

# Effects of Permit-to-Purchase Laws on State-Level Firearm Murder Rates

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**Abstract** The purpose of the present study is to determine if permit-to-purchase laws are significantly related to firearm murder rates. There has been very little research done on the effect of this particular gun control measure on crime. The present study differs from prior research in two ways. First, a large longitudinal data set is used, and data for all 50 states for the period 1980 to 2011 are examined. Second, a fixed effects model, controlling for both state and year effects is used. Results suggest that permit-to-purchase laws have no statistically-significant effect on state-level firearm murder rates. These results are contrary to the results found in prior studies on this topic.

**Keywords** Permit-to-purchase laws · Murder rates · Gun control

**JEL** K14 · K4

## Introduction

There are various state-level measures designed to reduce access to firearms. These measures are generally believed to benefit society primarily because firearms are the most common type of weapon used to commit both murder and suicide. One such gun control measure is known as the permit-to-purchase law (PTP). These laws require prospective handgun purchasers (and in some states, long gun purchasers) to obtain a permit or license prior to the purchase of a firearm. In order to obtain a gun permit, an individual must pass a background check and, in some states, complete a firearm safety training course as well. Most states with PTP laws also require prospective firearm owners to apply for a permit in person at a local law enforcement agency. Finally, these permits are required for sales from both licensed dealers and private sellers. Most states

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do not have PTP laws. As of 2011, eleven states and the District of Columbia had PTP laws. Missouri had one for several years, but it was repealed in 2007. In all other states, all a person has to do to purchase a firearm is to pass a background check, and, in most states, background checks are not required for private sales. Hence, PTP laws significantly increase the effort required to purchase a firearm.

Given this increase in effort, some individuals, especially those persons who may have difficulty in passing a background check or appearing in person at a police station to submit their permit application, may choose not to purchase a firearm in a state with a PTP law. Therefore, fewer persons may own guns in states with PTP laws, especially those persons with criminal or mental health histories. Unfortunately, state-level data on firearm ownership is not generally available. However, if one assumes that PTP laws reduce the availability of firearms, especially for those with criminal or mental health histories, and if one further assumes that a reduced supply of firearms will result in fewer firearm crimes being committed, then one can hypothesize that states with PTP laws will have lower firearm crime rates. That hypothesis is tested in the present study.

## Literature Review

As of 2015, there have only been two studies conducted on the impact of PTP laws on murder rates (Rudolph et al. 2015; Webster et al. 2014). In addition, one study was conducted on the effects of PTP laws on suicide rates (Crifasi et al. 2015). All of these studies had Vernick and Webster as co-authors. Regarding the homicide papers, Webster et al. (2014) examined the effects of the repeal of Missouri's permit-to-purchase law on homicides. Rudolph et al. (2015) looked at Connecticut's PTP law and its relationship to murder rates. The Missouri paper used fixed effects and correlation analysis; the Connecticut paper used the relatively new synthetic control method. Both studies found that PTP laws resulted in fewer murders. For Connecticut, it was estimated that the PTP law reduced the firearm homicide rate by 40% over a 10-year period, while the repeal of the Missouri PTP law resulted in a 16–23% increase in the murder rate.

One primary difference between the present study and these two prior studies is that the present study uses a very large longitudinal data set. In fact, data for all 50 states for the period 1980 to 2011 are examined. The two prior studies, however, only focused on the effects of the PTP law on one state. In addition, the present study uses a fixed effects regression model which is much more common than either of the estimating techniques used in the prior studies. The empirical technique used in this study is presented in the following section.

## Empirical Technique and Data

In order to determine if PTP laws are related to murder rates, a fixed effects model that controls for both state-level and year fixed effects is used. All observations are weighted using state-level population, standard errors are corrected using a clustering method, and two functional forms are estimated, linear and log-linear.

