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The Social Costs of Gun Ownership: Gun Control Policy and Crime

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I. Abstract

This paper investigates the impact of gun control legislation on the homicide rate across two countries - the US and Canada. The Brady Act from the US creates the national background check system we use today, while the Firearms Act from Canada starts a new national background check system along with labeling certain guns as "restricted" or "banned" for civilian purchase[1][2]. For each of these policies, I created a regression that predicts the state's or province's homicide rate based on the policy, year, alcohol consumption, police per capita, and many demographic variables to measure the policy's short-term and long-term impact on the firearm homicide rate. Based on these regressions, both acts significantly decreased firearm homicides in the long-term, but the Brady Act had a bigger impact in relation to the current firearm homicide rate at the time. Therefore, the Brady Act was more effective than the Firearms Act. One main future direction with this research is to analyze homicides caused by other means during the same timeframe. Additionally, since firearm homicides significantly decreased with these acts, it would be valuable to know if firearm suicides also decreased.

II. Introduction

According to Statista, in 2020, 42% of US households own at least one firearm[3]. Furthermore, approximately one million firearms were registered in Canada in 2019[4]. Due to the size of this market in both countries, firearms can have significant social costs like other goods,

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[1] "Brady Law | Bureau of Alcohol, Tobacco, Firearms and Explosives," accessed May 5, 2021, https://www.atf.gov/rules-and-regulations/brady-law.
[2] "Gun Control in Canada | The Canadian Encyclopedia," accessed May 5, 2021, https://www.thecanadianencyclopedia.ca/en/article/gun-control.
[3] "Gun Ownership in the U.S. 1972-2020," Statista, accessed May 5, 2021, https://www.statista.com/statistics/249740/percentage-of-households-in-the-united-states-owning-a-firearm/.
[4] "Canada: Firearms Registered to Individuals or Businesses, by Province 2019," Statista, accessed May 5, 2021, https://www.statista.com/statistics/520630/canada-firearms-registrations-by-province/.

which is seen in the 40,000 lives lost annually in America and 1,300 lives lost annually in Canada[5][6]. Therefore, I address an act from both countries, the Brady Act and the Firearms Act, and compare their respective impacts on their country's firearm homicide rate.

Before continuing further into this paper, it is important to note that this research does not provide evidence to the validity of restricting or banning certain firearms within modern-day contexts. Even though the key difference between the Brady Act and Firearms Act is the additional restrictions from the Firearms Act, there are too many cultural differences between Canada and the US that I cannot account for in my regressions. These differences, if accounted for, could significantly impact my results. Furthermore, I do not control for past and future gun control acts in these countries that would impact the firearm homicide rates. Thus, my research paper focuses on answering which act had a better impact on addressing social costs within their respective countries.

To address this question, I created multiple Ordinary Least Squares (OLS) regressions accounting for many different variables from the US and Canada. Within these regressions, I measure the short-term and long-term impacts of these acts. Furthermore, some of the regressions are in the semi-log form to measure these impacts in terms of percentage of total firearm homicide rates, which helps compare the acts on a similar scale. Overall, both the Brady Act and the Firearms Act had statistically significant results, but the Brady Act was more impactful in the US compared to the Firearms Act's relative impact in Canada.

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[5] Chelsea Parsons, Eugenio Weigend Vargas, and Rukmani Bhatia, "The Gun Industry in America," Center for American Progress, accessed April 14, 2021, https://www.americanprogress.org/issues/guns-crime/reports/2020/08/06/488686/gun-industry-america/.

[6] Department of Justice Government of Canada, "Firearms, Accidental Deaths, Suicides and Violent Crime: An Updated Review of the Literature with Special Reference to the Canadian Situation," March 10, 1999, https://www.justice.gc.ca/eng/rp-pr/csj-sjc/jsp-sjp/wd98_4-dt98_4/p3.html.

Before going straight into the research, it would be beneficial to provide a summary of the future sections of this paper. In the literature review section, I talk about past research in the social costs of owning firearms, as well as research for similar and different gun control acts and restrictions. In the theory section, I describe the main economic model that explains why we would pass these acts in the first place. Even though my main assumption going into this research is that more guns provide more social costs, I provide both sides of the standard gun control argument in case these gun control acts provide counterintuitive results. In the data and empirical evidence section, I explain my regressions more in-depth and calculate the net impacts from the Brady Act and Firearms Act. In the conclusion section, I summarize the key results from the previous data and empirical evidence section. Furthermore, I explain how this research contributes to the past research mentioned in the literature review section and mention the shortcomings with my analysis. In the bibliography section, I provide all sources I have used in this paper to help structure my analysis and reasoning. Lastly, all my graphs and tables mentioned in the data and empirical evidence section will be included in the appendix section.

III. Literature Review

The main goal of my research paper is to compare the effects of the Brady Act in the US and the Firearms Act in Canada. In this review, the articles focus on either measuring a potential social cost in the firearms market or analyzing the impact of other gun laws. These studies investigate the social costs of gun ownership and the implications of gun control policy.

