Using Fixed Effects to Estimate the Impact of Constitutional Carry on State-Level Crime Rates

Mark Gius
Quinnipiac University
Email: mark.gius@qu.edu

Abstract

Over the past several years, there has been a significant increase in the number of states allowing concealed weapons carry without a permit (constitutional carry). The purpose of the present study is to determine if the enactment of constitutional carry has any statistically significant effects on various state-level crime rates. Using a two-way fixed effects model, it was found that constitutional carry is positively and significantly related to all violent crime rates. These results suggest that the relaxing of concealed carry laws may result in an increase in homicides and other violent crimes.

Keywords: constitutional carry; fixed effects; violent crime

1. Introduction

Gun rights proponents typically argue that firearms should be readily available because criminals would be less likely to commit crimes if they believed that their victims may be armed. This deterrent effect has been discussed at great length in many prior studies (Kovandzic, Marvell, and Vieraitis, 2005; Kovandzic and Marvell, 2003; Lott, 2000; Lott and Mustard, 1997). Gun control proponents, however, believe that there is a positive correlation between the increased availability of firearms and the probability of criminal activity occurring.

Over the past 20 years, several states have passed laws that relaxed constraints on firearm possession in public, the most relaxed being constitutional carry, which is concealed weapons carry (CCW) without a permit. Until the early 2000s, most states required civilians to obtain a permit to carry a concealed firearm in public places. Some states even prohibited the practice of concealed carry. Until the early 21st century, the two most common types of concealed carry laws at the state level were "shall issue" and "may issue". In a "shall issue" state, a permit is required to carry a concealed weapon, but state and local authorities must issue a permit to any qualified applicant who requests one. This type of concealed carry law is not very restrictive. In a "may issue" state, local and state authorities can deny requests for concealed carry permits, even requests from qualified applicants. "May issue" laws restrict the ability of citizens to carry concealed weapons and are considered restrictive.

Starting in the early 21st century, more and more states began to enact constitutional carry laws. In states with constitutional carry laws, no permit is required to carry a concealed firearm. The elimination of the permit requirement greatly reduces any barriers to carrying a firearm in public. By reducing these barriers, it was hoped that more and more civilians would carry firearms, thus potentially increasing the deterrent effect of constitutional carry.

To understand the loosening of concealed carry laws over the years, it is important to note that, in 1986, only Vermont had constitutional carry. In that same year, 9 states had shall

issue laws, 24 states had may issue, and 16 states did not allow the carrying of concealed weapons. It was not until 2003 that a second state adopted constitutional carry. In 2003, two states had constitutional carry, 34 states had shall issue laws, nine had may issue, and five had prohibitions on concealed carry. In 2013, the last state dropped its prohibition on concealed carry. Finally, in 2022, 25 states had constitutional carry, 17 had shall issue, and eight had may issue (Barati, 2016; Gius, 2019, 2014; Donohue, 2003). Table 1 lists the states that have enacted constitutional carry and the year in which it took effect. The table only lists those states that enacted constitutional carry prior to 2020.

Table 1

States with Constitutional Carry

State	Year Enacted
Alaska	2003
Arizona	2011
Arkansas	2014
Idaho	2017
Kansas	2016
Maine	2016
Mississippi	2017
Missouri	2017
New Hampshire	2018
Vermont	Before 1981
West Virginia	2017
Wyoming	2012

It is important to note that concealed carry laws are rather broad, and not all laws within a given category are equally restrictive. These broad categories are not definitive because the way in which a state not only interprets its concealed carry statute but also enforces it has an impact on the actual restrictiveness of the law. In addition, some cities and counties have more restrictive concealed carry laws than their home states.

Given the significant change in CCW laws over the past twenty years, it would be interesting to determine the impact of this change in CCW laws on violent crime rates. If the loosening of CCW laws is significantly and positively related to violent crime rates, then policymakers should implement the appropriate policy to reduce violent crimes. Therefore, the

purpose of the present study is to ascertain the impact of constitutional carry on state-level violent crime rates.

