UNDERSTANDING THE IMPACT OF GUN POLICY ON CRIME

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ABSTRACT

Recently, the gun control debate has been renewed in an effort to reduce violence. Much of the recent research examining the relationship between right-to-carry laws and crime rates has been conducted at the national level. This study analyzes the impact of gun control and right-to-carry laws specific to the state of Ohio utilizing data obtained from the Ohio Attorney General, the Ohio Department of Public Service Office of Criminal Justice Statistics, the Federal Bureau of Investigation Uniform Crime Reports, United States Bureau of Labor Statistics, and the United States Census Bureau. A simple first order regression model is estimated to test the hypothesis that strict gun control laws reduce crime more effectively than laws restoring the right-to-carry concealed handguns and found that right-to-carry laws in Ohio are estimated to reduce crime relative to strict gun control policies. Additionally, the results suggest that gun control policy decisions impact crime rates in Ohio more than economic disposition factors such as median income and unemployment rate. In addition to the impact on the overall state-level crime rate, this paper examines the impact of right-to-carry laws on each type of violent crime. The results of this analysis indicate that the impact is not equal across crime types. Specifically, the analysis suggests that rape was most impacted by the implementation of right-to-carry laws. This paper also examines county crime rates and found evidence suggesting that right-to-carry laws impact violet crime in metropolitan areas more than rural areas. This study also found that the policy is more effective at reducing crime than the prevalence of concealed handgun license holders. Lastly, an analysis of robbery and burglary rates in this study suggests that criminals perform a risk/benefit analysis and shift their mode of theft to burglary, the non-violent type.

1   INTRODUCTION

Due to recent high profile mass public shootings, the gun control debate has re-entered the sphere of policy discussion. Several states have enacted stricter gun control policies as a result. There is also a push to enact control at the federal level. Proponents of such legislation claim restricting lawful access to certain types of firearms will reduce mass shootings.

A recent PoliceOne.com survey found that 97.5% of officers polled felt that gun control policies such as the Assault Weapons Ban would have no effect on overall violent crime. In fact, 28% of law enforcement officers felt that more permissive concealed carry policies for citizens would help most in preventing mass shootings. Research by John R. Lott, Jr. and William M. Landes of the Chicago University School of Law found "that the only policy factor to influence multiple victim public shootings is the passage of concealed handgun laws." (Lott & Landes, Multiple Victim Public Shootings, Bombings, and Right-to-Carry Concealed Handgun Laws: Contrasting Private and Public Law Enforcement, 1999)

However, mass shootings are rare. Of the nearly ¾ of a million people murdered and assaulted in the United States in 2012 less than 0.02% were victims of public mass shootings[1]. Instead of focusing on such a minute sample of violent crime, the net effect on all violent crime should be considered.

