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FEDERAL GUN CONTROL REGULATION AND ITS EFFECT ON FIREARM HOMICIDE

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ABSTRACT

This paper's purpose is to explore whether gun control policy put in place by the government has any effect on the rates of homicide by firearm. Looking at homicide data across four countries--the United States, the United Kingdom, Australia, and Canada--and adding in trend, counter, and legislation dummy variables to account for the passage and enforcement of gun control laws, an interrupted time-series analysis model will be employed. The model found mixed results, but it appears that gun control legislation does, in at least some cases, have an effect on the rate of homicides by firearm.

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Chapter 1

Federal Gun Control Legislation and its Effect on Firearm Homicide

With the string of highly publicized mass shootings occurring in 2012, gun control and regulation has once again become among the most hotly debated political issues. The history of gun and fire arms regulation in the United States has been fraught with controversy and has often resulted in disappointment for those on both sides of the issue. The federal government has been involved in the issue of gun control and regulation since the Bill of Rights was ratified in 1791. The Second Amendment guarantees, "…the right of the people to keep and bear Arms, shall not be infringed" (Bill of Rights). Many question if the meaning of this statement has changed in the 222 years since the amendment was written. And, if the meaning has changed, is there anything the government can do?

In spite of the strong feelings on both sides of the aisle regarding the regulation of guns by the federal government, we can point to several laws attempting to impose regulations in the United States. The Gun Control Act of 1968 and the Brady Hand Gun Violence Prevention Act of 1993 are two such instances of government regulation of the firearms industry and the rights of the American people. A multiple interrupted time-series analysis will seek to understand whether regulations such as these have any effect on gun violence and specifically homicide by firearm in the United States and whether similar legislation has any effect in other nations.

"Since 1982, there have been at least 62 mass shootings across the country, with the killings unfolding in 30 states from Massachusetts to Hawaii. Twenty-five of these mass shootings have occurred since 2006, and seven of them took place in 2012" (Follman et al). These recent shootings lead one to believe that gun violence must be on the rise in the United States.

That is, however, not the case. Gun violence has been at a steady decline in the United States since the late 1970s with a period of increased violence in the late 1980s to the mid 1990s, though it remains the developed nation with by far the most gun violence incidences. It is true, however, that amass shooting often bring about the impetus for change in attitudes about gun control in a society. The United Kingdom and Australia, for example, both implemented their current gun control laws after public opinion shifted in favor of harsher controls after highly publicized mass shooting incidences (Mika).

The question raised by the changing trends and varying degrees of gun violence is: why does gun violence vary over time? A tentative answer is that it depends on the legal availability of firearms at the time of the recorded shootings. If this is the case, then incidences of gun violence should vary in accordance to the strength of government regulation. Focusing on homicide by firearm, different explanations will be explored.

The Gun Control Act of 1968 is the first instance of what we consider modern gun control legislation in the United States. It requires a license for gun dealers, manufacturers and importers as well as establishing a minimum age to purchase guns and prohibiting the possession of firearms by certain persons, such as convicted felons. This law was passed in reaction to the assassinations of John F. Kennedy and Martin Luther King Jr. It is the basis of Federal firearm legislation in the United States and most other legislation is codified as amendments to the Gun Control Act (Princeton University). The second major legislation from the United States, the one that will be examined most closely in this paper is the Brady Handgun Violence Prevention Act in conjunction with the Violent Crime Control and Law Enforcement Act of 1994. The Brady Act required background checks for handgun purchases and allowed for a maximum five-day waiting period to conduct them. It also increased the cost of obtaining a federal firearms license. The mandatory background check was later declared unconstitutional, though most states continued voluntarily. In 1998 the waiting period was replaced by a national instant background check

system. The 1994 Violent Crime Control and Law Enforcement Act included a minimum age for the purchase and possession of handguns and their ammunition and prohibited the manufacture, transfer, and possession of semi-automatic assault weapons that were not lawfully possessed prior to 1994. The semi-automatic assault weapons ban was a ten-year long ban that expired in 2004 (Princeton University). I expect the data to reflect that these laws inhibited the illegal purchase of firearms and thus cut down on the rates of firearm homicide. In the case of the assault weapon ban expiring, I would expect to see an increase in the amount of firearm homicides after 2004 in the United States.

A review of the current literature on the topic and some commonly accepted explanations for the changing trends in gun violence will be followed by an examination of the theory that legislation affects gun violence levels. Finally, the theory presented will be analyzed along with other possible solutions. In addition to the analysis of gun control legislation and firearm homicide rates in the United States, the levels of gun violence and the effectiveness of gun control legislation in Australia, the United Kingdom, and Canada will be included in this paper, along with a time-series regression model for each of the countries. Examining these reasonably similar cases will help us to determine if gun control legislation is always, sometimes, or never effective at stemming homicide rates.

Chapter 2

Literature Review

In regards to the effects of gun control legislation on levels of homicide by firearm, there is much literature in various veins of research. There appears to be a few different subsets of research and articles relating to the question being explored. A significant subset focuses on how to improve gun control legislation especially in regards to the "secondary firearm market" (Braga et al. 2002). Another set discusses the implementation and possible effects of laws such as the Gun Control Act of 1968 and the 1993 Brady Bill. Finally, there exists a subset that examines firearm availability and homicide rates. This subset is the most applicable to the questions explored in this paper, but none use the same methods and data regarding firearm homicide.

Many papers bring up the gun control debate and how both sides feel about and argue the issue. *Firearms and Federal Law: The Gun Control Act of 1968* posits that the presentation of data on the success or failure of gun control laws will not change the minds of those who feel strongly one way or the other about the issue, because each will see the data presented as evidence for their side (Zimring 1975). Opponents of progressive legislation such as gun control laws tend to bring up three types of points to make their case, which Hirschman refers to as "perversity, futility and jeopardy". This means that they argue the legislation will have the opposite effect of that intended, that it will have no effect at all, or that it is an affront to personal freedoms (Cook 1996).