Most prior studies on CCW laws and crime rates found that permissive concealed carry laws (shall issue or constitutional carry) either resulted in higher violent crime rates or that they had no significant effects on violent crime rates (Douchette, Crifasi, McCourt, Ward, Fix, and Webster, 2023; Douchette, McCourt, Crifasi, and Webster, 2023; Chakraborty, Menifield, and Daw, 2022; Fridel, 2021; Donohue, Aneja, and Weber, 2019; Siegel, Pahn, Xuan, Fleegler, and Hemenway, 2019; Crifasi, Merrill-Francis, McCourt, Vernick, Wintemute, and Webster, 2018; Hamill, Hernandez, Bailey, Zielinski, Matos, and Schiller, 2018; Shi and Lee, 2018; Durlauf, Navarro, and Rivers, 2016; Kleck, Kovandzic, and Bellows, 2016; Manski and Pepper, 2015; Ginwalla, Rhee, Friese, Green, Gries, Joseph, Kulvatunyou, Lubin, O'Keeffe, Vercruysse, Wynne, and Tang, 2013). Studies that found that permissive CCW laws reduced crime rates include Barati (2016), Ferguson, Odegard, and Weatherby (2014), Moody, Marvell, Zimmerman, and Alemante (2014), and Lott and Mustard (1997).

Results of the present study suggest that the adoption of constitutional carry resulted in an increase in all violent crime rates. Results suggest that states that adopted constitutional carry had murder rates that were 12% higher and violent crime rates that were 16.3% higher than states without constitutional carry.

2. Literature Review

Regarding CCW research, Table 2 summarizes the findings of most of the research in this area over the past 30 years.

As can be seen from this table, most studies found that permissive concealed carry laws ("shall issue" or unrestricted) either reduced violent crime or had no significant effects on crime. Some studies, such as Ayers and Donohue (2003), Donohue (2003), and Kovandzic and Marvell (2003), found that states with more permissive concealed carry laws had higher property crime rates. However, Devaraj and Patel (2018) found that property crime rates fell when Chicago went from "prohibited" CCW status to "shall issue". Hence, most prior research has found that permissive CCW laws either reduced violent crime, or they had no statistically significant effects on violent crime.

One issue with most of this prior research is that it examined the impact of moving from may issue CCW laws to shall issue CCW laws. Although this is a shift to a less restrictive concealed carry statute, it is not the focus of the present study. Instead, the present study examines the impact of moving to unrestricted or constitutional carry (concealed carry with no permit required). Only one prior study examined that change in CCW laws (Doucette, Crifasi, McCourt, Ward, Fix, and Webster, 2023). Doucette et al. (2023) used state-level data for the years 1981-2019 and a synthetic difference-in-differences method to determine the impact of adopting constitutional carry on various violent crime rates. They found that the adoption of constitutional carry had no significant effects on violent crime rates. The present study differs from this prior research by using a much larger data set than most prior studies and by employing a two-way fixed effects model.

Table 2
Summary of Papers that Examined Effects of Concealed Carry Laws on Violent Crime Rates

	Permissive CCW Laws Reduce Crime	Permissive CCW Laws Increase Crime	Insignificant or Mixed Results
Ayers and Donohue, 2003			X
Barati, 2016			X
Bartley and Cohen, 1998	X		
Benson and Mast, 2001	X (Model Specific)		
Black and Nagin, 1998			X
Blau, Gorry, and Wade, 2016			X
Bronars and Lott, 1998	X		
Chakraborty, Menifield, and Daw, 2022			X
Crifasi, Pollack, and Webster, 2016			X
Crifasi, Merrill-Francis, McCourt, Vernick, Wintemute, and Webster, 2018		X	
Devaraj and Patel, 2018	X		
Dezhbakhsh and Rubin, 1998			X
Donohue, 2003			X
Donohue, Aneja, and Weber, 2019		X	
Douchette, Crifasi, McCourt, Ward, Fix, and Webster, 2023		X	
Douchette, McCourt, Crifasi, and Webster, 2022		X	
Durlauf, Navarro, and Rivers, 2016			X
Duwe, Kovandzic, and Moody, 2002			X

Table 2 (continued)
Summary of Papers that Examined Effects of Concealed Carry Laws on Violent Crime Rates