A body of work spanning more than two decades by several economists, criminologists, and other scholars exists to assert that right-to-carry laws reduce violent crime. A rudimentary regression analysis of violent crime at the national level and the percentage of the US population living in states[2] with a shall-issue concealed carry licensing provision[3] as well as gun regulations like the Brady Bill and Assault Weapons Ban suggests a relationship where the percentage of Americans living in right-to-carry states decreases violent crime more than the aforementioned gun regulations.
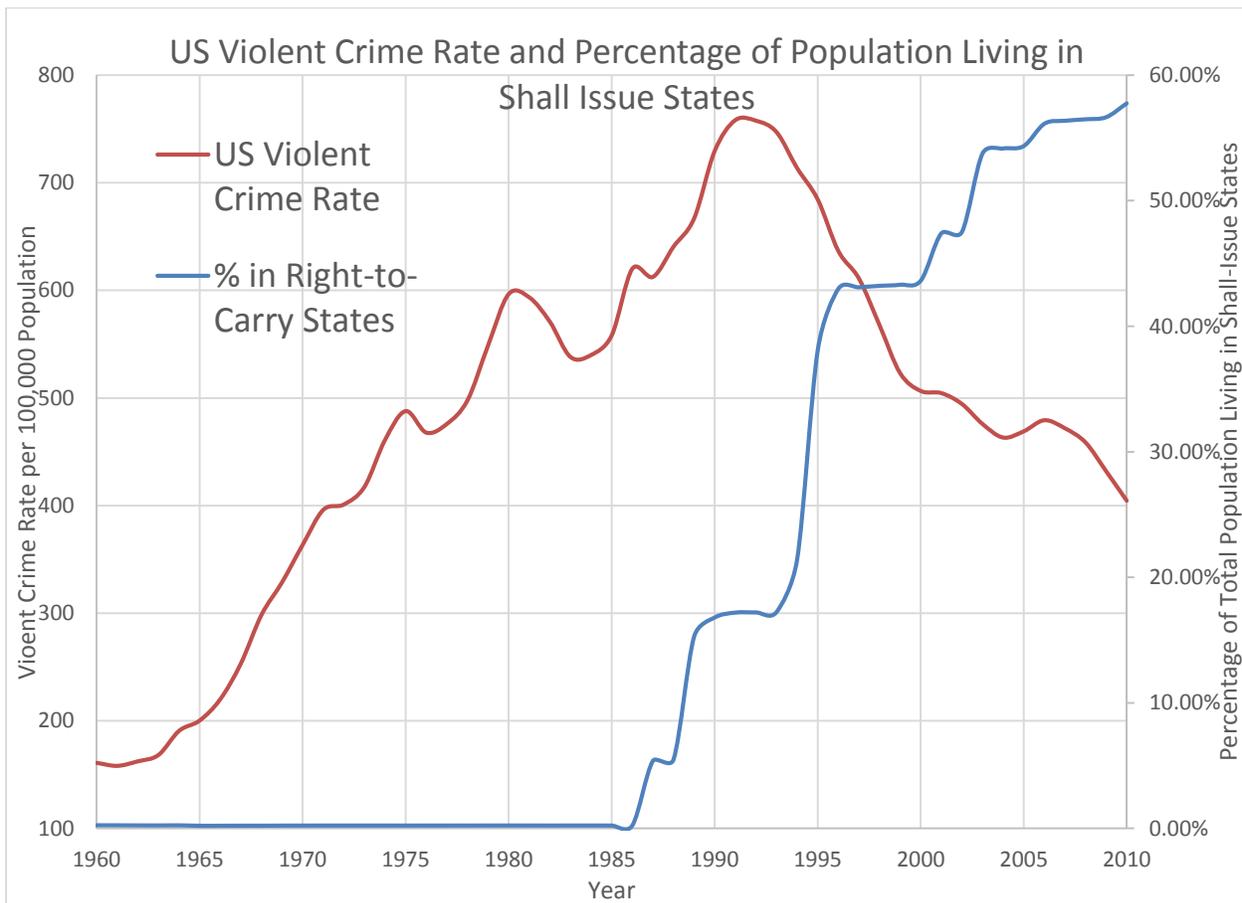

Figure 1 – US violent crime rate and percentage of US population living in shall issue states

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[1] FBI defines a mass shooting as "an individual actively engaged in killing or attempting to kill people in a confined and populated area." (Federal Bureau of Investigations, 2014)

[2] Right to carry law timeline obtained from the NRA-ILA (National Rifle Associaion Institute for Legislative Action, 2012)

[3] A shall-issue concealed carry licensing provision is one in which the issuing authority is required to issue a concealed carry license given the applicant meets certain criteria.