The following equation is estimated in the present study:

$$Y_{i,t} = \alpha_0 + \alpha_i + \gamma_t + \beta'X + \varepsilon_{i,t} \quad (1)$$

In the above equation,  $y$  denotes the gun-related murder rate,  $\alpha_i$  denotes the state-level effects,  $\gamma_t$  denotes the year effects, and  $X$  denotes the vector of explanatory variables which includes a permit-to-purchase dummy variable. This model is very similar to those used by other studies on gun control (Gius 2014; Moody and Marvell 2009; Moody 2001; Olson and Maltz 2001; Bartley and Cohen 1998; Lott and Mustard 1997).

States that had a permit-to-purchase law were represented by a one in the permit-to-purchase dummy variable; all other states were represented by a zero. Although there has been some criticism in the past regarding the use of binary variables to denote the status of gun control in a particular state, almost all prior studies used dummy variables in their regression analyses. Some of the studies that used this approach are Gius (2014), Rubin and Dezhbakhsh (2003), Dezhbakhsh and Rubin (1998), Lott and Mustard (1997), and Kleck and Patterson (1993).

Control variables were selected based upon their use in prior research (Gius 2014; Moody and Marvell 2009; Moody 2001; Olson and Maltz 2001; Bartley and Cohen 1998; Lott and Mustard 1997). These variables include the percentage of the state population that is black, per capita real income, percentage of population that is college educated, unemployment rate, percentages of population aged 18 to 24 and 25 to 34, population density, per capita alcohol consumption, per capita prison population, percentage of state population that lives in large cities, and police employees per capita.

Data for all 50 states for the period 1980–2011 were collected. State-level data is the most commonly used type of data in studies of this kind. State-level data on murder rates were obtained from the *Supplementary Homicide Reports (1980-2012)*, which were provided by the Bureau of Justice Statistics, U.S. Department of Justice. Unfortunately, there were a few anomalies in this data. Some of the values for murders committed were suspiciously low. In order to maintain the integrity of the data, these observations were deleted. The method by which anomalous data were identified was through a linear trend of the gun murder rates at the state level. If a data point was identified as an outlier (more than three standard deviations away from the trend line), then that observation was deleted. It is important to note that, out of 1564 observations, only 18 were excluded. The data set used in this study contains 1546 observations.

Information on PTP laws were obtained from Ludwig and Cook (2003), the Law Center to Prevent Gun Violence, and Rudolph et al. (2015). If the information obtained from these secondary sources were inconsistent, then the original state statute was examined in order to determine the status of a state's PTP law. All other state-level data were obtained from relevant Census Bureau reports. Descriptive statistics are presented on Table 1. A list of states that had a PTP law during the period in question (1980–2011) is presented on Table 2.

**Table 1** Descriptive statistics 1980–2011

| Variable   | Mean     | Standard Deviation |
|--|----------|--------------------|
| Firearm murder rate  | 3.42     | 2.32               |
| Proportion of population that is black                       | 0.097    | 0.094              |
| Population density (persons per square mile)                 | 175.7    | 243.7              |
| Real per capita median income                                | \$15,016 | \$3094             |
| Proportion of population with college degree                 | 0.22     | 0.05               |
| Unemployment rate  | 0.06     | 0.021              |
| Proportion of population > 18 and <24                        | 0.107    | 0.014              |
| Proportion of population > 25 and <34                        | 0.152    | 0.107              |
| Per capita annual alcohol consumption (gallons)              | 2.42     | 0.57               |
| Per capita prison population (prisoners per 100,000 persons) | 322.9    | 173.4              |
| Percentage of population in large cities                     | 0.137    | 0.132              |
| Police per capita (police per 100,000 persons)               | 283      | 61.6               |

Sources: U.S. Census Bureau (1980–2013); Supplementary Homicide Reports (1980–2012); own calculations

## Results

As noted earlier, all observations were weighted by state population, and clustered standard errors were used. A two-way fixed effects model, controlling for both state-level and year-specific effects, was used. Both linear and log-linear functional forms were estimated. One reason why prior studies used log-linear functional forms is because this type of functional form corrects for nonlinearities in the data.