	Permissive CCW Laws Reduce Crime	Permissive CCW Laws Increase Crime	Insignificant or Mixed Results
Ferguson, Odegard, and Weatherby, 2014	X		
Fridel, 2021		X	
Ginwalla, et al., 2013		X	
Gius, 2014	X		
Hamill, Hernandez, Bailey, Zielinski, Matos, and Schiller, 2018			X
Helland and Tabarrok, 2004	X		
Kleck and Patterson, 1993			X
Kovandzic and Marvell, 2003			X (Only Florida)
Kovandzic, Marvell, and Vieraitis, 2005			X
Lott, 1998	X		
Lott and Mustard, 1997	X		
Ludwig, 1998		X	
Manski and Pepper, 2015			X
Moody, 2001	X		
Moody, Marvell, Zimmerman, and Alemante, 2014	X		
Phillips, Nwaiwu, Lin, Edwards, Imanpour, Ohsfeldt, 2015			X
Siegel, Pahn, Xuan, Fleegler, and Hemenway, 2021		X	
Shi and Lee, 2018			X
Smith and Petrocelli, 2018			X

3. Empirical Technique and Data

To determine if constitutional carry laws are related to violent crime rates, a fixed effects model that controls for both state-level and year fixed effects was used in the present study. All observations were weighted using state-level population, and standard errors were corrected using a clustering method (the state is the level at which the standard errors are clustered).

The following equation was estimated in the present study:

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

In the above equation, y denotes the crime rate, α_i denotes the state-level effects, γ_t denotes the year effects, and X denotes the vector of explanatory variables which includes the constitutional carry dummy variable. The constitutional carry dummy variable equals one if a state has constitutional carry and zero otherwise. Crime rates estimated in the present study include the violent crime rate, the murder rate, the robbery rate, and the aggravated assault rate. Crime rates are defined as crimes per 100,000 persons. This model is similar to models used by other studies on this topic (Gius, 2019, 2014; Barati, 2016; Moody and Marvell, 2009; Moody, 2001; Olson and Maltz, 2001; Bartley and Cohen, 1998; Lott and Mustard, 1997). Explanatory variables include the percentage of the state population that is African-American, population density (Gius, 2019, 2014; Barati, 2016), percentage of population that has at least a bachelor's degree (Gius, 2019, 2014; Barati, 2016; Moody and Marvell, 2009; Moody 2001) , per capita median real income (Gius, 2019, 2014; Barati, 2016; Moody and Marvell, 2009; Moody 2001), per capita alcohol consumption (Gius, 2019, 2014), the unemployment rate (Gius, 2019, 2014), and the lagged crime rate. All data is at the state level and is for the period 1981-2019.

Regarding the effects of carry laws on crime, many contend that deterrence is the primary reason for these types of laws (Kovandzic, Marvell, and Vieraitis, 2005; Kovandzic and Marvell, 2003; Lott and Mustard, 1997). Permissive carry laws allow private citizens greater opportunity to carry weapons and hence to possibly deter crime. If criminals know that a state has permissive carry laws, then they may believe that the probability that a private citizen is armed is relatively high. In such a case, a criminal may be less likely to commit a crime. This argument assumes, however, that criminals are aware of a state's gun control laws and that private citizens are also aware of their right to carry a handgun, either openly or concealed. In addition, this argument assumes that private citizens would avail themselves of the opportunity to carry a weapon and that they would be willing to use it to defend themselves or others.

Data on crime was obtained from the US Department of Justice. The reason for excluding data after 2019 was concern about the impact of COVID on crime rates and the US Supreme Court decision on firearms (*Bruen)*. The *Bruen* decision significantly affected concealed carry laws in several states and essentially made "may issue" laws unconstitutional. Per capita alcohol consumption data was obtained from the National Institute on Alcohol Abuse and Alcoholism. All other state-level data was obtained from relevant Census Bureau reports. Descriptive statistics are reported on Table 3.

Table 3 Descriptive Statistics		
Variable	Mean	Standard Deviation
Violent Crime Rate (per 100,000 persons)	434.34	216.67
Murder Rate (per 100,000 persons)	5.6	3.2
Robbery Rate (per 100,000 persons)	118.2	88.2
Aggravated Assault Rate (per 100,000 persons)	273.8	142.2
Percent African American	0.101	0.094
Percent College Educated	0.24	0.057
Population Density	180.5	245.9
Real Median Income	$16,211	$4,156
Per Capita Alcohol Consumption	2.42	0.56
Unemployment Rate	0.058	0.21
N=1950		

4. Results

Results are presented on Tables 4-7. These results suggest that constitutional carry has significant and positive effects on all four violent crime rates examined. States with constitutional carry had 12% higher murder rates, 16.3% higher violent crime rates, 14.3% higher robbery rates, and 16.1% higher aggravated assault rates than states that did not have constitutional carry laws. Regarding the other explanatory variables, states with higher percentages of African-American residents, lower population densities, and higher per capita alcohol consumption had higher crime rates. These results are similar to the results found in prior studies in this area.