Table 1 – US Violent Crime Regression Analysis		
R-Squared Adjusted = 6.90%		
Term	Coefficient	Standard Error
Constant	758.07	28.514
Right-to-Carry	-621.73	97.732***
Gun Restrictions	71.20	46.517

Ohio added its population to the percentage of those living in right to carry states in 2004 with the passage of House Bill 12

Prior to the passage of House Bill 12, concealed carry of a loaded handgun was a felony (Klein, 2010). Police officers and persons who could demonstrate "affirmative defense" were exempt. This "prudent man" policy was problematic at best and many otherwise law-abiding citizens who decided to carry concealed handguns for their self-defense often times found themselves facing criminal charges for what they considered was an inalienable right. A citizen carrying a loaded handgun for self-defense was only permitted by law to do so openly, not concealed, as was confirmed by the Ohio Supreme Court (Klein v. Leis). Additionally, many people find open carry of a handgun for self-defense tactically desirable (Pincus, 2012). As a result, a movement to enact a concealed carry provision began with the formation of Ohioans for Concealed Carry in 1999 (Ohioans for Concealed Carry).

The right-to-carry a concealed handgun for self-defense in Ohio was codified into law with the passage of House Bill 12 on April 8, 2004 in the 125th General Assembly (Ohio's 125th General Assembly, 2004), marking a trend toward more relaxed gun regulation. Each General Assembly session since has seen the introduction of a bill that removes restrictions on licensed concealed carry. The bills addressed issued ranging from where concealed handguns may be carried to pre-emption of municipality authority.

Each bill was met with fierce opposition from groups in favor of strict gun control, such as the Ohio Coalition Against Gun Violence. For years, these groups have claimed that concealed handgun licensing would not reduce crime. In fact, they claimed that allowing citizens to carry concealed handguns would resulted an increase in violent crime, especially in more densely populated areas.

While the above analysis and aforementioned body of work suggests that idea is false, it provides a cursory insight into how gun policy impacts crime. Does it impact crime in more areas than others? Does it impact different segments of crime in different ways? Does the prevalence of concealed handgun licensees impact crime differently or more significantly than policy? What are the motivating forces with respect to gun regulations that impact crime?

Detailed analysis at the state level as well as on the types of violent crime impacted is just now beginning to emerge. This study analyses violent crime in Ohio with respect to gun control and right-to-carry laws. It attempts to answer those questions and to add to that body of work.

2   DATA AND POLICIES ANALYZED

Rates of violent crime, offenses which involve force or threat of force including murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault, as well as population data was obtained from Federal Bureau of Investigation Uniform Crime Reports (Federal Bureau of Investigation, 2014) and Ohio Department of Public Safety Office of Criminal Justice Services (Ohio Department of Public Service Office of Criminal Justice Statistics, 2013). Concealed carry licensee data was obtained from the Ohio Attorney General's Annual Concealed Carry Reports (Ohio Attorney General, 2014). Median income data was obtained from the United States Census. Unemployment data was obtained from the (United States Department of Labor, 2014).

The policies analyzed are as follows:
- Brady Bill (103rd Congress, 1994)
- Assault Weapons Ban (103rd Congress, 1994) – Banned the manufacture of certain semi-automatic firearms and magazines. It banned semi-automatic rifles able to accept detachable magazines and two or more of the following characteristics:
  - a folding or telescoping stock,
  - a pistol grip,
  - a bayonet mount
  - a flash suppressor, or threaded barrel designed to accommodate one, or
  - a grenade launcher mount.

It also banned semi-automatic pistols with detachable magazines and two or more of the following characteristics:
  - a magazine that attaches outside the pistol grip,
  - a threaded barrel to attach barrel extender, flash suppressor, handgrip, or suppressor,
  - a barrel shroud that can be used as a hand-hold,
  - an unloaded weight of 50 oz (1.4 kg) or more, or
  - a semi-automatic version of a fully automatic firearm.

Lastly, it also banned semi-automatic shotguns with two or more of the following characteristics:
  - a folding or telescoping stock,
  - a pistol grip,
  - a fixed capacity of more than 5 rounds, or
  - a detachable magazine.

- Concealed Carry (Ohio's 125th General Assembly, 2004) – A licensing process where citizens older than 21 years of age can obtain the right-to-carry a concealed handgun outside the home. The licensee must complete a 12-hour safety course. The licensee must also submit to a background check that verifies a record free of felonies and mental adjudications during the applicant's lifetime as well violent or drug related misdemeanors for the past three years and active orders of protection.