Regardless of the apparent stalemate between gun control supporters and gun advocates, it has been shown that a Laissez Faire approach to gun laws and regulations does not work and the majority of Americans favor moderate government regulation of firearms (Cook 1996). If this

is the case, why is there such a debate over gun control, and what type of regulations do the data support?

There is certain interest in whether federal gun control legislation can be effective if it only takes on the supply side of the issue. Braga et al agree that this approach is futile if one accepts the common notion that "guns are everywhere" (2002). They then argue, however, that the data does not support this idea. They cite reports that 75 percent of robbers did not use guns and that only one third of teenage gang members in New York owned a gun. In citing these statistics they find that it would be effective to curb the supply of guns to increase the "effective price" of obtaining and holding on to a gun. Cook, Molliconi, and Cole come to similar conclusions in their research. Most guns used in crimes were acquired relatively recently. To create effective gun control, both primary and secondary markets will have to be regulated especially in relation to gun transfers. In *Aiming for Evidence-Based Gun Policy* it is proposed that existing ideas of gun control policy will never be as effective as is necessary to lower our rates to those of Western Europe's because there is simply a cultural divide (Cook 2006). This cultural divide will be explored later in the Analysis section of this paper.

In examining the effects of the two aforementioned major gun control laws in the United States, the Brady Act and the Gun Control Act of 1968 are examined and both strengths and weaknesses are considered. There are arguments that the Brady Act is not effective at regulating the secondary market and thus cannot be a fully effective law. Jacobs and Potter argue that it is ineffective because of the potential for the use of a straw man for purchases, no fingerprints required, and that certain mental health records are sealed to background checks (1995). DeFrances and Smith, also take a look at the Brady Act, but find that it has been at least somewhat effective in preventing criminals from purchasing firearms and has had a significant impact on criminal history information sharing (1994). Zimring makes the point, when discussing the Gun Control Act of 1968, that the role of guns in 1975 is indisputably larger than that of

1968. He claims that the fact that homicides by firearm increased three times more than other homicides denotes a cultural phenomenon. He is also the first of the literature discussed in this paper to make the argument that it is difficult to measure and use gun scarcity as a factor in experimental design. In this case, he argues that guns have not become scarce (1975).

This issue of measuring gun availability becomes the crux of many articles hoping to find a link between regulation, the availability of guns, and gun violence. McDowall uses time-series data and the density of firearms in Detroit to conclude that the effect of this availability on homicides is relatively large. It too points to the difficulties in measuring gun availability and used the proportion of robberies and suicides committed with a gun to assess density in the city. These indicators are very interesting as the article does not focus on legislation, but uses practical measures to devise density of firearms in Detroit. Cook deals with similar difficulties in his assessment of *The Influence of Gun Availability on Violent Crime Patterns*. He presents a variety of evidence and comes to the conclusion that the "widespread availability of firearms contributes to the criminal homicide rate and influences violent crime patterns" in other ways as well. The use of interrupted time series data and a dummy variable for when legislation goes into effect will help to simplify some of the difficulties caused by trying to define and measure the availability of firearms directly.

To better understand the role gun control plays in each of the countries examined, a table including some of the main features of the current gun control legislation in these countries is included on the next two pages [*Table1-1*].

Table 1-1: Comparing Current Gun Control Laws Across Selected Nations		
	Australia	**Canada**
Current Legislation Categorized as	Restrictive	Restrictive
Right to Private Firearm Ownership	Not guaranteed by law	Not guaranteed by law
Regulation of Automatic Assault Weapons	Prohibited	Prohibited, except those registered before 1978
Regulation of Semi-Automatic Assault Weapons	Prohibited	Prohibited, except those registered before 1978
Regulation of Handguns	Private possession permitted under stringent conditions	Permitted with an authorization to carry
Civilian Gun Registration	Record of acquisition, position, and transfer of each privately held mus be retained in an official register	Record of acquisition, position, and transfer of each privately held mus be retained in an official register
Regulation of Private Gun Sales	Prohibited unless conducted by licensed dealer	Private sale and transfer permitted
Genuine Reason Required for License	Personal Protection not an accepted reason	No genuine reason required
Gun Owner Background Checks	Criminal, Mental, Physical, addiction, domestic violence, residential, and other records considered	Required for both public and private sales
Firearm Safety Training	Must pass theoretical and practical training course	Must pass theoretical and practical training course
Waiting Period for Gun Possession	Minimum of 28 days for first license	Minimum of 28 days for first license
Carrying Guns in Public	Prohibited without genuine reason	Both open and concealed carrying is allowed, subject to a valid permit

Table 1-1: Comparing Current Gun Control Laws Across Selected Nations		
	United States	**United Kingdom**
Current Legislation Categorized as	Permissive	Restrictive
Right to Private Firearm Ownership	Guaranteed by law	Not guaranteed by law
Regulation of Automatic Assault Weapons	Prohibited	Prohibited
Regulation of Semi-Automatic Assault Weapons	Permitted in some jurisdictions without a license	Prohibited
Regulation of Handguns	Permitted in some jurisdictions without a license	Prohibited
Civilian Gun Registration	Record of acquisition, position, and transfer of each privately held firearm not required by law	Record of acquisition, position, and transfer of each privately held mus be retained in an official register
Regulation of Private Gun Sales	Not regulated in some jurisdictions	Private sales Prohibited
Genuine Reason Required for License	No genuine reason required	Self defense not an accepted reason
Gun Owner Background Checks	Not required for private sales; required for sales by dealer	Criminal, mental, and addiction records considered
Firearm Safety Training	Not required by law	Not required by law
Waiting Period for Gun Possession	Undetermined in some jurisdictions	Undetermined by law
Carrying Guns in Public	Both open and concealed carrying is allowed in some jurisdictions with permit and prohibited in others	Prohibited by law

(Source: gunpolicy.org; itemized sources in Appendix 1)

Chapter 3

Theory

This paper will focus on homicides committed using firearms and will seek a correlation between homicide by firearm rates and gun control legislation. Varying rates in gun violence should coincide with the legal availability of firearms at the times of the shootings. Thus, the rates of firearm homicide should depend on the legislation in effect when they are carried out. This is because most murders are committed with legally purchased firearms. If it is more difficult to legally purchase firearms, then it is less likely that an unstable individual or an individual who is angry in the moment will have access to one. Also, depending on the legislation, more deadly weapons may be made illegal, such as assault rifles and high capacity magazines. If this is the case, homicide incidences may not decrease as significantly, but the number of victims should decrease.

