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Abstract

This paper is an examination and investigation of the relationship between socioeconomic factors and mass shootings. The objective of this paper was to see if economic policy making could be an effective tool for reducing the level of mass gun violence that America has been experiencing. This paper highlights the known relationship between violent crime and economics and tries to bridge that connection to mass shootings specifically through literature review and econometric testing. The ultimate takeaway from this paper's results and analysis is the need for a universal definition and governing body for data on mass shootings in order to allow the academic community to understand mass shootings better. The econometric results of this paper are not as statistically significant as other papers in the academic community, but the results provide support and evidence for a relationship between socioeconomic factors and mass shootings, and the results carry economic importance, even if they lack statistical significance.

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Socioeconomic Factors and Mass Shootings, 1982-2016

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by

Taylor Petkovich

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Advisor: Dr. Markus P.A. Schneider

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Introduction

The United States has had an ongoing epidemic of mass violence for decades, to the point where the country has almost become numb to the news of a mass shooting in daily life. Every new incident adds to the long list of tragedies that have occurred in this country over its history, and yet there is little action taken to make a change in this trend of violence. After every incident, there are arguments from all sides about what caused the incident, and what could have in theory prevented the violence from occurring. There are arguments regarding gun policy, immigration issues, mental health, and even economic circumstances. This thesis is dedicated to investigating the claims of socioeconomic circumstances, and the effect that the socioeconomic factors have on the potential mass shooting violence that America experiences. Prior to this thesis, I had conducted an incredibly small and limited empirical study of socioeconomic factors and mass shooting, which was focused solely on state data in the year of 2016 as an isolated observation. Although there was some statistical significance found in that empirical paper, it was a very narrow scope of analysis on the available data, and therefore this thesis was designed to expand on the data found in that empirical work, and determine if the results held up when examined with more data over more time, as well as employing analytical skills that have been developed over the course of my Master's program.

In the previous empirical analysis I conducted, the data was limited to only 2016, and the data that was used for the mass shooting variable was incredibly limited. In

addition, some of the variables used for analysis were far more sociological in nature, rather than being heavily economic centric. For this thesis, the timeframe was significantly expanded in order to provide more points of analysis, and the variables were more centered around economic specific variables, rather than including some of the sociological variables included in the previous papers. In addition to the expanded economic data, mass shooting data for this paper was pulled from multiple sources, using a variety of mass shooting definitions, in order to provide multiple angles for focus in the empirical analysis. Along with the expanded data, the empirical work conducted in this paper was more in depth and provided better controls and model creation than in the previous empirical work. Finally, the other major improvement in this paper in comparison to my previous empirical work is the expansion and improvement of the literature review and the theoretical development of this paper. The literature review was not a heavy focus point in the previous work, and as a result that paper did not account for many considerations that have been laid out by existing literature and researchers.

As for the literature on the subject, the review was broken into two sections. The first section of the literature review is focused on investigating the existing field of crime and economics. In this review, I lay out the existing findings regarding the relationship between crime and socioeconomic factors, and then the theoretical argument for expanding this subject to focus on mass shootings is laid out. There is substantial evidence supporting an existing relationship between economic conditions and increase in crime in the United States. After covering this literature in depth, I made a connection between this literature, and the hypothesis that I had developed that worsening economic

conditions may be breeding higher levels of mass gun violence in America. Once this connection was established, the second half of the review was focused on finding existing literature that homes in on mass shooting and economics specifically. In this portion of the review, I find the existing significant factors that have been found, and I elaborated on certain factors that need to be accounted for in any empirical research on the subject of mass shootings. Specifically, the relevance of gun ownership as the most statistically significant variable in explaining mass shootings and acknowledging the lack of significance that mental health seems to play in the empirical explanation of mass shootings. Some of the existing literature also helped to expand the economic variables that were taken into consideration in my own dataset and empirical analysis and provided keys considerations that would have previously been left out of my writing.

After a thorough review of the existing literature on the subject, I laid out the data that was used for this paper's empirical analysis, detailed definitions, sources, and measures. The data and methodology chapter of this thesis also acknowledges some of the limitations of the data that was used. This chapter also laid out the models that were developed, and the controls that were implemented into the statistical analysis in order to produce the best possible models and results given the data that was being used. The empirical analysis for this paper is not a time series analysis, despite the overwhelming evidence that mass shootings have been getting worse over time, the data in this paper was used as panel data of the 50 states over the time period from 1982-2016.