Social Costs

The main article to show how the firearm market acts like any other market is “The Market for New Handguns: An Empirical Investigation” by Bice and Hemley. They measured the price elasticity of demand and supply for handguns, which proved to be significant and with

the expected signs. They accounted for police, price of shotguns, crime, and input price when measuring these elasticities. Furthermore, they found that shotguns and handguns act like substitutes in this market. Even though the increased demand for guns are generally linked to higher gun crime, this article points out that people buy guns for self-defense, which means gun control could reduce welfare. For their demand and supply models, I think they could have included more control variables or more substitutes for firearms, such as knives or pepper spray. The key complication from this article is their analysis of the Brady Act in their model. Instead of decreasing gun sales as expected, the Brady Act could increase gun sales shortly before implementation due to expectations of future restrictions. Because of this surge in gun sales, this could lead to a connection between the Brady Act and increased homicides. This will be considered in my analysis, especially if I receive a significant, positive coefficient for my dummy variables for the two gun-control laws.

Along with demonstrating that the gun market acts like other markets, it is necessary to show that there are social costs to such a market. This is stated in "The Social Costs of Gun Ownership" by Cook and Ludwig in 2005. In this article, they measured social costs with firearm homicide rates, and measured gun ownership with fraction of suicides committed with firearms. According to their analysis, there are significant social costs when more people own firearms. Furthermore, they state that the social cost can be fixed with a licensing fee between $600 and $1800, dependent on elasticity of homicide with respect to gun prevalence. One main strength to their research is they analyzed multiple models and performed sensitivity analysis, which adds to their validity. Additionally, they controlled for many important variables, such as demographics, year fixed effects, and county fixed effects. However, if they want to measure if owning guns has a significant social cost, then I do not think they should use firearm suicides as a proxy for gun

ownership. Social costs should include homicides and suicides as a dependent variable; not to be accounted for in an independent variable. Even with this key weakness, this study helps my research question by showing the assumption that there are social costs to address with firearms is true. Without social costs in the firearm market, there would not be a purpose for stricter gun control after the Brady Act or the Firearms Act.

Gun Control Policy Outcomes

The first article looking at gun control policies is "The Impact of Gun Control (Bill C-51) on Homicide in Canada" made by Leenaars and Lester in 2001. As the name suggests, this article analyzes the impact on all homicides, firearm homicides, homicides of other methods, and percentage of homicides by firearms in Canada from Bill C-51. Their main conclusion is that, overall, Bill C-51 significantly decreased total homicides rates. However, they did not find many significant results in the other three categories mentioned or when they separated the data into males and females. This bill introduced acquisition certificates for firearms, restricted availability for some firearms, and a basic background check, but the later Firearms Act replaced this background check system and banned firearms such as certain shotguns. Bill C-51 may not be significant, but the stricter Firearms Act could be significant in decreasing gun crime. A key strength that is in this study is that it is easy to interpret. The researchers created a regression with Bill C-51 as a dummy variable and controlled for by other demographic variables. Thus, the coefficient on the dummy variable represents the change in homicide rates as soon as Bill C-51 was signed. However, I do not think they controlled for enough variables, such as police presence and alcohol consumption, which are used in later articles. This paper presents that Canada already had background checks and gun restrictions in place before the Firearms Act. Because of this, my results may not be significant if the Firearms Act is not significantly stricter

than Bill C-51. This knowledge of past gun control laws will be considered in describing my results.

Leenaars, Moksony, Lester, and Wenckstern in 2002 looked at suicide rates and in the same categories from the previous article. Along with the initial regression form that was used, this article included a second model with time, a dummy variable for Bill C-51, and a slope dummy variable for Bill C-51 and time. From the slope dummy model, this bill significantly dropped the change in rate of suicides over the years. From the initial regression model, this bill significantly dropped the rate of suicides when it was signed. To decrease the rate of suicides, we need to limit the access to lethal means for people who are suicidal. One main strength is they measured the change in rate of suicides instead of only finding the one-time impact on the rate of suicides with one dummy variable. However, in the model where they introduced the slope dummy variable, they did not control for any other variables, such as what were included in the initial regression. Instead of combining the two methods for optimal analysis, they separated the two methods, which created two less optimal approaches to the data. The slope-dummy approach is intuitive because any law should have a prolonged effect; not just a sudden change when it was signed. Furthermore, this study shows that I should consider suicide rates along with homicide rates in my paper. Even though gun crime is the main factor when considering gun laws, taking away access to firearms from depressed individuals is a significant benefit that should be measured.

Since the Brady Act and the Firearms Act include a form of national background checks, it would be beneficial to see if background checks are useful in preventing gun homicides and gun crime. The research article “The Effects of State and Federal Background Checks on State-Level Gun-Related Murder Rates” by Gius in 2015 demonstrates that national backgrounds help

fight against crime. His dependent variable was gun-related murder rates, and his main independent variables were state-level dealer background checks, state-level private sales background checks, and federal dealer background checks. The Brady Act introduces federal dealer background checks. Gius concluded that dealer background checks help reduce murder rates, but private sales background checks interestingly increase murder rates. Thus, one of his main conclusions is that criminals have found methods to circumvent the private sales background checks, especially due to these checks being implemented at a state level instead of nationally. However, standard background checks from licensed dealers are effective. Compared to the other research articles, Gius' research is the most in-depth with using ten different models to analyze the effects of background checks. Additionally, in each of the models, he has many control variables, such as race, age, unemployment, police presence, and alcohol consumption. However, one key problem with his analysis is his measure for background checks. More background checks imply more gun control and overall, more safe areas. Additionally, more background checks imply more guns being bought, which could lead to less safe areas. In terms of my research question, this research paper provides evidence that the Brady Act and the Firearms Act will significantly reduce gun crime in their respective countries. If these acts do not significantly reduce gun-related homicides, then it would be difficult in my paper to compare insignificant results.