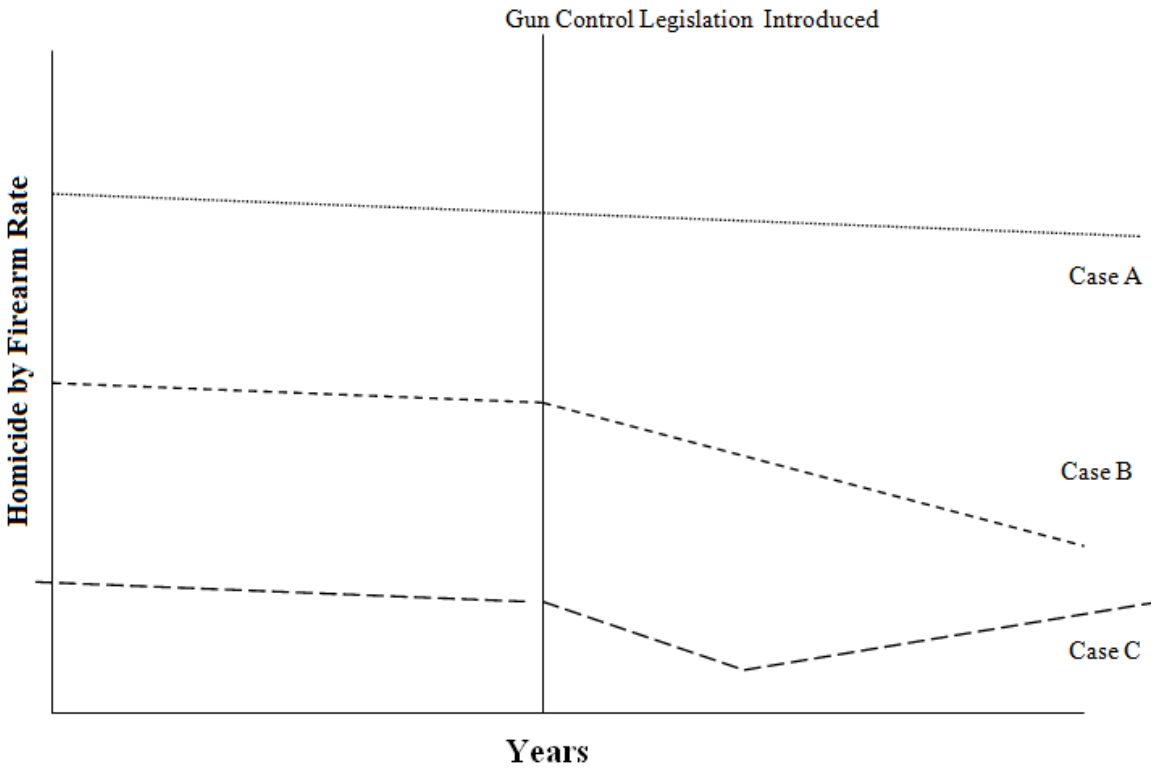
Because of this, I hypothesize that in the United States, as well as in the other cases examined, the passage of gun control legislation will decrease the number of homicides by firearm. The expiration or repeal of such legislation will, in turn, lead to an upswing in homicides. The varying levels of gun violence in the United States and other developed countries could be explained by other factors, as well. Some such factors may include overall levels of violent crime in the country, the levels of violence and attitudes towards guns in certain states and regions, and economic indicators leading to higher poverty levels in certain areas or nationwide. These possibilities will also be explored in this paper. It is certainly the case that a higher population would increase the number of incidences of homicide by firearm. Because of this, data will primarily be explored in terms of the rate of homicide by firearm per 100,000 population in the country.

This paper will control for the number of different factors in examining the data. First, gun violence and homicide by firearm will have to be examined within the framework of population. The number of households in the United States that owned guns decreased by twelve percent from 1980 to 1999, while the percentage of individuals owning guns remained relatively constant. This is more reflective of a trend in household composition than a change in gun ownership as fewer households contained an adult male in 1999 than 1980 (Braga et al 2002). Caucasians are more likely to own guns than African Americans and "rural residents are far more likely than urban residents to own firearms." The geographical pattern of gun ownership has remained fairly steady overtime with the highest levels of gun ownership reported in the south, followed by the Rocky Mountain states, the Midwest, then the Pacific States. New England consistently reports the lowest levels of gun ownership (Braga et al 2002). These trends should be reflected in the data and controlled for in an effort to get the most accurate results.

A hypothetical model of the types of relationships that we may expect to see is included on the next page. If there is no effect of the legislation, we should expect to see data similar to that shown in Case A. If this paper's hypothesis is correct, however; as gun violence is measured over time, we should expect to see a decline in the homicide by firearm rate after the passing of gun control legislation. This is reflected in the next figure as Case B. Case C indicates a short term effect of the legislation that eventually wears off.

[Figure 1-1]

Hypothetical Relationships for Gun Control Legislation over Time



Chapter 4

Background on the Countries Examined

To evaluate the impact of gun control regulations and the availability of firearms on the number of firearm homicides, a multiple interrupted time-series analysis will be employed. This is the ideal way in which to assess the impact of policy changes over time. The homicide by firearm rate will be plotted over an extended period of time for the United States, the United Kingdom (England and Wales), Australia, and Canada. The impact of gun control legislation will be assessed by determining if any statistically significant effect on the firearm homicide rate is observed after the selected gun control legislation is enforced.