The final chapter of the thesis is the results and analysis chapter. This chapter sums up the results of the empirical tests, providing the coefficients, standard errors, and

p-values of all three of the models that were constructed, as well as summary statistics for all of the included variables. In addition to the tables providing the numerical outcomes, this chapter also includes detailed analysis about the unique results and provides both support and criticism about the results and how the results are relevant to the existing literature, and how this paper can be important in the examination of mass shootings and empirical investigations. The results of the empirical analysis do not provide the same level of statistical significance that was found in the existing literature, but there are some relevant findings, and the results of the empirical work do provide a level of support to the findings from existing academic literature.

Literature

There is extensive existing literature explaining the relationship between crime and economics in society. To examine how economic factors could contribute to the subject of mass shootings, it is important to understand the existing relationship between standard crime and socioeconomic factors. The idea that socioeconomic indicators could be predictive of mass shootings in the United States stems from the existing literature on crime rates and economics. This chapter is an in-depth literature review of the existing contributions on crime, economics, and mass shootings.

In the existing literature on crime and economics, there is evidence that there is a direct relationship between crime and economic factors. Most of the literature is focused on the relationship between violent crime and economics, and those research findings are the main support of the theoretical development of this paper. There is also a portion of the literature that discusses property crime and economics, but since mass shootings are incidents of mass violence, the literature on property crime is not examined in this literature review. As a basic overview, many academic papers have cited that both unemployment and income inequality have significant impacts on crime rates across the United States. The primary authors that present this kind of evidence are Dr. Richard Freeman, Dr. Jeffrey Grogger, and Dr. Ted Chiricos. The evidence that these authors

presented in their own empirical analyses serve as the foundation for this paper's assumptions around socioeconomic factors and violent crime.

Over the course of this literature review, I examine the existing literature on violent crime and economics and use those results to assume that mass shootings specifically would also have a strong connection to socioeconomic factors. Once I have established the assumptions about mass shootings having a relationship with socioeconomic factors, I then examine the existing empirical findings that indicate that mass shootings may be a result of socioeconomic conditions. As a result, the aim of this paper is to provide empirical evidence that mass shootings are a result of poor socioeconomic conditions, and therefore socioeconomic policy could be an appropriate solution for reducing mass gun violence in America. If there is not going to be drastic change in gun ownership policies in America, perhaps socioeconomic policymaking could serve as a sufficient alternative.

The specific evidence for the relationship between basic crime and economics has been examined heavily by economists and sociologists alike over the years. Dr. Richard Freeman is one of the foremost experts on economics and crime. Freeman wrote *The Economics of Crime* in the 1999 *Handbook of Labor Economics*, where he wrote on his findings about the relationship between economics and crime. Before we can examine the conclusions that Freeman made in his paper, it is important to outline some of the assumptions that Freeman made in his work. The first assumption that Freeman works under is that crime prevention is an economic activity. With the amount of spending the government uses for things like police, incarceration, and other "crime prevention" tools,

it becomes an economic activity purely due to the financial resources that are dedicated toward preventing illegal activity. This serves as a primary assumption in Freeman's work and serves as a core assumption of my work in this paper. If this assumption is correct, then economic policy should serve as an appropriate tool for trying to fight violent crime like mass shootings. It is under this assumption, as well as more assumptions that will be illustrated in the literature section, which allow me to create my hypothesis for this paper and to explore the data empirically. Another major assumption that Freeman makes is that crime is just inherently related to economic factors. Freeman says, "The economics of crime is also important because crime is closely related to poverty, social exclusion, and other economic problems." (Freeman, Pg. 3532) Freeman is making this assumption based on the assumption and findings of academics before him that have worked to prove that there is a relationship between things like poverty and unemployment and crime levels. In my work, I make the same assumption, that crime is inherently related to economic problems in a country, and that examining these kinds of economic problems can serve as a useful tool for solving crime related issues such as mass shootings. In the existing literature on crime and economics, researchers put the relationship into the economic theory that individuals behave in a way that allows them to maximize their utility and payoffs from their available options. The first conclusion that Freeman makes in his paper is that "incapacitating" criminals by simply arresting them and making them serve a punishment is not enough to reduce crime in a society. Freeman argues that crime is committed by an individual because the criminal activity is the utility maximizing option for the individual. Freeman writes "most empirical evidence supports