- Pre-Emption (Ohio's 126th General Assembly, 2007) – Ohio Revised Code 9.68 provided that municipalities and other divisions of the state have no authority to enact laws or rules respective to the sale or possession firearms. It reserved the right for the legislature. This was done to provide uniform laws across the state.

- Castle Doctrine (DeWine, 2013) – Case law provides that three requirements must be met to justify lethal force in self-defense. The actor must:
    - have a reasonable fear of serious bodily harm and or death,
    - not be at fault,
    - have attempted to flee if he can do so safely.

  Castle doctrine removes the duty to retreat inside the actor's home or vehicle (Ohio's 127th General Assembly, 2008).

- Restaurant Carry (Ohio's 129th General Assembly, 2011) – This policy removed the statutory ban on carrying concealed handguns into establishments licensed to serve alcohol for consumption on premises under a Class-D Liquor License.

Unless otherwise noted, state level data from 1990 to 2012 was considered. County level data from 1998 to 2011 was available and utilized in noted comparisons. State level data was preferred as the county level data excluded the time period from 1993 to 1998. A significant reduction in crime was observed while the only gun policy decisions in place were restrictive in nature. While the sample size was smaller, the potential for omitted bias rendered its use more desirable.

3   ANALYSIS METHODS AND RESULTS

Rather than develop complex models in an effort to explain a relationship between crime, income, unemployment, population density, and gun policy decisions, this study utilizes simple multi-factor regression analyses performed in Minitab statistical software to understand the relationships that exist if any.

The R-Squared Adjusted value is presented in each table. A value above 30% indicates the regression is an acceptable model. Regressor significance levels are denoted as follows:
- *** indicates statistical significance at the 1% level,
- ** indicates statistical significance at the 5% level, and
- * indicates statistical significance at the 10% level.

Where no level is indicated, the regressor was found not be significant at the 10% level.

3.1   General Model Search

A regression analysis on state level data was performed with all input variables considered, including gun policy decisions, population density, unemployment rate, and median income, to understand what if any relationship between the variables and violent crime existed over time. Gun policies were rated "1" for each month in the year the policy was in effect and "0" otherwise. The initial analysis suggested no

correlation existed between the dependent and independent variables. This is likely due to a high degree of multicollinearity between gun policy decision factors as well as between the socioeconomic factors.

In order to obtain a more useful analysis, gun policy decisions were grouped and a single categorical factor for permissive and restrictive policies scaled from 0 (for least) to 1 (for most) was developed. The aggregate regression factors were established as:

- Gun Rights Restoration – This aggregate regressor is scaled from 0 to 1 accounting for each new right-to-carry provision in place. To estimate the input each right-to-carry provision had on the combined regressor, a regression was performed where each provision was treated as a binary variable input with concealed handgun license rates[4] as the output. The scaling was applied is as follows:
    - Concealed Carry – 0.49
    - Pre-Emption – 0.04
    - Castle Doctrine – 0.25
    - Restaurant Carry – 0.22
- Gun Regulation Strengthening – This aggregate regressor is scaled from 0 to 1 accounting for each new gun control regulation in place. To estimate the input each gun control provision had on the combined regressor, a regression was performed where each provision was treated as a binary variable input with the number of National Instant Criminal Background Check System (Federal Bureau of Investigation, 2014) checks performed as the output. The scaling applied is as follows:
    - Brady Bill – 0.67
    - Assault Weapons Ban – 0.33

The regression analysis was performed using the new policy regressors. The following results were obtained:

Table 2 – Ohio Violent Crime Rate Regression Analysis		
R-Squared Adjusted = 89.80%		
Term	Coefficient	Standard Error
Constant	1537.22	232.01
Unemployment Rate	10.9	6.741
Median Income	-0.01	0.004***
Population Density	-1.58	.653**
Right-to-Carry	-197.1	47.396***
Gun Restrictions	-109.48	26.149***

The R-Squared adjusted value of 89.80% indicates that the model is a good predictor of violent crime. P-values for median income, Right-to-Carry, and Gun Regulations indicate they are statistically significant regressors. Of the significant regressors, median income accounts for 1% of the reduction in violent while Gun Restrictions and Right-to-Carry account for 36% and 64% respectively.