In my paper, I am comparing an act from the US with an act from Canada, but it would be helpful to see if one of the strictest gun control acts, the Australian Buyback Program, also significantly decreased gun homicides and suicides. This program is covered in the journal article "Do Gun Buybacks Save Lives? Evidence from Panel Data" by Leigh and Neill in 2010. They analyzed the impact that buying guns back from citizens impact firearm homicides, non-

firearm homicides, firearm suicides, and non-firearm suicides. Surprisingly, they concluded that the buyback program significantly reduced firearm suicides but did not change the other three rates. People who would commit suicide with guns would normally get them legally, but criminals have some alternative ways to obtaining firearms. Similar to the previous article, one benefit here is they tested with multiple models to see if significance or direction of these coefficients would change. However, this research paper did not have many data points to use. They only had eight data points, which represented the eight regions of Australia that had this program. Due to not many data points, it is difficult to obtain meaningful results. With this paper, I hoped to have an upper bound for decrease in gun homicides and suicides, based on the assumption that a stricter gun control policy would lead to a larger decrease in gun-related crime. However, this may not be the case, but still adds context behind the Brady Act and Firearms Act.

According to my research, there are social costs to address in the firearms market. Background checks, in general, are a helpful way to decrease social costs within this market. However, more policies such as a licensing fee or restricting access to more guns may be needed. I hope to address the need for more policies in my research paper. If the Brady Act and Firearms Act have similar impacts to crime, then background checks may be enough for a country. However, if the Firearms Act significantly decreases crime more than the Brady Act, then the U.S. may need more gun control laws to decrease social costs further. If either of these acts indicate an increase in crime when they are signed, then this may be a consumer's reaction to future expectations of access being restricted to this good. Based on the approaches in some of these articles, along with firearm-related homicides, I should analyze firearm-related suicides, since they do not have to both be significant or insignificant. With these different measures of social costs, I hope to accurately predict the impact from these policies.

IV. Theory

The main theoretical model that will be used for my research is when there are negative externalities of consumption in the demand and supply model. The key assumption with this model is that more guns cause more marginal damages than marginal benefits, which moves the social marginal benefits curve to the left of the private marginal benefits curve. Therefore, if we decrease gun consumption through strict gun laws, then we will shift the private marginal benefits curve to the social marginal benefits curve by internalizing social costs. However, there are important arguments to consider from both sides of the gun control debate. According to gun rights advocates, higher rates of gun ownership are likely to be associated with less crime, and that stricter gun policy only diminishes the enjoyment of gun ownership[7]. When more guns are sold, law-abiding citizens have access to guns to protect themselves from criminals. Additionally, they believe that it increases the likelihood that a crime can be deterred through intervention by gun owners[8]. Furthermore, the mere knowledge of higher rates of gun ownership in the community could also act as a deterrent. Moreover, they claim that stringent regulations of gun purchases and ownership would make it more difficult for citizens to obtain guns to protect themselves, while criminals may continue to obtain them illegally.

However, those who support more stringent gun laws claim that more guns could be associated with higher crime rates. Studies by Cook and Ludwig[9] and Duggan[10] have shown that gun purchases could adversely impact even those who are not party to transactions in the market

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[7] John R. Lott, *More Guns, Less Crime : Understanding Crime and Gun-Control Laws,* (University of Chicago Press, 2010).

[8] Gary Kleck and Marc Gertz, "The Illegitimacy of One-Sided Speculation: Getting the Defensive Gun Use Estimate Down," *The Journal of Criminal Law and Criminology (1973-)* 87, no. 4 (1997): 1446–61, https://doi.org/10.2307/1144021.

[9] Philip J. Cook and Jens Ludwig, "The Social Costs of Gun Ownership," *Journal of Public Economics* 90, no. 1–2 (January 2006): 379–91, https://doi.org/10.1016/j.jpubeco.2005.02.003.

[10] Mark Duggan, "More Guns, More Crime," *Journal of Political Economy*, October 1, 2001, 1086–1114, https://doi.org/10.1086/322833.

for guns, i.e., gun purchases cause negative externalities. The laws of gun ownership are such that it is extremely difficult or near impossible to track who has access to that gun after purchase. According to Cook[11], guns are commonly obtained by criminals through a series of exchanges initially started from a licensed dealer to a citizen with a clean background. Despite both sides of the debate appearing equally valid, this research will continue with the assumption that more guns cause more harm than good and will measure how effective the US Brady Act and the Canada Firearms Act worked to fight against gun-related homicides.