As a robustness check, equation (1) was re-estimated using four property crimes as dependent variables. The four property crimes were arson, burglary, larceny, and grand theft auto. Given that these crimes do not involve firearms, it is reasonable to assume that the enactment of constitutional carry would have little to no effect on these property crime rates. The period examined for these crimes was 1986-2019. State-level property crime data was not available prior to 1986. Results for property crimes are presented on Tables 8-11. According

to these results, constitutional carry had a positive and significant effect only on arson. It had a significant and negative effect on larceny and grand theft auto, and it had no significant effect on burglary. Hence, given these inconsistent results for property crime, the violent crime results are shown to be significant and robust.

Table 4

Fixed Effects Results: Violent Crime Rate

Variable	Coefficient	Test Statistic
Constant	104.89	1.70*
Constitutional Carry Dummy Variable	84.29	4.49***
Percent African American	1108.90	4.35***
Percent College Educated	-297.85	-3.37***
Population Density	-1.46	-12.72***
Real Median Income	-0.00343	-2.35**
Per Capita Alcohol Consumption	259.43	17.26***
Unemployment Rate	812.39	3.88***
Lagged Violent Crime Rate	0.171	12.49***

10% Significance = *; 5% Significance = **; 1% Significance = ***

Adjusted R^2 = 0.866

Table 5

Fixed Effects Results: Murder Rate

Variable	Coefficient	Test Statistic
Constant	-5.25	-5.64***
Constitutional Carry Dummy Variable	0.783	2.77***
Percent African American	30.5	7.90***
Percent College Educated	4.11	3.09***
Population Density	-0.00297	-1.73*
Real Median Income	-0.00007	-3.19***
Per Capita Alcohol Consumption	3.32	14.77***
Unemployment Rate	-0.70	-0.22
Lagged Murder Rate	0.163	11.93***

10% Significance = *; 1% Significance = ***

Adjusted R^2 = 0.832

Table 6

Fixed Effects Results: Robbery Rate

Variable	Coefficient	Test Statistic
Constant	-5.08	-0.15
Constitutional Carry Dummy Variable	23.55	2.34**
Percent African American	-99.90	-0.73
Percent College Educated	-278.46	-5.88***
Population Density	-0.316	-5.17***
Real Median Income	-0.0034	-4.28***
Per Capita Alcohol Consumption	132.82	16.48***
Unemployment Rate	537.49	4.79***
Lagged Robbery Rate	0.243	16.41***

5% Significance = **; 1% Significance = ***

Adjusted R^2 = 0.82

Table 7

Fixed Effects Results: Aggravated Assault Rate

Variable	Coefficient	Test Statistic
Constant	95.84	2.58***
Constitutional Carry Dummy Variable	49.98	4.43***
Percent African American	1171.64	7.64***
Percent College Educated	-23.22	-0.44
Population Density	-1.023	-14.72***
Real Median Income	0.000052	0.06
Per Capita Alcohol Consumption	105.49	11.75***
Unemployment Rate	259.39	2.07**
Lagged Aggravated Assault Rate	0.148	10.57***

5% Significance = **; 1% Significance = ***

Adjusted R^2 = 0.872

Table 8

Fixed Effects Results: Arson Rate

Variable	Coefficient	Test Statistic
Constant	-12.59	-1.99**
Constitutional Carry Dummy Variable	3.67	2.19**
Percent African American	145.78	5.52***
Percent College Educated	-9.38	-1.20
Population Density	-0.032	-2.67***
Real Median Income	-0.00064	-4.76***
Per Capita Alcohol Consumption	17.96	11.36***
Unemployment Rate	7.35	0.35

5% Significance = **; 1% Significance = ***

R^2 = 0.784

Table 9

Fixed Effects Results: Burglary Rate

Variable	Coefficient	Test Statistic
Constant	114.52	0.96
Constitutional Carry Dummy Variable	-25.17	-0.80
Percent African American	2447.23	4.91***
Percent College Educated	414.65	2.80***
Population Density	-4.14	-18.31***
Real Median Income	0.0084	3.28***
Per Capita Alcohol Consumption	358.3	12.0***
Unemployment Rate	4040.33	10.15***