**Table 2** States with permit-to-purchase laws

| State                | Effective Dates |
|----------------------|-----------------|
| California           | 2003-present    |
| Connecticut          | 1995-present    |
| District of Columbia | 1976-present    |
| Hawaii               | 1988-present    |
| Iowa                 | 1978-present    |
| Illinois             | 1968-present    |
| Massachusetts        | 1972-present    |
| Michigan             | 1927-present    |
| Missouri             | 1981–2007       |
| Nebraska             | 1991-present    |
| New Jersey           | 1970-present    |
| New York             | 1934-present    |
| North Carolina       | 1919-present    |

The time period examined in the present study is 1980–2011. Hence, “present” refers to 2011

Sources: Law Center to Prevent Gun Violence (2013); Ludwig and Cook (2003); Rudolph et al. (2015)

Nonlinearities are sometimes due to a widely varying dependent variable (a dependent variable with a large range and variance). That is not the case in the present study. The firearm murder rate ranges only from 0 to 15. Many other studies examined various crime rates, such as violent crime, that had much larger variances, and hence there was the potential for nonlinearities in their data. For studies that examined those types of crimes, it may be possible that the log-linear form was more appropriate. For the present study, however, given that only firearm murder rates were examined, the variances are much smaller and hence the potential for nonlinearities in the data is much less.

Results are presented on Tables 3 and 4. These results suggest that, for both functional forms, PTP laws are not significantly related to firearm murder rates. These results are contrary to the results found in the two prior studies on this topic (Rudolph et al. 2015; Webster et al. 2014). In both of these studies, it was found that permit-to-purchase laws resulted in significant declines in murder rates. Both studies used different empirical techniques: Rudolph et al. (2015) used a synthetic control method, while Webster et al. (2014) used fixed effects and a correlation analysis. The present study uses a much more established and more commonly used empirical technique than either of these prior studies.

In addition, Rudolph et al. (2015) only looked at the effects of the Connecticut law, while Webster et al. (2014) only examined Missouri's law. In contrast, the present study uses data from all 50 states for a 32-year period. This is important because several states had PTP laws for relatively long periods, and Missouri's law was repealed in 2007. Hence the examination of only one state's experience with a PTP law may not capture the true effects of this law on murder rates.

**Table 3** Fixed effects regression linear model 1980–2011

| Variable                                     | Coefficient | Test Statistic |
|--|-------------|----------------|
| Constant                                     | -5.01       | -3.33***       |
| Permit-to-purchase law                       | -0.182      | -1.20          |
| Proportion of population that is black       | 53.44       | 12.08***       |
| Population density                           | 0.00753     | 3.69***        |
| Real per capita median income                | -0.000047   | -1.23          |
| Proportion of population with college degree | 0.926       | 0.75           |
| Unemployment rate                            | 2.55        | 0.95           |
| Proportion of population > 18 and <24        | 6.24        | 0.98           |
| Proportion of population > 25 and <34        | -2.15       | -0.47          |
| Per capita alcohol consumption               | 1.89        | 9.42***        |
| Per capita prison population                 | -0.0012     | -2.56**        |
| Percentage of population in large cities     | 2.12        | 1.48           |
| Police per capita                            | -0.0104     | -9.69***       |

$R^2 = 0.831$ ; Year and state dummies are not shown

\*5% <  $p$ -value <10%; \*\* 1% <  $p$ -value <5%; \*\*\*  $p$ -value < 1%

Sources: U.S. Census Bureau (1980–2013); Supplementary Homicide Reports (1980–2012); own calculations