The goal of both acts is to shift the private marginal benefits curve closer to the social marginal benefits curve, which leads to a lower price and quantity sold for guns. The Brady Act introduces national background checks to the US, which make it more difficult for consumers to purchase guns. Since it is more difficult to purchase guns, less guns should be bought, and price should be lowered to match that decrease in demand. Along with national background checks, the Firearms Act restricts and bans the purchase of certain types of guns. Thus, there will no longer be a market for the banned guns. Overall, this policy should shift the private marginal benefits curve further to the left compared to the Brady Act, assuming national background checks are equally implemented, since some guns are now removed from the overall gun market.

Even though the goal of these acts is to significantly decrease gun sales, citizens may suddenly buy firearms shortly before the acts are signed and implemented. According to Bice and Hemley, instead of decreasing gun sales as expected, the Brady Act is predicted to increase gun sales shortly before implementation due to expectations of future restrictions[12]. Because of this surge in gun sales, this could lead to a connection between the Brady Act and increased

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[11] Philip J. Cook, *The Gun Debate: What Everyone Needs to Know*, What Everyone Needs To Know (Oxford, New York: Oxford University Press, 2014).

[12] Douglas C. Bice and David D. Hemley, "The Market for New Handguns: An Empirical Investigation," *The Journal of Law and Economics* 45, no. 1 (April 2002): 251–65, https://doi.org/10.1086/324656.

homicides. These acts should lead to a decreasing trend in gun homicides through a decrease in gun sales in the long term after implementation, but the sudden increase in gun homicides could lead to the false conclusion that the acts were ineffective in preventing crime.

V. Data and Empirical Evidence

The main data I will look at for my project are firearm homicide rates throughout the years by state in the US and by province in Canada. From my economic theory section, the plan is to determine whether more guns provide more positive or negative externalities. If more negative externalities are created, then I need to measure the impact that the Brady Act from the US and the Firearms Act from Canada had in counteracting these negative externalities through restricting access to guns. After measuring their impacts, I can determine whether a more restrictive gun control law was more effective than a less restrictive law. In this project, the externalities are measured in firearm homicides per 1000 people in the state or province. The independent variables that will be the focus of this paper will be the dummy variable representing the sudden change in firearm homicides before and after the acts were implemented, and the slope-dummy variable representing the future annual change of firearm homicides. The impact from these acts is separated into two variables because the initial response to these acts can be unexpected, such as buying many more firearms before the restriction takes place[13]. Furthermore, as seen in past research, I will account for control variables that could be linked to the firearm homicide rate, such as police presence, alcohol consumption, the proportion of males in each area, and the proportion of young adults in each area[14][15].

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[13] Bice and Hemley 2002.

[14] Mark Gius, "The Effects of State and Federal Background Checks on State-Level Gun-Related Murder Rates," Applied Economics 47, no. 37–39 (August 2015): 4090–4101.

[15] Antoon A Leenaars and David Lester, "The Impact of Gun Control (Bill C-51) on Homicide in Canada," Journal of Criminal Justice 29, no. 4 (July 2001): 287–94, https://doi.org/10.1016/S0047-2352(01)00094-0.

Ideally, my chosen variables would not have any missing values in them. Fortunately, this is true for the data I am using from the US for the range of years I need. However, this was not the case for the data with Canada. In all 50 states, there are more than enough people to calculate a reliably accurate value like firearm homicide rates and number of officers. For Canada, there are few people who live in the Northwest Territories, Newfoundland, Yukon, and Prince Edward Island. Thus, I could not find all values within the provided range of years needed for this research. Additionally, some sources were not consistent in how they referred to the Northwest Territories, especially with Nunavut. Some sources accounted for Nunavut's values within their data for Northwest Territories, some excluded Nunavut entirely, and others identified them as distinct areas in the data. I hope that I addressed this inconsistency correctly when combining data from multiple sources. With an ideal dataset, I could easily label the data points as under "Northwest Territories", but with the actual dataset, adjustments needed to be made.

The summary statistics shown in Table 1 are with data from the US. FirearmPer1000Lagged represents the firearm homicide rate per 1000 people in each state, lagged by one year. Brady is a binary variable indicating the year that the Brady Act was implemented. Thus, Brady equals 1 when it is 1995 and after, and it equals 0 when it is 1994 and before. Year represents the given year for these data points, which is restricted to between 1990 and 1999. BradyYear is the interaction variable between the binary Brady variable and year. Instead of simply multiplying Brady and Year together, BradyYear equals 0 before 1995, will start with 1 at 1995, and increase to 5 at 1999. MedianIncome is the household median income of a state. PercentInPoverty is the percentage of people in poverty in a state. PercentBlack is the percentage of black people in a state. PercentMale is the percentage of males in a state.

PercentBetween15To34 is the percentage of people who are between the ages of 15 and 34 in a state. OfficersPer1000 represents the number of police officers per 1000 people in each state. UnemploymentRate is the unemployment rate in a state. VotedForDemocrat equals one if the state voted for the Democratic candidate for the majority of the three presidential elections from 1992, 1996, and 2000, and zero otherwise. AlcoholGallonsPerCapita is the number of gallons of alcohol consumed per person in a state. NE equals 1 if the state is in the Northeastern region of the US, and 0 otherwise. W equals 1 if the state is in the Western region of the US, and 0 otherwise. S equals 1 if the state is in the Southern region of the US, and 0 otherwise.