1% Significance = ***

R^2 = 0.872

Table 10

Fixed Effects Results: Larceny Rate

Variable	Coefficient	Test Statistic
Constant	560.03	1.99**
Constitutional Carry Dummy Variable	-130.37	-1.75*
Percent African American	1168.32	0.99
Percent College Educated	-3.72	-0.01
Population Density	-5.28	-9.89***
Real Median Income	0.0132	2.18**
Per Capita Alcohol Consumption	957.76	13.61***
Unemployment Rate	6518.14	6.95***

10% Significance = *; 5% Significance = **; 1% Significance = ***

R^2 = 0.829

Table 11

Fixed Effects Results: Grand Theft Auto Rate

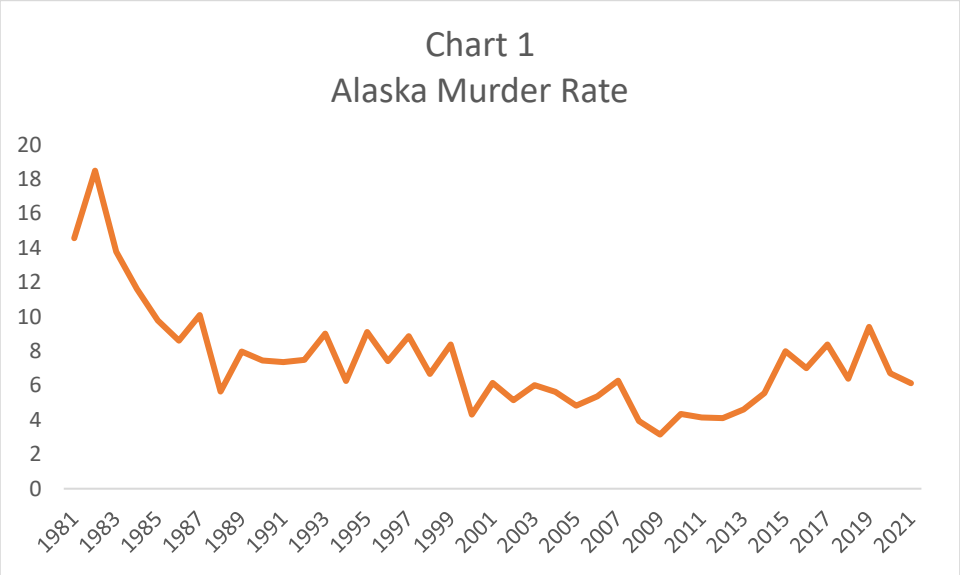
Variable	Coefficient	Test Statistic
Constant	6460.103	5.20***
Constitutional Carry Dummy Variable	-72.46	-3.10***
Percent African American	574.42	1.56
Percent College Educated	-320.71	-2.93***
Population Density	-2.16	-12.93***
Real Median Income	-0.0096	-5.09***
Per Capita Alcohol Consumption	239.98	10.87***
Unemployment Rate	1066.02	3.62***

