deaths Rates by Shall Issue Status

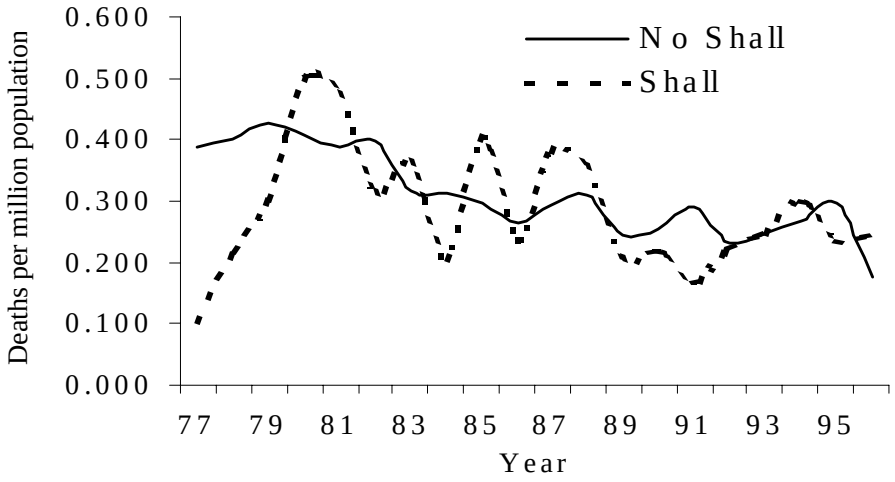
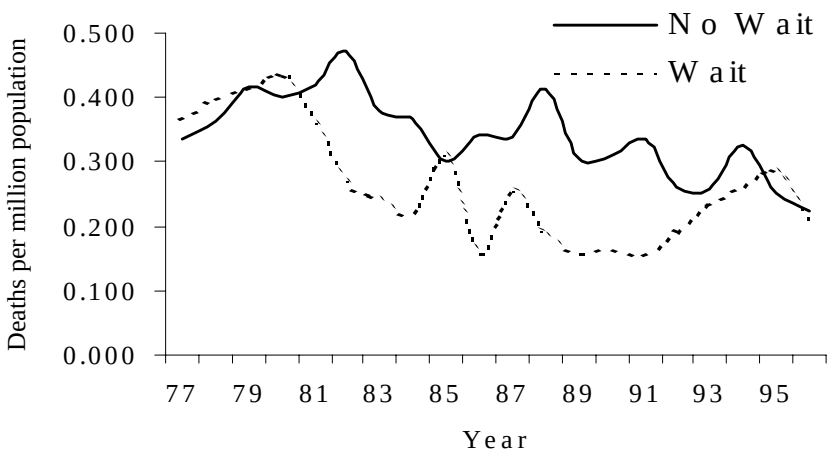


Figure 3
Police Death Rates by Waiting Period Status



Appendix 1
Control Variables Not Reported in the Table 2 Logit Regression

Variables	Felonious Police Death	Felonious Police Death-Handgun	Felonious Police Death	Felonious Police Handgun-Death
Log (Population)	1.054	-0.560	1.361	-0.289
	(4.704)	(4.858)	(4.769)	(4.902)
	[0.026]	[-0.159]	[0.036]	[-0.142]
Log (Full-Time-Equivalent Police)	6.244*	7.135***	6.046*	6.236*
	(3.721)	(3.717)	(3.467)	(3.772)
	[0.260]	[0.455]	[0.268]	[0.449]
Pay per Full-Time-Equivalent Police	0.026	1.248	0.080	1.139
	(1.101)	(1.167)	(1.120)	(1.171)
	[-0.166]	[0.165]	[0.175]	[0.147]
Expenditures per Full-Time-Equivalent Police	-0.004	-0.011	-0.011	-0.014
	(0.057)	(0.058)	(0.059)	(0.059)
	[-0.006]	[0.003]	[0.008]	[0.003]
Violent Arrests per Full-Time-Equivalent Police	1.180	-0.470	0.692	-0.804
	(0.989)	(1.010)	(0.960)	(1.030)
	[0.101]	[-0.007]	[0.093]	[-0.015]
Property Arrests per Full-Time-Equivalent Police	-0.017	0.382	0.356	0.433
	(0.316)	(0.348)	(0.320)	(0.352)
	[-0.042]	[0.016]	[0.038]	[0.013]
Violent Crimes per Full-Time-Equivalent Police	-0.282	-0.195	-0.521	-0.345
	(0.661)	(0.640)	(0.661)	(0.641)
	[-0.061]	[-0.098]	[-0.047]	[-0.094]
Property Crimes per Full-Time-Equivalent Police	-0.017	0.038	0.007	0.044
	(0.119)	(0.100)	(0.121)	(0.106)
	[-0.001]	[0.005]	[0.001]	[0.005]
Real Per Capita Personal Income	0.0000	-0.0000	-0.0001	-0.0001
	(0.0003)	(0.0004)	(0.0003)	(0.0004)
Real Per Capita Income Maintenance	-0.0005	0.001	0.001	0.003
	(0.0089)	(0.008)	(0.009)	(0.008)
Real Per Capita Unemployment Comp.	0.004	0.004	0.005	0.004
	(0.007)	(0.007)	(0.007)	(0.007)
Real Per Capita Retirement Compensation	0.009	0.021	0.005	0.015
	(0.017)	(0.021)	(0.017)	(0.020)
% of the Population Between 10-19	0.554*	0.577	0.498	0.681
	(0.340)	(0.394)	(0.364)	(0.442)
% of the Population Between 20-29	0.381	0.357	0.688	0.627
	(0.425)	(0.486)	(0.473)	(0.535)
% of the Population Between 30-39	1.632**	1.610**	1.728**	1.694**
	(0.766)	(0.808)	(0.770)	(0.800)
% of the Population Between 40-49	1.195*	1.230*	1.541**	1.319*
	(0.726)	(0.743)	(0.781)	(0.791)
% of the Population Between 50-64	0.818	1.212	0.704	1.163
	(0.757)	(0.782)	(0.777)	(0.805)
% of the Population Over 65	1.319*	1.900**	1.248*	1.955**
	(0.721)	(0.821)	(0.750)	(0.860)
% of the Population that is	-2.439	-3.078	-1.910	-2.697

Variables	Felonious Police Death	Felonious Police Death-Handgun	Felonious Police Death	Felonious Police Handgun-Death
Female	(1.852)	(2.132)	(1.841)	(2.126)
% of the Population that is Black	-0.682*	-0.662	-0.727*	-0.628
	(0.409)	(0.427)	(0.417)	(0.429)
Time Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Chi-Squared	26.84	30.02	34.39	33.48

Notes: ***, **, * designates significant at 0.01, 0.05 and 0.10 levels, respectively.

The first number in each row is the coefficient estimate from the logit regression. The second number (in parentheses) is the standard error.