The summary statistics shown in Table 2 are with data from Canada. FirearmPer1000Lagged represents the firearm homicide rate per 1000 people in each province, lagged by one year. FirearmsAct is a binary variable indicating the year that the Firearms Act was implemented. Thus, FirearmsAct equals 1 when it is 1996 and after, and it equals 0 when it is 1995 and before. Year represents the given year for these data points, which is restricted to between 1991 and 2000. FirearmsActYear is calculated similarly to the BradyYear variable mentioned earlier, but it starts with 1 at 1996 instead of 1995. OfficersPer1000 represents the number of police officers per 1000 people in each province. AlcoholGallonsPerCapita is the number of gallons of alcohol consumed per person in a province. PercentBetween15To34 is the percentage of people who are between the ages of 15 and 34 in a province. PercentMale is the percentage of people who are male in a province. MedianIncome is the household median income in a province. PercentInPoverty is the percentage of people in poverty in a province. UnemploymentRate is the percentage of people who are unemployed in a province. VotedForDemocrat equals 1 for provinces that had an average of at least 39% of the popular vote for the Liberal Party of Canada in the 1993, 1997, and 2000 elections. Manitoba equals 1 if the

province is Manitoba, and 0 otherwise. NewBrunswick equals 1 if the province is New Brunswick, and 0 otherwise. NovaScotia equals 1 if the province is Nova Scotia, and 0 otherwise. BritishColumbia equals 1 if the province is British Columbia, and 0 otherwise.

As shown in Table 3 with correlations for variables using US data, besides Brady, Year, and BradyYear being very correlated with each other, barely any of the variables have a high correlation with the others. The other correlation that we could worry about is the high correlation between MedianIncome and PercentInPoverty, which is expected. When a state has higher percentage of people in poverty, they tend to have a lower household median income. However, in the regression with this data, these two variables still proved to be significant.

As shown in Table 4 with correlations for variables using Canada data, along with FirearmsAct, Year, and FirearmsActYear being very correlated with each other, the other five variables have correlation values above at least .7 with some of the other variables. For example, the officer_rate_per_1000 variable is very correlated with the FirearmPer1000Lagged dependent variable, which may create a dominating variable in my regression. Additionally, OfficersPer1000, PercentMale, and AlcoholGallonsPerCapita are very correlated with each other. Even though there is significant multicollinearity with this dataset, all variables are included to closely match the regression for US data.

As stated earlier, the main relationship I want to analyze is how the firearm homicide rate has changed over the years due to the Brady Act and the Firearms Act. Based on Graph 1, the Brady Act had a very significant impact in the slope, making the homicide rate decrease for future years instead of increasing. However, with Graph 2, there does not appear to be a noticeable change caused by the Firearms Act for both in the short-term and long-term. Additionally, the three outliers in Graph 2 were removed.

I expect MedianIncome to be negative because states with greater income would lead to people not having an incentive to commit crimes. However, this variable produced inconclusive results by Gius[16]. I expect PercentInPoverty to be positive because poor people would tend to commit more crimes. I expect PercentBlack to be positive since black people tend to live in poorer neighborhoods in the US, which would lead to disproportionately more firearm homicides committed by black people. This prediction is shown by Gius[17] and Cook and Ludwig[18]. I expect PercentMale to be insignificantly positive since men can be stereotypically seen as more aggressive than women, but I do not think this increase in aggression would be enough to change the firearm homicide rate. I expect OfficersPer1000 to be negative because more officers in a state should deter people from committing any type of crime. Gius[19] supports this prediction, but to varying levels of significance. UnemploymentRate should be positive because, similar to PercentInPoverty, people who are unemployed tend to commit more crime than people who are not unemployed. Gius' results are inconclusive about this variable[20]. I expect VotedForDemocrat to be negative because I think Democratic states are more likely to enforce gun control policies than Republican states. AlcoholGallonsPerCapita should be positive because people who drink more are less likely to make rational choices, which leads to more crimes and unnecessary deaths. Gius' results are inconclusive about this variable[21]. However, Lang estimates a significant negative relationship between alcohol consumption and homicide rates[22]. PercentBetween15To34 should be positive because people who commit crimes and homicides

[16] Gius 2015.
[17] Gius 2015.
[18] Cook and Ludwig 2006.
[19] Gius 2015.
[20] Gius 2015.
[21] Gius 2015.
[22] Matthew Lang, "State Firearm Sales and Criminal Activity: Evidence from Firearm Background Checks," *Southern Economic Journal* 83, no. 1 (July 2016): 45–68.

tend to be relatively younger people. Both Lang and Gius provide inconsistent results with their models[23][24].

Table 5 displays the results from the regressions created from US and Canada data with FirearmPer1000Lagged as the dependent variable for the first two columns, and with log of FirearmPer1000Lagged as the dependent variable for the second two columns. As expected from the previous graph, the Brady Act had a significant long-term beneficial effect on the firearm homicide rate, which indicates that reducing access to guns created a social benefit. Thus, purchasing guns creates a net negative externality. Furthermore, as a percentage of firearm homicide rates, the Brady Act is still significantly effective.