The research design includes examining four socio-economically similar states--The United States, Australia, The United Kingdom, and Canada-- and recording their incidences of homicide and gun deaths. These nations have been chosen for a few different reasons. First, each is English speaking and has gained its Independence from Great Britain (except of course for the United Kingdom), and thus it can be argued that they are fairly culturally similar. Each of these nations is also included in the World Health Assembly's high income country bracket. All have relatively large populations, especially for developed English-speaking nations, though the United States' is largest by far. Each country has a stable government and political system which includes democratic representation of the people. Additionally, the birth and death rates are very stable in each of these nations, indicating no major public health concerns affecting morbidity. The table included below highlights some more similarities and differences between these nations that help to explain their inclusion in this paper.

Table 2-1: Comparing Selected Nations on Key Socioeconomic Indicators

		United States	United Kingdom	Australia	Canada
Population (Millions)	1974	213.8	56.2	13.7	22.8
	2010	309.3	62.2	22.3	34.1
UN Nominal GDP Rankings	2011	1	7	12	11
IMF GDP Per Capita Rankings	2010	6	22	13	16
World Bank GDP Per Capita (Dollars)	1980	12,179	9,622	10,198	10,933
	2010	46,611	36,256*	51,085	46,212
Percent of GDP Spent on Education	1990	5.01	4.37	4.63	6.09
	2009	5.43	5.63	5.11	5
Life Expectancy	1975	72.6	72.7	73	73.5
	2010	78.2	80.4	81.7	80.8
Military Expenditures as Percent of GDP	2000	3.05	2.39	1.89	1.14
	2010	4.83	2.57	1.97	1.47
Intentional Homicide Rate per 100,000 Population	1995	8.11	1.57	1.8	2.01
	2009	5	1.2	1.2	1.8

*Marked decline from $46,330 in 2007

(Source: World Development Indicators, The World Bank)

You can see from the table that very much is consistent between these countries including economic and health information. There are, however some differences that should be addressed. The United States is a much larger country and is currently much more demographically and ethnically diverse, though each of these countries is moving in that direction. In addition, to draw attention to the final two categories in the table, it is clear that the United States currently spends a significantly higher percentage of the GDP on Military Expenditures and that the Intentional Homicide Rate is also much higher. There are, of course, multiple explanations for this, but a leading one is that the United States has a more violent and gun-friendly culture. The United States is the only of the nations chosen that guarantees the right of citizens to own guns in its

constitution and guns are much more widespread and readily available. It has been argued on numerous occasions that this “gun culture” can be traced back to the revolutionary founding of the United States, the frontier experience of the Wild West, and the violent history of slavery in the American South (Lane 1999).

Chapter 5

Research Design and Analysis

The passage of gun control legislation will be coded as a 1 for all years in which the selected law is being enforced. This same dummy variable will be coded as a 0 for the years in which the selected legislation has not passed, is not enforced, or has expired. This is ideal because the dummy variable can be turned on and off as different gun laws are passed. Then, in looking at the effects of gun control legislation, we will determine whether government intervention and regulation of the sale and ownership of guns has any statistically significant effect on rates of mass murders and gun-related deaths. This will also be helpful in identifying the effects of different gun control legislation. Different regression models can be run which code the dummy variable for different features of legislation—assault weapon bans and national gun registries, for example. Additionally, it will be important to note differences in the substance of the gun control legislation examined. As the intended effects and policies imposed by the different cases of legislation varies, so should the effect on the data.

Data regarding homicide rates and homicide by firearm obtained from the Australian Bureau of Statistics, the Canadian Socio-economic Information Management System, United Nations Office on Drugs and Crime, United States' Bureau of Justice Statistics, and the United Kingdom Home Office will be analyzed. There are some limitations to this data that should be discussed. First it is important to note that in many cases, laws precede the centralized collection of data. For this reason, many different sources have been consulted and have been verified as best as possible. It is also for this reason that some data on homicide by firearm does not exist until the late 1990s. These limitations will be addressed in the conclusion where they are relevant.

Thus, detailed consideration of the data should be able to give us some insight into the effects of gun control legislation. Annual figures on homicides by firearm, y, will be plotted over an extended number of years from 1974 through 2010 for each year in which the data is available. The research and regression will attempt to determine it the observations made in this time series have been affected by gun control legislation. To informally assess the Brady Handgun Violence Prevention Act, for example we can look for a shift in the number of homicides committed by firearm after the law was implemented in 1993. We would expect the United States rates to decline with the implementation of this act, while the rates in other countries should remain relatively constant and fluctuate in accordance to their own gun control laws. Formally, though, it is important to worry about whether any observed change in the rate is statistically significant.

Correct estimation of the following regression equation will allow us to evaluate this interrupted time-series design.

$$y=a+b_1 x_1+b_2 x_2+b_3 x_3$$

Where Y represents the number of homicides by firearm; while x_1 is a dichotomous, or dummy variable, scored 0 for observations before gun control legislation takes effect (or in the case that it expires), and coded 1for years in which gun control legislation is enforced. x_2 represents a counter for years, from 1 to *n*, the number of observations for each country and serves as a control for other trends that could be effecting the data, such as growth in population. x_3 is another counter of years, scored 0 for observations before gun control legislation takes effect and scored 1, 2, 3… for observations after the law is enforced. b_1, b_2, b_3 are the parameters to be estimated. The parameters *a* and b_1, respectively, indicate the intercept and slope of the time-series prior to the implementation of the specific gun control legislation being examined. To evaluate whether *a* and b_1 were altered by this new gun control legislation, we must examine b_2 and b_3. If the estimate for b_2 is not significantly different than zero, the inference is that the legislation had no effect on the slope of the time-series.