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[4] Concealed handgun license rates were calculated using license issuance and revocation information from the Ohio Attorney General's Annual Concealed Handgun License Reports (Ohio Attorney General, 2014) and population data from the Federal Bureau of Investigation Uniform Crime Reports (Federal Bureau of Investigation, 2014).

This analysis suggests that gun policy decisions impact violent crime more than the other regression factors considered and that Right-to-Carry laws may be more effective crime reducing policies than the Assault Weapons Ban and Brady Bill mandated background checks combined.

3.2 Gun Policy Decisions versus Concealed Handgun Licensure Rates

An analysis of data was performed to understand the impact of right-to-carry compared to the impact of the prevalence of concealed handgun licensees on total violent crime. Since the two variables are related, separate regression analyses were performed utilizing the previous right-to-carry regressor and concealed handgun license rate per 100,000 residents to understand the difference, if any, on the impact of total violent crime. The outputs of the regressions are as follows:

Table 2 – Regression Comparing Policy and Prevalence of Licenses on Violent Crime Rate				
R-Squared Adjusted	89.80%		84.91%	
Term	Coefficient	Standard Error	Coefficient	Standard Error
Constant	1537.22	232.01	2133.55	245.003
Unemployment Rate	10.9	6.741	23.916	7.148***
Median Income	-0.01	0.004***	-0.029	0.003***
Population Density	-1.58	.653**	-1.327	0.788
Right-to-Carry	-197.1	47.396***		
Gun Restrictions	-109.48	26.149***		
CHL Rate			-0.134	0.021***

Both models are good predictors of total violent crime. However, the impact on the constant coefficient is significantly different. This suggests that gun policy decisions are more effective at reducing crime than the prevalence of concealed handgun licensees.

3.3 The Impact on Crime in Rural and Metropolitan Areas

An analysis of data since concealed carry was first enacted in 2004 was performed to understand the impact right-to-carry laws had on violent crime in Ohio's rural versus metropolitan areas[5] over time. Crime rates for these analyses was scaled to 2004 rates. Previous gun policy regressors were utilized. The outputs of the regression is as follows:

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[5] County level violent crime data for metropolitan statistical areas as defined by the Census Bureau (U.S. Department of Commerce, 2013) was combined into one set of data points and the remaining counties were treated as rural for another set of data points for each regression. Unemployment and median income data at the county level was not available for the conduct of this study.

Table 3 – Comparative Regressions on Crime Rates in Rural vs Metropolitan Areas				
	Metropolitan Areas		Rural Areas	
R-Squared Adjusted	63.18%		13.59%	
Term	Coefficient	Standard Error	Coefficient	Standard Error
Constant	1.612	0.267	0.892	0.218
Right-to-Carry	-0.670	0.194**	-0.227	0.158
Gun Restrictions	-0.194	0.287	0.019	0.234

The results of the analysis found is no statistically significant relationship between gun policy and violent crime in rural areas. It did find a statistically significant a relationship between gun policy and violent crime in metropolitan areas. This suggests that gun policy decisions impact violent crime in metropolitan areas more than in rural areas.

3.4 Individual Crime Segment Impact

An analysis of data was performed to understand the impact right-to-carry laws had on murder, rape, robbery, and aggravated assault in Ohio over time. Crime rates for these analyses was scaled to 2004 rates. Previous gun policy regressors were utilized.

The following models discussed in this section suggest that rape and robbery are significantly impacted more than aggravated assault and murder.