Unlike what I predicted from Graph 2, the Firearms Act had a significant positive impact on the firearm homicide rate. However, as a percentage of firearm homicide rates in Canada, the Firearms Act did not have statistically significant effect. Even if the coefficients for FirearmsActYear were significant in the log regression, they would not be as practically important as the Brady Act was in the US, with 9.35% decrease for the Brady Act and 7.96% decrease for the Firearms Act. However, this difference in significance could be attributed to the lack of data I have from Canada compared to the US. Overall, it appears that the Brady Act was more beneficial than the Firearms Act, but more reliable data could change these results. Since both acts decreased firearm homicide rates in the US, it is safe to conclude that less guns in the market are more beneficial to society.

VI. Conclusion

Overall, the Brady Act was relatively more effective than the Firearms Act. Even though both acts did not have statistically significant impacts in the year they were signed, they did have

[23] Lang 2016.
[24] Gius 2015.

statistically significant long-run impacts, at least in the first five years after implementation. However, as a basis of percentage of firearm homicide rates, the Brady Act decreased these rates more than the Firearms Act. As stated earlier, this does not imply that banning certain firearms is not effective, but the US addressed their gun problem more effectively than Canada in the 1990s. Furthermore, since both the Brady Act and the Firearms Act decreased firearm homicide rates through additional restrictions to accessing firearms, our initial assumption that owning firearms create a social cost is shown to be correct.

There are already many papers stating there are significant social costs with owning more guns, but they tend to prove this idea through estimating gun ownership in their chosen country, such as using firearm suicide rates as a proxy for gun prevalence[25]. However, my research provides evidence for this idea indirectly by showing gun control acts reduce firearm homicide rates. In other words, greater costs to accessing guns is correlated with lower homicide rates. Furthermore, if past research papers measure the impact of a certain gun control act, they do not compare the act to other gun control legislation in other countries during the same period. Even though the US and Canada are distinct in many ways, comparing different countries' approaches to gun control could provide information on how some countries could do better in the future.

Although some results in the regressions were expected, there are some shortcomings within the data. The main problem that is difficult to solve is the lack of data obtained from Canada compared to the US. In the US, there were not any missing values with any of the variables in the given timeframe. However, in Canada, there were many missing values with some variables due to not many people living in certain provinces and territories, such as the

[25] Cook and Ludwig 2006.

Northwest Territories and Yukon. Due to this problem, the regressions for Canada had much higher multicollinearity compared to the regressions for the US, despite having less variables.

Furthermore, the independent variables used in both the US and Canada regressions were not always measured in the exact same way. For example, the VotedForDemocrat was calculated differently between the regressions to account for the multiple significant parties in Canada compared to the practically two-party system in the US. I would not think this would heavily impact the significance of the variables representing the gun control acts, but it would change the significance of this variable representing political affiliation of a state or province.

The main route for possible future work is to analyze the Brady Act's and Firearm's impact on specific types of crime. Instead of firearm homicides, I can focus on firearm suicides and gun-related robberies. Additionally, I should analyze a possible substitution effect with firearms. Even though firearm homicide rates generally decreased with the Brady Act and Firearms Act, non-firearm homicide rates could have increased due to criminals switching to other weapons such as baseball bats and knives.

I have neither given or received, nor have I tolerated others' use of unauthorized aid.

Thomas Shomer

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VIII. Appendix

Table 1: Summary of US Data

	Mean	Std Dev	Minimum	Maximum
Lagged Firearm Homicides per 1000	0.04639	0.03682	0	0.23265
Brady	0.5	0.5005	0	1
Brady_Year	1.5	1.80458	0	5
Year	1994.5	2.87516	1990	1999
Poverty Rate	12.9956	3.85727	5.3	26.4
Unemployment Rate	5.37992	1.5201	2.35	11.30833
Median Income	54733.71	8813.6	34278	82374
Percent of Population that is Black	0.09861	0.09491	0.002534	0.37643
Percent of Population that is male	0.49523	0.013574	0.46133	0.58449
Percent of Population in the Age Group 15-34	0.29876	0.019831	0.25084	0.38269
Number of Police Officers per 1000	2.1347	0.52891	1.39	4.34
Gallons of alcohol per capita	29.90597	5.140578	16.04167	53.95
Lean toward Democratic Party in elections	0.58	0.49405	0	1

Table 2: Summary of Canada Data

	Mean	Std Dev	Minimum	Maximum
Lagged Firearm Homicides per 1000	0.0077485	0.010917	0	0.0664
Firearms Act	0.50427	0.50213	0	1
Firearms Act_Year	1.51282	1.817612	0	5
Year	1995.52	2.89053	1991	2000
Poverty Rate	13.922	2.81997	8.7	21.4
Unemployment Rate	10.749	3.88068	5	20.1
Median Income	69162	8283.98	55100	90000
Percent of Population that is male	0.49912	0.0089123	0.4885	0.52466
Percent of Population in the Age Group 15-34	0.31961	0.074734	0.26703	0.60227
Number of Police Officers per 1000	1.95182	0.65501	1.421	4.047

Gallons of alcohol per capita	2.08131	0.44303	1.55861	3.72483
Lean toward Democratic Party in elections	0.41026	0.4934	0	1