1% Significance = ***

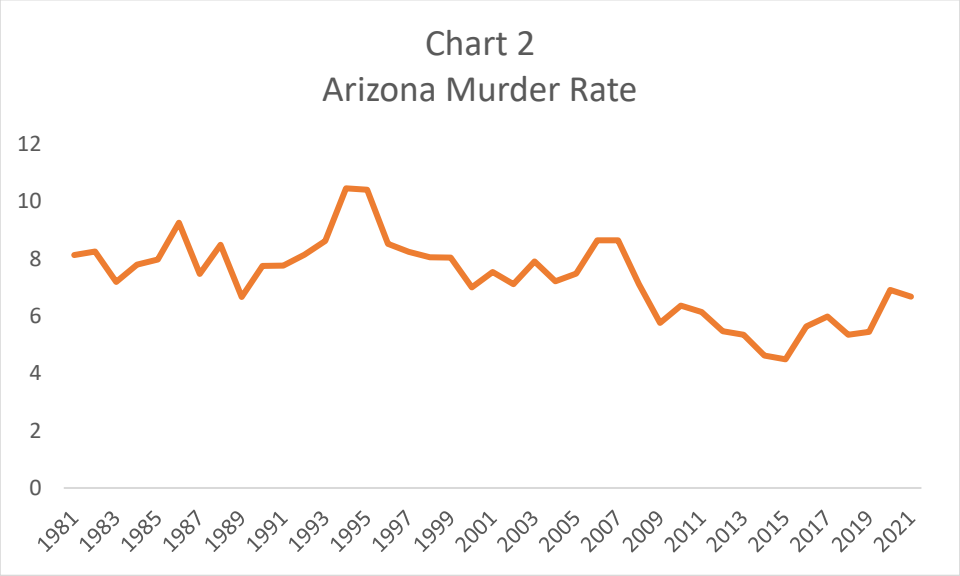
R^2 = 0.808

As an additional check on the robustness of the violent crime results, murder rates were examined pre- and post-adoption of constitutional carry for the following states: Alaska, Arizona, Arkansas, and Wyoming. The reason for excluding other states with constitutional carry is because most states with constitutional carry in 2019 had it in effect for only two or three years. There would not have been enough time since the adoption of constitutional carry to have a significant effect on crime. Vermont was also excluded because it had constitutional carry for the entire period being examined (1981-2019). Results are presented on Charts 1-4.

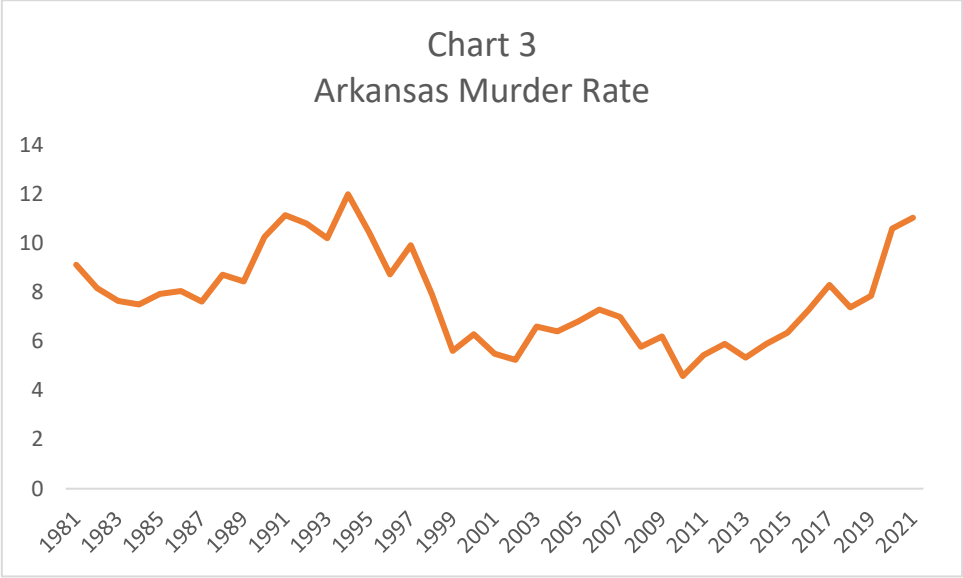
These results suggest that the enactment of constitutional carry was not endogenous. Three of the four states had declining murder rates before the enactment of constitutional carry, and the murder rate in Wyoming was relatively constant. This indicates that the adoption of constitutional carry was not based on fears regarding increasing crime but was instead based upon exogenous, most likely, political events.



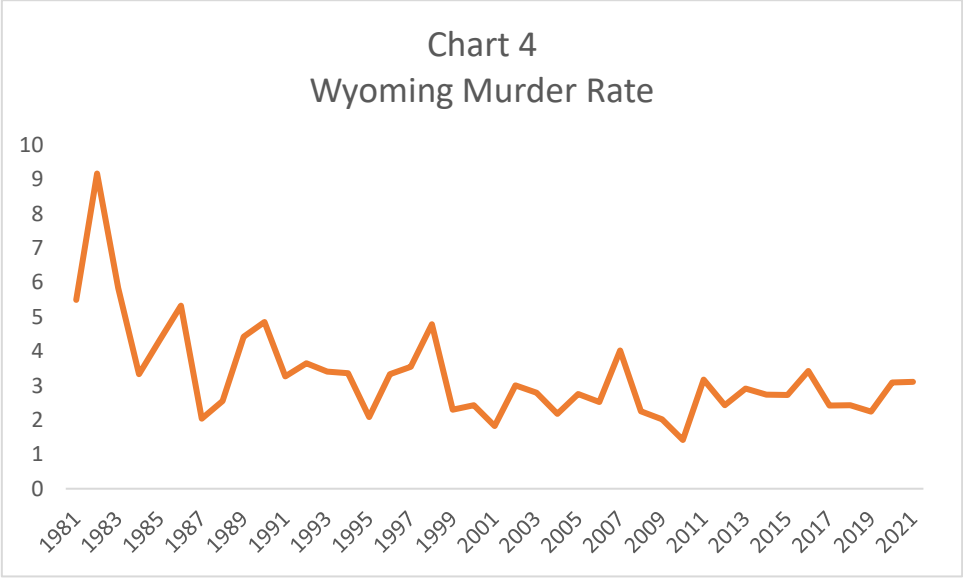
Constitutional carry enacted in 2003.