**Table 4** Fixed effects regression log-linear model 1980–2011

| Variable                                     | Coefficient | Test Statistic |
|--|-------------|----------------|
| Constant                                     | -0.646      | -1.71*         |
| Permit-to-purchase law                       | -0.594      | -1.55          |
| Proportion of population that is black       | 10.83       | 9.75***        |
| Population density                           | 0.00297     | 5.80***        |
| Real per capita median income                | -0.0000052  | -0.54          |
| Proportion of population with college degree | -0.255      | -0.83          |
| Unemployment rate                            | -0.019      | -0.03          |
| Proportion of population > 18 and <24        | 0.24        | 0.15           |
| Proportion of population > 25 and <34        | -2.27       | -1.99**        |
| Per capita alcohol consumption               | 0.319       | 6.32***        |
| Per capita prison population                 | 0.00021     | 1.79*          |
| Percentage of population in large cities     | 0.889       | 2.47**         |
| Police per capita                            | -0.00178    | -6.63***       |

$R^2 = 0.863$ ; Year and state dummies are not shown

\*5% <  $p$ -value <10%; \*\* 1% <  $p$ -value <5%; \*\*\*  $p$ -value < 1%

Sources: U.S. Census Bureau (1980–2013); Supplementary Homicide Reports (1980–2012); own calculations

It is important to note, however, that Webster et al. (2014) included in their analyses other state-level gun control laws that were in effect during the period in question. In order to determine if the inclusion of these laws would alter the results of the present study, additional regressions were estimated that included variables for right-to-carry laws, assault weapons bans, and background checks. The inclusion of these state-level laws in the regressions had no effect on the significance of the PTP laws. The PTP laws were still not significantly related to murder. The results of these additional regressions are available upon request.

Regarding the significance of the other variables in the model, more densely populated states with larger black populations and higher than average alcohol consumption had higher firearm murder rates, while states with more police per capita had lower firearm murder rates. These results are similar to those found in other studies on the determinants of state-level firearm murder rates.

## Conclusions

Although crime rates are lower now than they have been in decades (in 1970, the firearm homicide rate was seven per 100,000 persons; in 2011, it was 3.6 per 100,000 persons), many individuals still believe that we live in a very violent society and that something must be done to reduce crime. One gun control law that has been found to reduce murder rates in two prior studies is the PTP law. Using various estimation methodologies and data for the period 1980–2011, the present study found that PTP laws had no statistically-significant effects on state-level

murder rates. These results are robust and hold regardless of functional form used or the inclusion of other gun control variables.

There are, however, several limitations with the present study. First, only murder is examined. PTP laws may have statistically-significant effects on other types of crime. Firearms are used in a variety of other crimes, including robbery, rape, and aggravated assault. Second, more recent data should be analyzed. Several states' gun control laws have been significantly altered since 2011, especially in the wake of the Sandy Hook shooting in 2012. This additional data may shed new light on the relationship between PTP laws and crime rates.

The results of the present study are important because this study is one of the first English-language studies that examines the impact of PTP laws on murder. The only other studies that considered this gun control measure were co-authored by the same researchers, and both found that PTP laws reduced murder rates. Unfortunately, these studies focused on only one state and used relatively novel empirical techniques, while the present study looks at all states over a 32-year period and uses a much more established and accepted empirical methodology. Given the results of the present study, it does not appear that PTP laws would significantly reduce firearm murders.

Hence, from a public policy perspective, PTP laws create significant barriers to lawful firearm possession while, at the same time, not significantly reducing firearm-related murders. Although we all want to reduce gun violence, enacting laws that are not found to be statistically related to firearm murders only imposes burdens on lawful gun owners and does nothing to achieve the goal of less gun violence. Hence, states should reconsider their enactment of PTP laws.

Unfortunately, very little research has been conducted on PTP laws. Future research should focus on the use of more recent data, an examination of some of the more recently enacted PTP laws, and the use of more sophisticated statistical models so that the true relationship between PTP laws and crime can be ascertained. In addition, future research should examine the relationship between PTP laws and all types of gun-related violent crimes. Given that PTP laws are essentially universal background checks, it would be instructive to determine if such laws act as a deterrent to would-be criminals. If they do not, then clearly this type of gun control measure should be reconsidered, and more emphasis should be placed on finding more effective ways to reduce gun violence in America.

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