3.4.1 The Impact on Murder

A regression was performed to understand the impact of gun policy decisions on murder rate. The following results were obtained:

Table 4 – Ohio Murder Rate Regression		
R-Squared Adjusted = 75.06%		
Term	Coefficient	Standard Error
Constant	1.775	0.639
Unemployment Rate	-0.002	0.019
Median Income	-0.00001	0.00001
Population Density	-0.0001	0.002
Right-to-Carry	-0.313	0.313**
Gun Restrictions	-0.284	0.072***

The R-Squared adjusted value of 75.06% indicates that the model is a good predictor of murder rate. P-values for Right-to-Carry and Gun Regulations indicate they are statistically significant regressors. Of the significant regressors, Restrictions and Right-to-Carry account for 16% and 17.6% in murder rate respectively.

This analysis suggests that gun policy decisions impact murder rate more than the other regression factors considered and that right-to-carry is likely no less or more significant in the reduction of murder rate than gun regulations.

3.4.2 The Impact on Aggravated Assault

A regression was performed to understand the impact of gun policy decisions on aggravated assault rate. The following results were obtained:

Table 5 – Ohio Aggravated Assault Rate Regression		
R-Squared Adjusted = 86.89%		
Term	Coefficient	Standard Error
Constant	3.97	0.614
Unemployment Rate	0.026	0.018
Median Income	-0.00004	0.000001*
Population Density	-0.005	0.002**
Right-to-Carry	-0.435	0.125***
Gun Restrictions	-0.185	0.069**

The R-Squared adjusted value of 86.89% indicates that the model is a good predictor of aggravated assault rate. P-values for Median Income, Population Density, Right-to-Carry, and Gun Regulations indicate they are statistically significant regressors. Of the significant regressors, median income accounts and population density account for a negligent reduction in aggravated assault rate while gun restrictions and right-to-carry account for 4.7% and 11% in aggravated assault rate respectively.

This analysis suggests that gun policy decisions impact aggravated assault rate more than other regressors considered and that right-to-carry is marginally more effective than gun restrictions at reducing aggravated assault rate.

3.4.3 The Impact on Robbery

A regression was performed to understand the impact of gun policy decisions on robbery. The following results were obtained:

Table 6 – Ohio Robbery Rate Regression		
R-Squared Adjusted = 71.04%		
Term	Coefficient	Squared Error
Constant	1.954	0.588
Unemployment Rate	0.020	0.017
Median Income	-0.00001	0.00001
Population Density	-0.002	.0002
Right-to-Carry	-0.283	0.120**
Gun Restrictions	-0.187	0.066**

The R-Squared adjusted value of 71.04% indicates that the model is a good predictor of robbery rate. P-values for Right-to-Carry and Gun Regulations indicate they are statistically significant regressors. Of the significant regressors, gun restrictions and right-to-carry account for 9.6% and 14.5% in robbery rate respectively.

This analysis suggests that gun policy decisions impact robbery rate more than other regressors considered and that right-to-carry is marginally more effective than gun restrictions at reducing aggravated assault rate.

3.4.4 The Impact on Rape

A regression was performed to understand the impact of gun policy decisions on rape rate. The following results were obtained:

Table 7 – Ohio Rape Rate Regression		
R-Squared Adjusted = 87.99%		
Term	Coefficient	Squared Error
Constant	1.549	0.368
Unemployment Rate	0.008	0.011
Median Income	-0.00001	.000006
Population Density	-0.001	0.001
Right-to-Carry	-0.313	0.075***
Gun Restrictions	-0.180	0.041***

The R-Squared adjusted value of 87.99% indicates that the model is a good predictor of rape rate. P-values for Right-to-Carry and Gun Regulations indicate they are statistically significant regressors. Of the significant regressors, gun restrictions and right-to-carry account for 11.62% and 20.2% in rape rate respectively.

This analysis suggests that gun policy decisions impact rape rate more than other regressors considered and that right-to-carry is significantly more effective than gun restrictions at reducing rape rate.