Table 3-1: Determining Factors of the Homicide by Firearm Rate per 100,000 Population for 4 Countries, results from an OLS Regression

	Dependent Variable 1: Homicide by Firearm Rate per 100,000 population									
Ind. Variable	United States		Canada		Australia		United Kingdom		Combined 1	
Gun Control Legislation in Effect (Dummy)	-0.73	***	0.112	**	0.07		--		-0.37	*
	0.26		*0.06*		*0.07*				*0.24*	
	2.81		*1.75*		*1.03*				*1.55*	
How long Gun Control Legislation has been in Effect (Counter)	-0.25	***	0.02	***	0.01		-0.002	*	-0.15	***
	0.05		*0.01*		*0.01*		*0.00*		*0.03*	
	4.63		*2.94*		*0.88*		*1.43*		*5.35*	
Trend Variable	0.07	**	-0.03	***	-0.04	***	--		0.10	***
	0.04		*0.00*		*0.01*				*0.02*	
	1.99		*6.72*		*2.85*				*5.46*	
United States	--		--		--		--		3.85	***
									0.22	
									17.49	
Canada	--		--		--		--		0.95	***
									0.23	
									4.13	
Australia	--		--		--		--		--	
United Kingdom	--		--		--		--		0.43	**
									0.24	
									1.77	
Constant	4.64		1.20		1.16		0.147		-1.07	
R-Squared	0.7499		0.8150		0.8089		0.1564		0.7684	
Number of Observations	31		37		23		13		148	

Coefficients are standardized withStandard Errors shown in italics below, with t-values listed below that
Analyzed using a One-Tailed Test
*=p<0.10, **=p<0.05, ***=p<0.01

[Sources: World Bank, Statistics Canada, Australian Bureau of Statistics, UN World Population Prospects, U.S. Census Bureau, U.S. Department of Justice, United Nations office on Drugs and Crime, UK Historical Crime Data]

Table 3-1, above, shows results from an OLS regression analysis of the data and describes possible determining factors of the homicide by firearm rate per 100,000 population for

the four countries examined-- the United States, Canada, Australia, and the United Kingdom-- and the Combined 1 model, which aggregates each individual country's data to analyze the general results of gun control regulation across multiple examples. The independent variables examined are Gun Control Legislation in Effect, a dummy variable that is coded 1 if gun control legislation exists and 0 if it does not. The next is a counter variable that determines the effect of gun control legislation over the years after its passage; coded zero before passage, one in its first year, and subsequently counts up for each following year. The third is a trend variable simply counting the observations over time for each country. This variable should control for any other trends happening in the data over time, not attributable to gun control legislation. Each country was also coded for as a control variable, simply so that in the combined model, variance between the countries could be taken into account. There are a few omitted results in the United Kingdom and Australia data due to a lack of available observations for regression.

The data in the first model, showing the United States, finds that if all independent variables were to equal zero, we could expect a firearm homicide rate of 4.64 per 100,000 population. The dummy variable denoting whether gun control legislation has an effect shows a statistically significant coefficient of -0.73, meaning there is a -0.73 unit change in the rate of firearm homicides in the United States when gun control legislation is in effect. As gun control remains in effect, as denoted by the counter variable, there is a -.25 unit change on the homicide by firearm rate. This result is also statistically significant. Both of these results support the hypothesis that gun control legislation reduces the rate of homicides by firearm.

The trend variable, controlling for other trends over time in the United States that may have an effect on homicide by firearm rates, shows a 0.07 unit change for each year that passes. This result is statistically significant and could denote a trend towards increasing violence and population over time that is slightly mitigated by the existence of gun control legislation. The R^2

value for this model as a whole indicates that all of the independent variables explored account for 74.99 percent of the variance of the homicide by firearm rate in the United States.

The data in the second model, showing Canada, finds that if all independent variables were to equal zero, we could expect a firearm homicide rate of 1.20 per 100,000 population. The dummy variable denoting whether gun control legislation has an effect shows a statistically significant coefficient of 0.112, meaning there is a 0.112 unit change in the rate of firearm homicides in the Canada when gun control legislation is in effect. As gun control remains in effect, as denoted by the counter variable, there is a .02 unit change on the homicide by firearm rate. This result is also statistically significant. The trend variable, controlling for other trends over time in Canada that may have an effect on homicide by firearm rates, shows a -0.03 unit change for each year that passes. This result is statistically significant and could denote a trend towards decreasing overall violence over time, while the small but positive effects in the first two variables could indicate a slight increase in the use of firearms in Canada. The R^2 value for this model as a whole indicates that all of the independent variables explored account for 81.50 percent of the variance of the homicide by firearm rate in Canada.

The data in the third model, showing Australia, finds that if all independent variables were to equal zero, we could expect a firearm homicide rate of 1.16 per 100,000 population. The dummy variable denoting whether gun control legislation has an effect shows a statistically insignificant coefficient of 0.07. As gun control remains in effect, as denoted by the counter variable, there is a .01 unit change on the homicide by firearm rate. This result is also statistically insignificant. The trend variable, controlling for other trends over time in Australia that may have an effect on homicide by firearm rates, shows a -0.04 unit change for each year that passes. This result is statistically significant and could denote a trend towards decreasing overall violence over time, an example similar to Canada above. The R^2 value for this model as a whole indicates that

all of the independent variables explored account for 80.89 percent of the variance of the homicide by firearm rate in Australia.

The data in the fourth model, showing the United Kingdom, finds that if all independent variables were equal to zero, we could expect a firearm homicide rate of 0.147 per 100,000 population. Given high colinearity the regression model could not simultaneously include the trend variable and the legislation dummy variable. The homicide data does not actually exist prior to the implementation of the gun control legislation used for the dummy and counter variables, which was implemented in 1989. This certainly accounts for why regression results could not be calculated. As gun control remains in effect, denoted by the counter variable, there is a -0.002 unit change on the homicide by firearm rate. This result is statistically significant. The R^2 value for this model as a whole indicates that all of the independent variables explored account for 15.64 percent of the variance of the homicide by firearm rate in the United Kingdom. The lack of sufficient observations, especially none dating before 1995, makes it difficult to get accurate results from a regression of this type.

The data in the fourth model, showing data from the four countries combined, finds that if all independent variables were to equal zero, we could expect a firearm homicide rate of -1.07 per 100,000 population. The dummy variable denoting whether gun control legislation has an effect shows a statistically significant coefficient of -0.37, meaning there is a 0.37 decrease in the rate of firearm homicides in these countries when gun control legislation is in effect. As gun control remains in effect, as denoted by the counter variable, there is a -0.15 unit change on the homicide by firearm rate. This result is statistically significant. The trend variable, controlling for other trends over time in these countries that may have an effect on homicide by firearm rates, shows a 0.10 unit change for each year that passes. This result is statistically significant.