Constitutional carry enacted in 2011.



Constitutional carry enacted in 2014.



Constitutional carry enacted in 2012.

5. Concluding Remarks

Recently, in certain cities and in certain parts of the country, murder rates have started to increase after years of decline. To combat this increase in crime, several proposals and suggestions have been put forth. A perennial suggestion from gun rights groups is to loosen restrictions on concealed carry and allow more private citizens to carry firearms so that they may defend themselves and others from crime. Numerous studies have examined the relationship between concealed carry laws and crime. As noted earlier, most studies have found that permissive concealed carry laws (shall issue or unrestricted) either reduced violent crime rates or that they had no effects on crime. Regarding the effects of these laws on property crimes, the results are somewhat inconclusive.

In the present study, data for the years 1981-2019 was used to determine if the adoption of constitutional carry had a significant effect on violent crime rates. Looking at violent crime, murder, robbery, and aggravated assault, the results of this study indicate that states with unrestricted concealed carry laws have higher rates of all violent crime when compared to states that require CCW permits.

The present study attempts to determine if constitutional carry laws resulted in an increase in crime rates. Using a fixed effects model and data for a 40-year period, results of the present study indicate that the adoption of constitutional carry laws results in an increase in all violent crime rates. This result validates the findings of some prior studies in this area. Hence, policymakers should be aware of the potential negative impact of enacting constitutional carry laws in their states.

There are several limitations of the present study. First, the crime data that was used includes non-firearm related crime. Approximately 25-30% of murders are committed with weapons other than firearms, and the percentage of non-firearm related incidents is much higher for robbery and aggravated assault. Given the data used in the present study, it is unknown if the increase in violent crimes is due to an increase in firearm-related violent crimes or to an increase in non-firearm related crimes.

Another potential problem with the results found in the present study is the uncertainty involved with any examination of the effects of concealed carry laws on crime over the past 30 years. Crime rates increased during the 1980s and early 1990s and then fell to historic lows. During this period, however, there were numerous changes in gun control laws, both at the state and Federal level. Most of the changes loosened existing statutes, but some laws increased restrictions on various types of firearms. Hence, there were changes in the regulation of firearms at the same time that there were societal changes that resulted in lower crime rates. Donohue (2003) believes that "… a disaggregated data push toward a more-guns, more-crime conclusion…" (pg. 324) and that "…crime swings that occurred in the late 1980s and 1990s happened to correlate with the passage of shall-issue laws, and the panel data model seems unable to separate out the contribution of the relatively minor influence of the shall issue law from the major impacts of these broad swings" (Donohue, 2003, pg. 325). Therefore, even though some of the results of the present study suggest that permissive concealed carry laws are significantly and positively related to murder, it is reasonable to assume that various societal factors may have much greater effects on crime than any single gun control statute.

Finally, some prior studies have shown that crime rates are negatively affected by permissive CCW laws, while other studies have found that crime rates are either unaffected or are positively related to CCW laws. This inconclusiveness is no doubt due to the variety of CCW laws at the state level and the uncertainty regarding the frequency with which citizens avail themselves of the opportunity to defend themselves from criminal acts. Given that one

of the goals of CCW laws is deterrence, it is difficult to measure deterrence if it is unknown how many persons are actually carrying concealed weapons on a regular basis. Binary variables denoting the legal status of concealed carry laws are poor substitutes for actual data on the number or proportion of citizens carrying concealed weapons on a regular basis. Since there is no available data on that variable, the present study, just like every other study on this topic, cannot ascertain the true relationship between concealed carry laws and crime. More research is warranted in this area.

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