Table 3: Correlation for US Data

	FirearmPer1000Lagged	Brady	Year	BradyYear	MedianIncome	PercentInPoverty	PercentBlack	PercentMale
FirearmPer1000Lagged	1	-0.19913	-0.2039	-0.21901	-0.13131	0.43441	0.56598	-0.10783
Brady	-0.19913	1	0.87039	0.83205	0.21139	-0.15695	0.02414	0.16788
Year	-0.2039	0.87039	1	0.91733	0.23486	-0.16661	0.02791	0.18428
BradyYear	-0.21901	0.83205	0.91733	1	0.26217	-0.18452	0.02524	0.16451
MedianIncome	-0.13131	0.21139	0.23486	0.26217	1	-0.74083	-0.1333	0.25758
PercentInPoverty	0.43441	-0.15695	-0.1666	-0.18452	-0.74083	1	0.34808	-0.27743
PercentBlack	0.56598	0.02414	0.02791	0.02524	-0.1333	0.34808	1	-0.21284
PercentMale	-0.10783	0.16788	0.18428	0.16451	0.25758	-0.27743	-0.21284	1
PercentBetween15To34	0.3592	-0.45748	-0.5359	-0.46422	0.05024	0.06423	0.2454	0.34802
OfficersPer1000	0.20567	0.14077	0.15248	0.14652	0.26017	0.00105	0.50233	-0.0061
UnemploymentRate	0.42865	-0.47774	-0.4829	-0.50663	-0.22099	0.47809	0.13496	-0.17891
VotedForDemocrat	-0.08771	0	0	0	0.23754	-0.10592	-0.09625	-0.21581
AlcoholGallonsPerCapita	0.01025	-0.11335	-0.1267	-0.08372	0.13244	-0.07545	-0.15191	0.14819

	PercentBetween15To34	OfficersPer1000	UnemploymentRate	VotedForDemocrat	AlcoholGallonsPerCapita
FirearmPer1000Lagged	0.3592	0.20567	0.42865	-0.08771	0.01025
Brady	-0.45748	0.14077	-0.4777	0	-0.11335
Year	-0.53588	0.15248	-0.4829	0	-0.12665
BradyYear	-0.46422	0.14652	-0.5066	0	-0.08372
MedianIncome	0.05024	0.26017	-0.221	0.23754	0.13244
PercentInPoverty	0.06423	0.00105	0.47809	-0.10592	-0.07545
PercentBlack	0.2454	0.50233	0.13496	-0.09625	-0.15191
PercentMale	0.34802	-0.0061	-0.1789	-0.21581	0.14819
PercentBetween15To34	1	0.14832	0.2435	-0.17314	-0.03739
OfficersPer1000	0.14832	1	0.01432	0.06608	0.00168
UnemploymentRate	0.2435	0.01432	1	0.20871	0.03262
VotedForDemocrat	-0.17314	0.06608	0.20871	1	0.08078
AlcoholGallonsPerCapita	-0.03739	0.00168	0.03262	0.08078	1

Table 4 Correlation for Canada Data

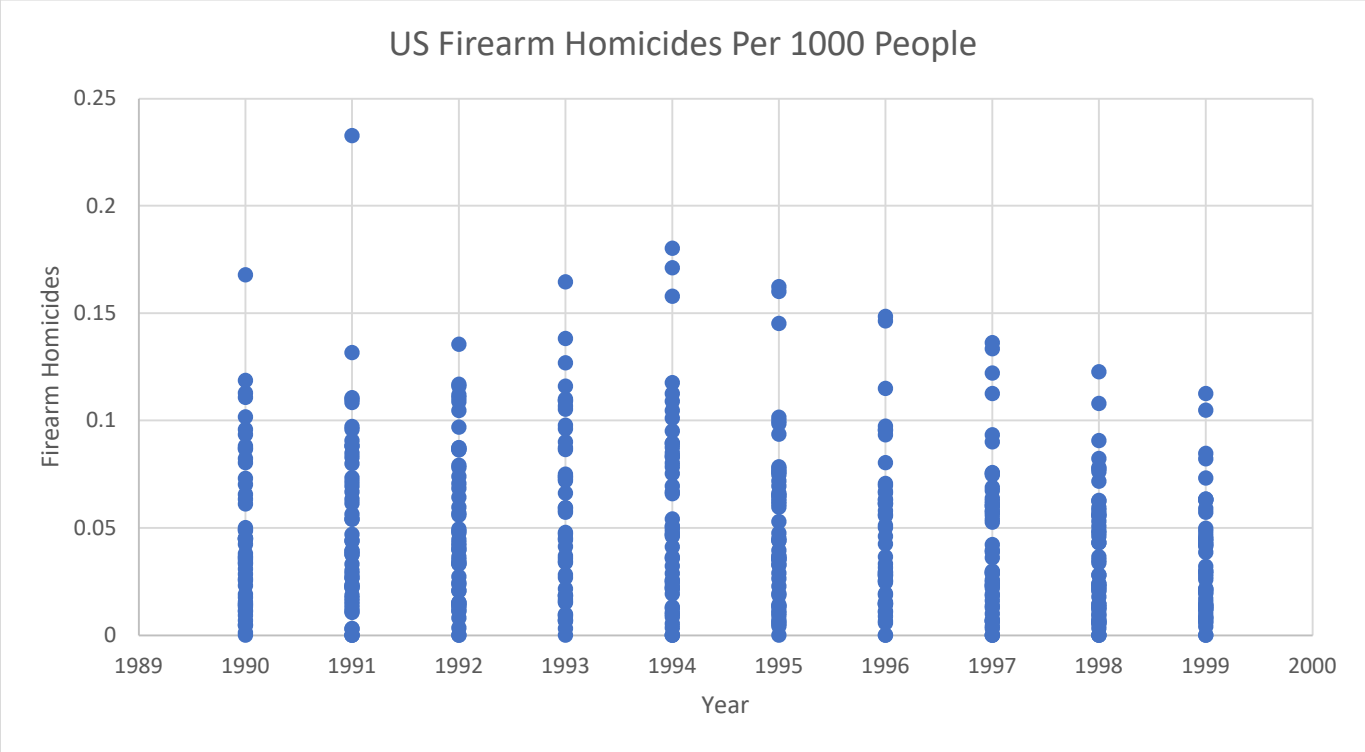
	FirearmPer1000Lagged	FirearmsAct	Year	FirearmsActYear	MedianIncome	PercentInPoverty	PercentMale
FirearmPer1000Lagged	1	-0.08768	-0.12475	-0.07398	0.22563	-0.01126	0.68932
FirearmsAct	-0.08768	1	0.86858	0.82878	0.09948	0.14327	-0.05957
Year	-0.12475	0.86858	1	0.91676	0.12934	0.15138	-0.08829
FirearmsActYear	-0.07398	0.82878	0.91676	1	0.16441	0.18208	-0.07685
MedianIncome	0.22563	0.09948	0.12934	0.16441	1	-0.7705	0.25442
PercentInPoverty	-0.01126	0.14327	0.15138	0.18208	-0.7705	1	-0.08095
PercentMale	0.68932	-0.05957	-0.08829	-0.07685	0.25442	-0.08095	1
PercentBetween15To34	0.65699	-0.17906	-0.2184	-0.18736	-0.12111	-0.01883	0.70173
OfficersPer1000	0.88242	0.02939	0.05071	0.06746	0.31029	-0.17743	0.81273
UnemploymentRate	-0.23986	-0.2665	-0.30589	-0.3075	-0.69604	0.43428	-0.22413
VotedForDemocrat	0.01576	-0.00713	-0.01223	-0.00591	-0.25181	0.0518	-0.01351
AlcoholGallonsPerCapita	0.52948	-0.08025	-0.09442	-0.05039	0.45245	-0.21162	0.74508