Additional independent variables examined in this model include dummy variables coded so that each country's unique intercepts can be compared to the reference case of the combined

model. A 3.85 unit increase in the homicide by firearm rate is present when the United States is the country in question. This result is statistically significant. A 0.95 unit increase in the homicide by firearm rate is present when Canada is the country in question. This result is statistically significant. Australia's results were omitted from the table due to a lack of observations. A 0.43 unit increase in the homicide by firearm rate is present when the United Kingdom is the country in question. This result is also statistically significant. The R^2 value for this model as a whole indicates that all of the independent variables explored account for 76.84 percent of the variance of the homicide by firearm rate in these four countries.

Chapter 6

Conclusion

As we can see from Figure 2-1 on the following page, a scatter plot demonstrating the actual homicide by firearm rates for four countries compared to predicted rates using the data, is included. There are a few important things to note about this graph. First, at a glance, the data seems to fit fairly well with the predictions. We do see a sizable gap in some of the United States data where the independent variables were not able to accurately predict the extreme rises and falls in the homicide by firearm rate. This is potentially because the late 1980s to 1990s were an extremely tumultuous time in the United States as far as gun violence and homicide levels go. Second, we not the extreme gap between the United States and the three other countries examined. Certainly, as we're looking at rate of homicides, there is something going on besides the population disparities. I would attribute this gap to the "gun culture" of the United States discussed previously in this paper. Third, it is important to note that only Canada has observations starting in 1974. The United States, Australia, and the United Kingdom begin in 1980, 1990, and 1995 respectively.

Following Figure 2-1, Figure 3-1 shows the same data separated by country and also varies the scale of the homicide by firearm rate to best match the data. This gives a closer look at how the actual data match the values predicted in the linear regression. Using these case-specific scales show that the predicted values are not as close to the actual values as the combined figure [Figure 2-1] would have led us to believe.

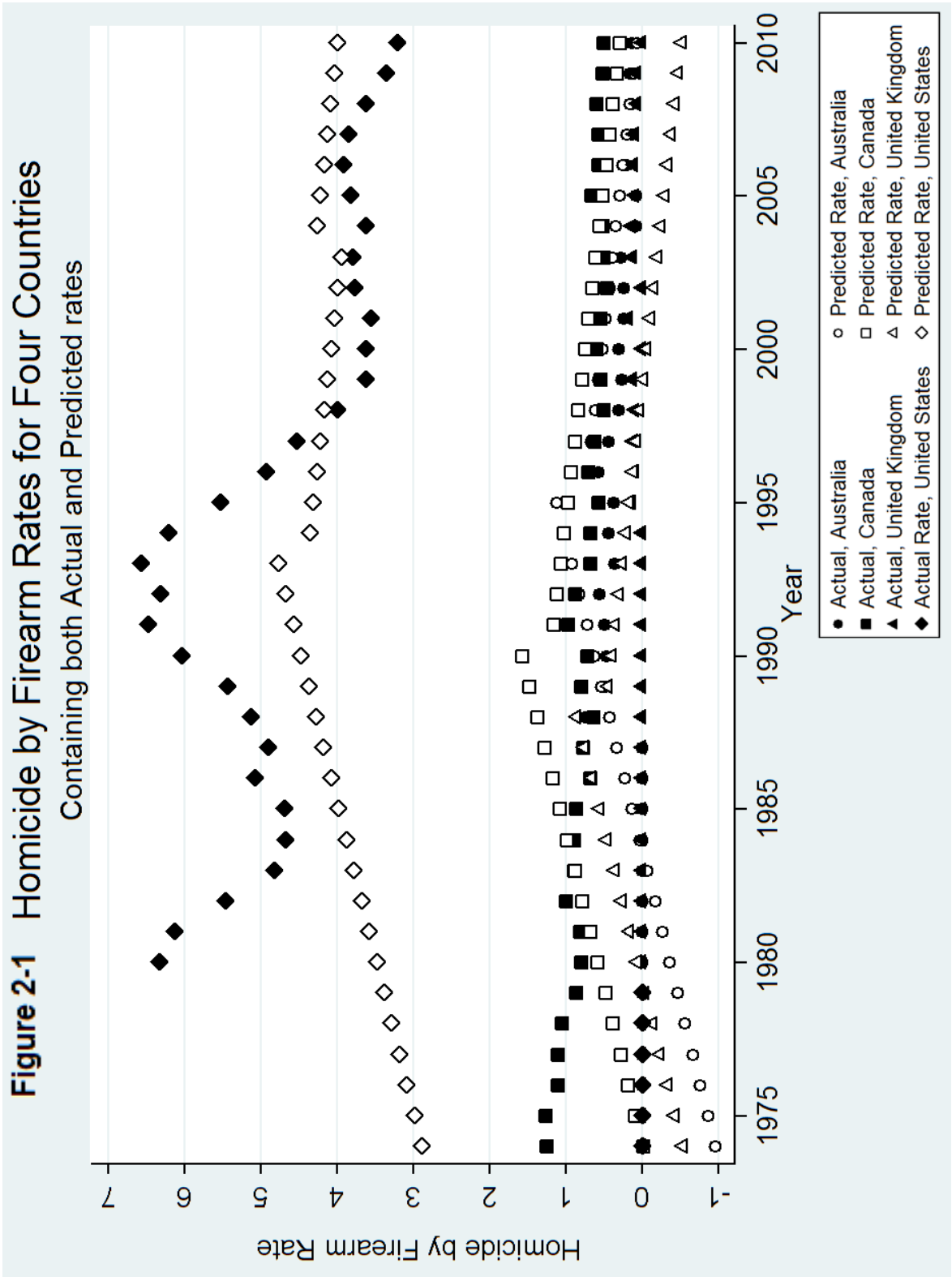


Figure 2-1 Homicide by Firearm Rates for Four Countries
Containing both Actual and Predicted rates
Homicide by Firearm Rate
-1
0
1
2
3
4
5
6
7
1975
1980
1985
1990
1995
2000
2005
2010
Year
Actual, Australia
Predicted Rate, Australia
Actual, Canada
Predicted Rate, Canada
Actual, United Kingdom
Predicted Rate, United Kingdom
Actual Rate, United States
Predicted Rate, United States