the role of incentives in the criminal decision: legitimate labor market experiences, sanctions including incarceration, and the risk of apprehension all influence decisions to engage in crime.” (Freeman, Pg. 3530) In his own research, as well as his investigation into other existing literature, the consensus conclusion is that labor market experiences, or employment experiences, play a significant part in criminal behavior. If these labor market experiences are negative for an individual, meaning an individual either cannot find employment or the wages from any employment opportunities are not sufficient, they may resort to criminal activity. Criminal activity usually offers higher wages than legal employment methods, to offset the increased risk that comes along with participating in such activity. In addition, Freeman puts crime into a market setting, meaning there is a supply of crime so to speak. Freeman says, “when the elasticity of supply to crime is high, one criminal replaces another in the market; and thus, the importance of deterring crime by altering behavior” (Freeman, Pg. 3530) Freeman is saying that incarceration is not an effective method for stopping crime, but rather there needs to be a focus on changing behavior or motivation for crime. Freeman does not mean there needs to be psychological therapy or counseling, but rather there needs to be change to the economic conditions under which individuals decide whether to engage in criminal activity. This is where my work attempts to build off Freeman’s conclusions. Freeman states that there needs to be economic policy action to try to combat crime levels, and I wanted to make the same conclusion around mass shootings. If the relationship between violent crime and economics extends to mass shootings specifically, then mass shootings could also be reduced in theory through economic policy that

incentivizes individuals to choose different utility maximizing actions that do not involve illegal activity. If individuals make decisions with the goal of maximizing their utility or payoff, then they need to be given better options than crime. This is how I believe that empirical analysis of the relationship between crime and economics, and the bridging of that relationship to mass shootings specifically, can be a useful socioeconomic policy tool for combatting the mass violence that America experiences, and is the main motivation of this paper.

Freeman goes on to explain more connections between crime and economics, “The economics of crime is also important because crime is closely related to poverty, social exclusion, and other economic problems. Most criminals have limited education and labor market skills, poor employment records, and low legitimate earnings.”

(Freeman, Pg. 3532) In this statement Freeman is creating a connection between violent crime and things such as education and employment opportunities. This continues to support the idea that criminals are participating in illegal activity due to the economic options they have, given their financial, educational, or employment standing. I believe that based on Freeman’s statement, that this relationship is a two-way street in a sense. Early childhood education failures, due to lack of funding or other socioeconomic policies to encourage education, make citizens more likely to fall into the wrong circles and engage in criminal activity later in life due to the educational system failures. So, in this instance, the lack of proactive socioeconomic policy leads to criminal activity in the long run, and therefore better socioeconomic policy early on could help prevent crime in the long run. This assumed relationship is a focal point of the theory for my work in this

paper. If there is better socioeconomic policy implemented in the country, then in theory violent crime like mass shootings should be reduced as citizens have better educational opportunities in life. But the connection does not stop there. It is also clear that once an individual has participated in illegal activity, their economic opportunities become even more limited once they have been convicted of a crime, and therefore the options to maximize their opportunity costs become narrower, and it is likely they will return to illegal activity. So, in this instance, it is also important to implement socioeconomic policy that can help those individuals have better legal opportunities to improve their economic standing and maximize their opportunity in life through legal avenues. This also extends to the victims of crimes, not just the perpetrators. Freeman explains that those who are victimized by crimes are usually surrounded by poor economic conditions themselves. “The rate of victimization for violent crimes (which range from robbery to assault to rape) is inversely related to household income.” (Freeman, Pg. 3532) These are examples of violent crime that a community sees that are linked to poorer economic conditions. This is further support for my theory that poor socioeconomic conditions are a main source of the mass shooting numbers that we see in America. This assumption serves as another pillar of my work in this thesis, of trying to connect the evidence of violent crime and economics to mass shootings specifically. Families and individuals who have lower income or are in poorer counties or cities, are more likely to fall victim to violent crimes. This shows that it is not enough to just not participate in illegal activity to avoid being impacted, and that is why proactive socioeconomic policy is vital to

stopping the mass violence we see in America. Just being in a place with poor economic conditions increases the risk of falling victim to violent crime.