	PercentBetween15To34	OfficersPer1000	UnemploymentRate	VotedForDemocrat	AlcoholGallonsPerCapita
FirearmPer1000Lagged	0.65699	0.88242	-0.23986	0.01576	0.52948
FirearmsAct	-0.17906	0.02939	-0.2665	-0.00713	-0.08025
Year	-0.2184	0.05071	-0.30589	-0.01223	-0.09442
FirearmsActYear	-0.18736	0.06746	-0.3075	-0.00591	-0.05039
MedianIncome	-0.12111	0.31029	-0.69604	-0.25181	0.45245
PercentInPoverty	-0.01883	-0.17743	0.43428	0.0518	-0.21162
PercentMale	0.70173	0.81273	-0.22413	-0.01351	0.74508
PercentBetween15To34	1	0.44124	0.44075	0.34437	0.18521
OfficersPer1000	0.44124	1	-0.55341	-0.24259	0.78069
UnemploymentRate	0.44075	-0.55341	1	0.5886	-0.03776
VotedForDemocrat	0.34437	-0.24259	0.5886	1	-0.25259
AlcoholGallonsPerCapita	0.18521	0.78069	-0.03776	-0.25259	1

Table 5: Regressions

	US Lagged Firearms	Canada Lagged Firearms	US Lagged Log Firearms	Canada Lagged Log Firearms
Intercept	-4.97365*	-0.6823*	-148.01695**	98.28432
Brady	-0.0001307	NA	0.11748	NA
Brady_Year	-0.0033**	NA	-0.0935**	NA
Firearms Act	NA	-0.00015477	NA	-0.16371
Firearms Act_Year	NA	-0.00059625**	NA	-0.07958
Year	0.00245*	0.00046005**	0.071**	-0.01053
Poverty Rate	0.00257***	0.00042479**	0.02897**	0.06523
Unemployment Rate	0.00595***	-0.00000478	0.20862***	-0.03285
Median Income	0.000000951***	0.000000199**	0.00001819***	0.00004197*
Percent of Population that is Black	0.20878***	NA	4.50915***	NA
Percent of Population that is male	-0.22668*	-0.57857***	-3.83615	-173.95496***
Percent of Population in the Age Group 15-34	0.37591***	0.10788**	7.93956***	13.001
Number of Police Officers per 1000	-0.00815**	0.00153	0.00771	-1.955
Gallons of alcohol per capita	0.0005057**	0.00253	-0.00876	0.27937
Lean toward Democratic Party in elections	-0.0037	-0.00567***	0.02201	-1.22443***
N	500	94	500	84
R-squared	0.5532	0.667	0.5585	0.4635
Adjusted R-squared	0.5394	0.603	0.5442	0.3451
* = 10% significance				
** = 5% significance				
*** = 1% significance				
State and Province effects are controlled				

Graph 1



Graph 2