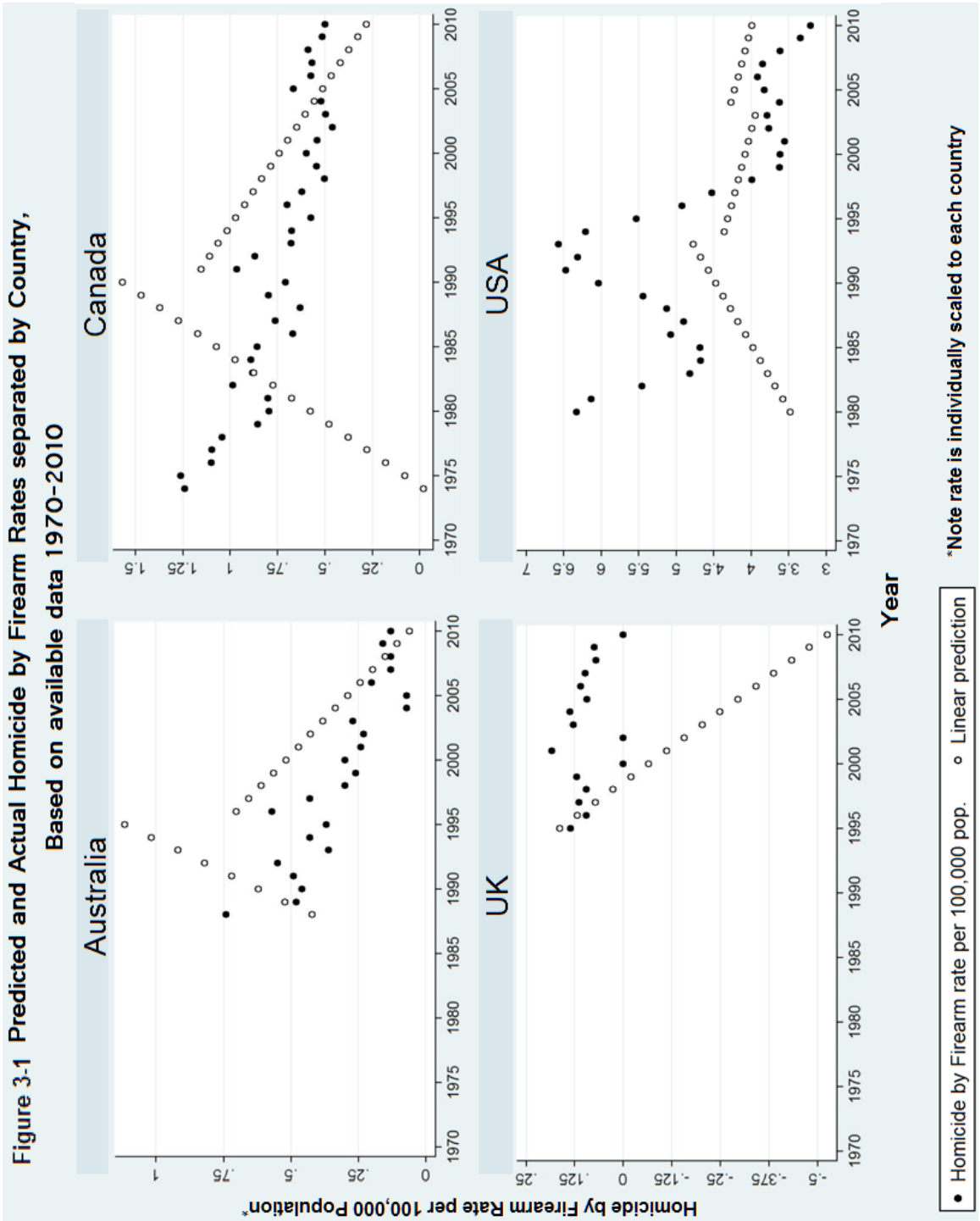


Figure 3-1 Predicted and Actual Homicide by Firearm Rates separated by Country,
Based on available data 1970-2010
Australia
Canada
UK
USA
Homicide by Firearm Rate per 100,000 Population*
Year
• Homicide by Firearm rate per 100,000 pop. ∘ Linear prediction
*Note rate is individually scaled to each country

In Figure 3-1, I chose to use the same time scale for each of the countries. This is because it gives an accurate visual representation of the years represented in the data for each country without sacrificing the visual effectiveness of each graph. Lack of observations was one of the greatest limitations to this research. The Cases of the United States and Canada in particular show interesting features of the predicted linear regression versus the actual data. In the United States, we see that the legislation chosen, the implementation of the Federal Assault Weapons Ban as an addition to the Brady Handgun Violence Prevention Act, has a slight effect on the data. The predicted values, as shown by the white dots, show a very clear delineation between the assault weapon ban going into effect, existing, and then expiring. In the Canadian case, an ideal case because of the abundance of data, it is evident that the predicted values anticipated an increasing level of gun violence up until the legislation was passed, when a decline was predicted. What we see, however, is that rates of gun violence in Canada have been on a steady decline for the past 35 years which as rates begin to level out apparently not connected to the legislation passed in 1990.

The role of gun control legislation in stemming the amount of victims of gun violence will always be a controversial issue. The political debate is so fierce, that it is almost certainly the case that myriad convincing results either confirming or denying the effectiveness of gun control legislation would not be enough to sway the loudest voices on either side. Continued research into the effectiveness of government control over a public safety issue, such as gun violence, however could certainly sway many people. Could such results ever be found?