3.5   Analysis of the Impact on Criminal Behavior

A time series plot of total theft, violent theft (robbery), and non-violent theft (burglary) shows that both violent and non-violent theft move in similar trends over time until the passage of Castle Doctrine and Pre-Emption. Castle Doctrine removed the duty to retreat, but more importantly, Pre-Emption created uniformity across the state with respect to right-to-carry. The relevant data was regressed to explore the possibility that a relationship exists between gun policies and modality of property-related crime.
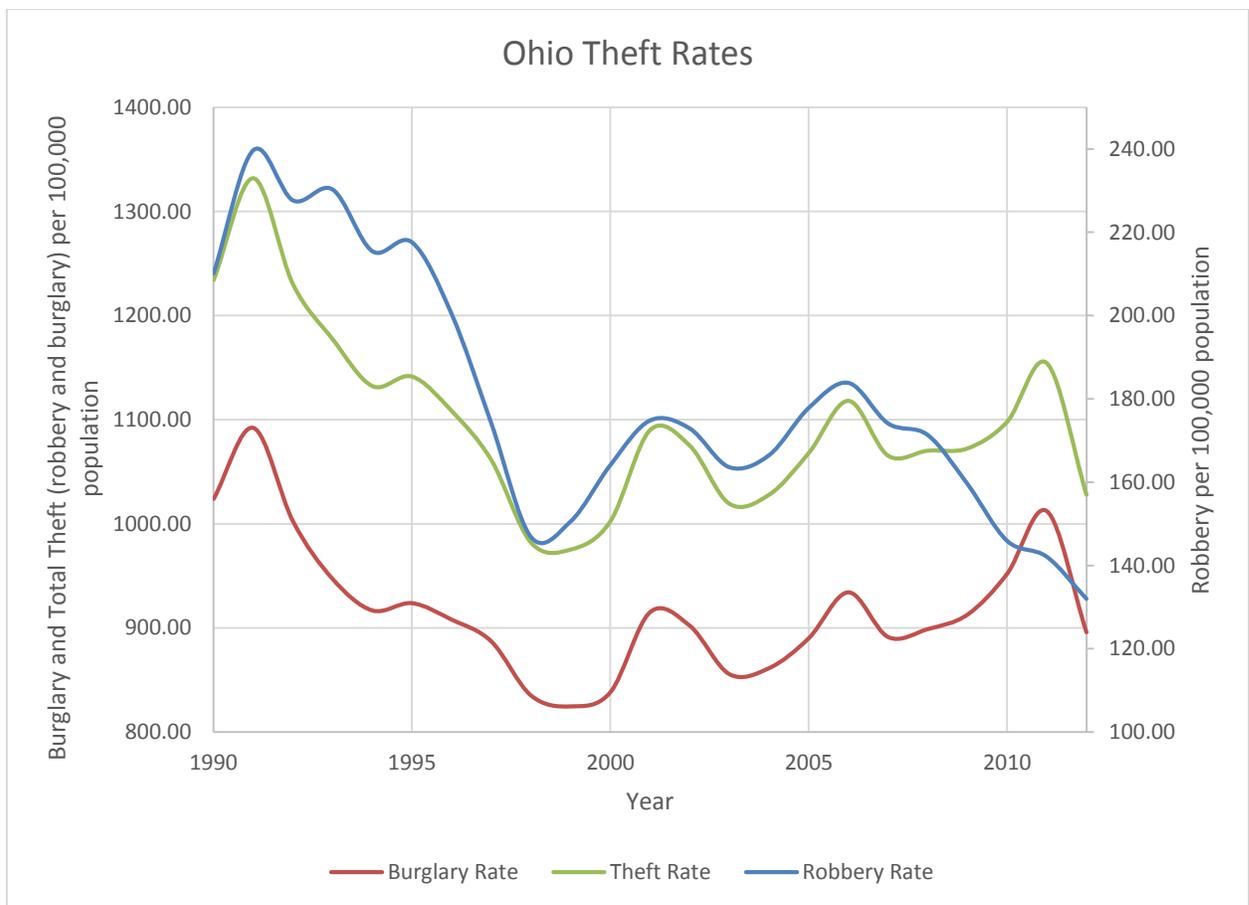

Figure 2 – combined Ohio theft rates over time

Three time periods were considered to determine if a shift in policy caused the modality change; the entire period data is available (1990 – 2012), the period of time before Ohio's right-to-carry law was enacted (1990 – 2004), and the period of time after Ohio's right-to-carry was enacted (2004 – 2012). The rate of robbery (violent theft) was divided by burglary (non-violent theft) to establish a new rate for analysis. The idea is that is one rate increases or decreases more than the other or they diverge, a

regression will provide insight on modality of crime. This insight may help then help provide understanding of criminal behavior.