The relationship between violent crime and economics is not always just the economic conditions of a criminal, it can also include the victims, which only increases the importance of understanding the relationship between them. Freeman, Dr. Jeffrey Grogger, and Dr. Ted Chiricos all authored papers and did studies in the 1990s confirming the relationship discussed by Freeman in *The Economics of Crime*. Dr. Grogger's 1997 paper, *Market Wages and Youth Crime*, focuses heavily on how the economic conditions of wages impact youths and their criminal activity. Grogger's theories build off of the basic Gronau model of crime and decision making for youths developed in 1977. The original Gronau model's basic idea is based around the marginal magnitude of benefits for a youth to commit illegal activity. However, Grogger criticizes the Gronau model to a degree, saying "it ignores the possibility that there may be fixed costs associated with committing crime. Nor does it account for involuntary un- or under-employment, which may affect young workers if the minimum wage is binding." (Grogger, Pg. 8) Grogger's own model works to incorporate these ideas into Gronau's original model, and Grogger indicates that including considerations for wage and employment does not drastically change Gronau's model's assumptions, it simply improves upon them. Grogger does note that all of these models and research are purely practical because crime is never as simple as a rational economic decision, there is of course human emotion and therefore any economic explanation provided can only be a

portion of the answer to crime rates, which is an important caveat to keep in mind once this research is extended to mass shootings specifically.

Grogger goes on to explain his findings using his improved Gronau econometric model. An individual who had been arrested in 1979 would have wages that were 15% lower than the average for similar individuals and being on probation led to wages 29% lower than the average. These findings support the portion of the crime and economics cycle where those who have participated in illegal activity experience harsher economic conditions. Grogger does note that the probation wage relationship can be a result of probation conditions. Typically, finding a job is a condition of being put on probation, and if an individual does not find a job, this probation may be revoked. Therefore, an individual is highly motivated to maintain their freedom and will take lower paying jobs to avoid going back to jail or prison. Overall, Grogger confirms his belief that youths are influenced by wage incentives, and if the incentives of legal employment opportunities are too low, youths will look for avenues with higher wage incentives, including illegal activity, and crime becomes an economic decision in this way.

In Dr. Chiricos's paper, *Rates of Crime and Unemployment: An Analysis of Aggregate Research Evidence*, he largely summarizes the work of much of the existing research on crime and employment. In 85% of the studies that Chiricos reviewed, there was a positive relationship between property crime rates and unemployment, where property crime rates increased as unemployment increased. In 64% of the same studies, there was a similar positive relationship between violent crime rates and unemployment. Specifically for murder, which would be the main connection to mass shootings, 66% of

the studies showed a positive relationship. This kind of evidence supports many of the assumptions that other researchers and I make in the study of socioeconomic factors and mass shootings. The relationship between poor economic conditions and violent crime like mass murder may not be obvious on the surface, but based on the empirical results, there appears to be a tangible connection between the two. Although these are not overwhelmingly high percentages, there is a consistency to studies finding a relationship of some relevance between unemployment rates and crime rates. However, Chiricos goes on to discuss the results when the data is examined and focused around a more local level, and there is an interesting explanation proposed.

Chiricos says

“researchers using more local data are better able to capture what can be termed ‘milieu effects’ of unemployment on a particular area. That is, high unemployment may have a demoralizing impact on a particular neighborhood or section of a city or county that creates a climate of hopeless or anomie with criminogenic consequences even for those not directly unemployed.” (Chiricos, Pg. 195)

Areas of any state or city that are in particularly poor economic standing are likely to experience higher levels of crime due to a social climate of hopelessness. Chiricos goes on to explain that these differences are less significant when looking at data at higher level aggregate data, so looking at this topic from a national level is not sufficient, rather the data needs to be examined as locally as possible for the true results to show. Studying crime and economics of the United States as a whole will likely tell researchers that there is not a significant relationship, but if this topic is examined at say the county level, there may be better explanations for the relationship.

The findings from Freeman, Grogger, and Chiricos represent just a fraction of the research done by economists to explore crime and economics, but they provide a foundation for the theories of this paper and the examination of the relationship between economics and mass shootings. Similar findings on the relationship between economics and crime can be found in many textbooks, as well as *Economics of Crime* by Eide, Rubin, and Shepherd, and in a variety of essays published in *Essays in the Economics of Crime and Punishment* by Becker and Landes. The theory is here is to see if mass shootings occur in places that are suffering from poor economic conditions, and if so, can there be preventative actions or policies to improve these conditions and decrease the mass violence in communities. Freeman made conclusions from his work that crime was a result of poor educational, employment, and financial opportunities. Based on his conclusions, I make the argument that improving socioeconomic conditions in order to provide better utility maximizing opportunities in life such as better education and employment opportunities, would reduce the number of mass shootings in The United States, under the assumption that mass shootings react to socioeconomic conditions in the same ways that violent crime such as murder and rape react to socioeconomic conditions. Grogger drew the conclusions that violent crime was linked to lower income levels, and that individuals living in areas with lower income levels or more income inequality feel a sense of hopelessness or lack of opportunity, and could therefore resort to crime in response to their economic climate. This serves as another core assumption in my work in this paper. If lower income levels, or higher income inequality seems to be linked to violent crime through existing empirical analysis, then I believe that it will also show a