I examined the relationship between homicide by firearm rates across four countries over time and the effect the implementation of gun control legislation had on these cases. My hypothesis was that the implementation of gun control legislation, as measured by both a dichotomous variable for “legislation exists”, or “legislation does not exist” and a counter variable that measures the time passing after the implementation of the legislation, would have an effect on the rates. The existence of legislation should make it more difficult or more expensive to

own a gun, and thus decrease the rate of homicides by firearm in each case. By employing an interrupted time-series analysis, I was able to simply code for gun control legislation and use that in lieu of a measure of the availability of firearms, which has proven difficult to measure. My findings in some compelling cases supported my hypothesis and in others did not. In the case of the United States and all of the countries' data combined, both the simple existence of gun control legislation and the number of years the gun control legislation had been in effect produced statistically significant negative results on the rate of homicides by firearm.

Canada's results were also statistically significant but showed a slight positive effect on the rate of homicide by firearm from both the dummy and the counter variable measuring the existence of gun control legislation. Australia's coefficients for both gun control variables were also slightly positive but were not statistically significant. Many of the United Kingdom's results had to be omitted due to a lack of observations before the gun control legislation was in effect to compare with any changes the legislation may have made. The variable counting years the legislation has been in effect did have a slight negative effect that is statistically significant.

These results tell me that using the parameters I chose to measure gun violence--the homicide by firearm rate per 100,000 population--and the individual pieces of legislation I chose as well as how they were measured, yielded a statistically significant result that was at time consistent with my hypothesis. The hypothesis was originally modeled after the case of the United States and other countries were added in order to compare data and analyze the effects of gun control across countries. The reason I believe the legislation variable had the expected effect on the homicide by firearm rate in the United States is due to the fact that there is an actual gun violence problem to be stopped, as opposed the other countries examined which have relatively low rates of gun violence compared to the United States, which has rates of gun violence nearly unprecedented for a developed nation. The coefficients that measure the effect of each country on the combined data illustrate this point. Being the United States affords a 3.85 unit increase to the

expected rates of homicide by firearm while the coefficients for Canada and the United Kingdom respectively are 0.95 and 0.43, marked decreases.

I attribute the slight positive effects found from the gun control legislation variables on homicide by firearm rates in the cases of Canada and Australia to cultures that have not been consumed with the idea of guns such as the United States has. As more guns are manufactured, and they almost certainly become more available just due to sources such as the internet and increased globalization, the rates of homicide by firearm are not decreasing in the manner in which we would expect them to, simply because the rates were never high enough to begin with to merit the type of decrease and fluctuation seen in the United States. The fact that the model exploring the data from these four countries combined fits with the hypothesis and is statistically significant is encouraging. It shows that gun control legislation may not be futile, but instead exercise an effect on homicide by firearm rates.

These results are important because thus far, the only papers that have found a successful link between gun control policy and decreasing gun violence have had certain limitations. Either they were forced to examine a very limited time period or geographical area, to limitations to data collection, or they have been questioned for the parameters chosen to measure gun control policy. These results fit alongside those that have attempted to determine if gun control legislation had an effect previously and were inconclusive.

The policy implications for the results of this paper are actually quite immense, should these findings be subsequently repeated in further research. I have alluded to the fact that gun control is a volatile issue in the United States, one of the only nations to guarantee citizens the right to bear arms in its constitution. This debate, like most, is the most explosive on the two extremes of the issue and much more open to debate and compromise in the center. If compelling evidence for the effectiveness of certain types of gun control could be empirically supported, it is very likely and, in fact, necessary that these measures be implemented to curtail the high rates of

gun violence and homicide by firearm in the United States. In the other countries' cases, the policy implications are murkier. These results do not propose that the gun control legislation in place in those countries is ineffective. With rates still on the decline and consistently much lower than those of the United States, it can be argued that they are quite effective.

Certainly these public policy implications are only relevant if the findings of this paper are sound and consistent with subsequent research in this vein. There are, of course, certain limitations of this analysis which should be taken into account. First, there were issues with the sheer number of observations that are available regarding homicide by firearm rates. It is often the case that collection of data of this type is not required or standardized until law makes it so. Until interest in passing gun control legislation exists, there is often little incentive to compile good data on the subject. In other cases, like the United Kingdom, legislation existed in the late 1980s, but it wasn't until 1995 that accurate data was kept on the subject. Because of the lack of data, questions can also be raised about the quality and reliability of the data observed. Much of this has to do with individual precincts reporting results to be compiled at the national level. There is certainly room for error along the way.

Another limitation is that, though based on well reasoned estimates, the parameters chosen in this paper for the measure of gun control legislation and the use of firearm by homicide rate as the primary dependent variable were relatively arbitrary decisions. In the past, gun control legislation has been measured by trying to determine the scarcity of guns in an area over a period of time. This has been previously been done by determining the percentage of robberies and other crimes committed with a firearm. This method has been called in to question for its reliability as well as its implications that guns have become scarce. To combat this, I chose to use the existence of gun control legislation as the measure for how easy guns are to attain while using a trend variable to control for other trends that could be effecting this connection. This method simplifies

the situation in that it is much easier to accurately measure, but it could also oversimplify it in such a way that the effects of gun control legislation are increased.

In choosing the legislation to measure for; I monitored each country's past legislation and chose to interrupt the time series after new legislation was implemented that included the ban of an additional category of firearm (assault, semi-automatic, or handgun). The use of different pieces of legislation for each country could vary realistically yield different results. It is worth noting that this could be helpful for additional research.

More additional research could include waiting a few years and trying again with more recent data available. It is also possible that in time countries will release better historical data or someone more skilled than me at data collection will dig some up. Having more historical cases would definitely help support this research in the future. It may also help in the future if more specific trend variables are included instead of relying on a simple trend variable to help control for changes in population, overall violence rates, and other factors. If more research were done and findings that gun control legislation can be effective at lowering the rates of homicide by firearms, the implications would be great.

Appendix A

Expanded Sources for Table 1-1: A list of laws and works referenced by gunpolicy.org

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