Regression analyses performed on the robbery/burglary ratio with all previously used regressors suggested no statistically significant relationship existed. The regressions were performed with gun policy decisions only as input variables to examine a relationship with the robbery/burglary ratio. The following results were obtained:

Table 8 – Robbery/Burglary Rates Ratio Regression						
	1990-2012		1990-2004		2004-2012	
R-Squared Adjusted	62.16%		35.06%		80.70%	
Term	Coefficient	Squared Error	Coefficient	Squared Error	Coefficient	Squared Error
Constant	0.228	0.008	0.226	0.008	0.228	
Right-to-Carry	-0.057	0.010***			-0.084	0.014***
Gun Restrictions	-0.028	0.009***	-0.028	0.001***	-0.038	0.028

Each model is a good predictor of violent crime. However, the regressions where the right-to-carry regressor is present have higher R-Squared Adjusted values. The regression on the data since the passage of right-to-carry found no statistical significant relationship between gun restrictions and the ratio. It did find a significance in the inverse relationship between right-to-carry laws in both regressions including data where a such a law was in place. A graph of theft crime rates in Ohio show that since passage or Ohio's right to carry law combined theft rate has not appreciably changed, that burglary has increased slightly, and that robbery has decreased markedly.

4   DISCUSSION & CONCLUSION

Gun Rights Restoration accounts for 64% of the reduction in total violent crime while Gun Regulation Strengthening accounts for 36% suggesting that restoring the right-to-carry a concealed handgun may be a more effective crime reducing policy than both the Assault Weapons Ban and Brady Bill mandated background checks combined.

The analysis used to develop these models did not correct for the large decrease in crime observed from 1991 to 1999. Since crime was decreasing before and after passage of the Brady Bill and Assault Weapons Ban, one can not necessarily attribute a decrease in crime solely to those policy decisions. In fact Congress allowed the Assault Weapons Ban to expire due to such a small impact on the crimes committed by the guns that the ban affected (Koper, Roth, & Woods, 2004). Some theories suggest that other factors played a significant role in the reduction of crime during this time including D'Amico's that the voluntary decline in cocaine use among youths was of significant impact (D'Amico, 2014). Indeed if there were some correction for other factors gun restrictions would play a less significant role in the reduction of violent crime. Likewise, several other factors were at play in the reduction of crime post assault weapons ban that is otherwise being attributed to the decline in crime. For this reason omitted bias is likely not a factor in the perceived strength of gun policy decisions either restrictive or permissive.

In addition to suggesting that right-to-carry laws are more effective crime reducing policies than gun restrictions, the models developed in this study also suggest that:

- gun policy decisions impact violent crime more than the prevalence of licensees and
- right-to-carry laws reduce rape rate significantly more than other segments of violent crime.

An old gun-rights adage states "God made man and woman. Samuel Colt made them equal." The models developed in this study suggest right-to-carry laws impact rape more than any other segment of violent crime suggesting that adage may be valid. More research in this area is warranted to understand if women realize more benefit than men from the deterrence right-to-carry laws offer.

The models in this study also suggest a shift in modality of crime and that passage of right-to-carry resulted in a change in criminal behavior. While the prevalence of property-related crime did not significantly change with passage of right-to-carry, the rate of violent theft decreased with respect to the rate of non-violent theft. In fact, the two rates diverge slightly. This shift in modality of property-related theft suggests a risk-benefit analysis response to the potentiality of an armed victim.

The suggested risk-benefit analysis performed by criminals is this study's significant contribution to existing literature on the subject of gun policy's impact on crime.

ACKNOWLEDGMENTS

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