strong link to mass shootings specifically. Finally, Chiricos found evidence from a wide range of sources on crime and economics that empirically show that there is a link between violent crime rates and unemployment levels. In his conclusions, it can also be assumed that murder has a positive relationship with unemployment levels. This serves as the final assumption for the theory behind my paper, and how I believe mass shootings are linked to socioeconomic factors. With the evidence that unemployment levels are linked to violent crime rates, my paper is aimed at proving that this strong link exists between mass shootings specifically, and unemployment levels. The work of the three authors I just reviewed in depth, as well as supporting papers from Eide, Rubin, Shepherd, Becker, and Landes, serve as the theoretical framework for my paper. These authors all offer different conclusions and assumptions about the relationship between violent crime and economics, and using these conclusions and assumptions, I am attempting to focus in on mass shootings specifically to see if economic policy would serve as a useful tool for combatting the mass gun violence in The United States.

Before a connection can be made from the existing literature on crime and economics to the study of mass shootings and economics, there is an important theoretical debate to discuss first. In most studies of crime and economics, researchers can establish some kind of economic motive, and then develop a model that illustrates the economic and utility repercussions of criminal activity. That is to say, someone committing robbery will be punished with jail time, and when they serve their time and return to the normal world, they will then see the economic impacts that are a result of them being convicted of a crime. The specific point of information here is that the

perpetrator commits the crime with the expectation of surviving, and therefore they make an internal decision to change their economic utility by committing the crime. In a paper published by Justin McCrary at UC Berkeley for *Handbook of the Economics of Crime*, he cites the work of Becker's 1968 development of a crime and economics model. In this model, Becker describes crime as "a point-in-time bet, and crime occurs when the expected utility of taking the bet is greater than the expected utility of turning it down." (McCrary, Pg. 1) In Becker's model of crime and economics, it is viewed as a gamble by the perpetrator, and they are making their decision based on their choices in that moment, and in their mind the payout or expected change in utility from committing the crime is greater than the utility if they continue to operate under legal opportunities. This is also something that Gronau built off of, and the Becker and Gronau models are prime examples of static time allocation models for examining crime and economics, and the work of my paper is also based around a static time allocation model like Becker and Gronau's. This is where the theoretical debate comes in though. In Becker and Gronau's models, they are assuming that the perpetrator will survive their criminal activity, and thus it is worth examining the impact that crime will have on their economic utility. In the study of mass shootings and economics however, most of the shooters do not plan to survive their criminal activity. Many mass shooters have either taken their own life at the end of their rampages, or they expect to be killed by authorities. Therefore, the theory that mass shooters are committing mass shootings in order to improve their economic standing becomes shaky if they do not expect to survive their rampages. I felt it was important to point this argument out, and to explain why I think the connection between

economic factors and mass shootings is still relevant, even if they are not aiming to improve their economic utility. My theory is that when mass shooters reach the point of deciding to commit a mass shooting, they have hit a point where their expectations of their economic utility are so low, that they have lost interest in finding economic improvement opportunities. In response, they commit mass violence in order to make a political statement, and to lash out with their anger about their economic standing, and in their mind their economic utility is basically zero, whether they are alive or dead. Therefore, the economic connection to mass shootings is still relevant, because utility expectations for an individual or community may have gone so low that people would rather die than be market participants. Therefore, there needs to be an examination of how economic utility expectations can be improved in these communities to give people hope that they have better opportunities than dying.

Expanding on this idea, I want to briefly bridge the gap between the assumptions I have discussed about economics and violent crime and how this connection is also reflected in mass shootings specifically. As it has already been established, there is a relationship between economic factors and violent crime, but violent crime covers a wide variety of incidents, and an immediate jump to assuming the same relationship is true for mass shootings is not possible. To bridge this gap, I want to discuss how economic conditions are directly related to all levels of gun violence, and how this relationship relates to the utility problem I just discussed. Gun violence and economics is not just a relationship between murder and economics. Gun violence includes things such as suicide, and suicide is clearly a form of violence that can come from poor economic

standings. These are commonly referred to as deaths of despair, coined by Dr. Angus Deaton and Dr. Anne Case in their book, *Deaths of Despair and the Future of Capitalism*. Although in their work, deaths of despair include everything from overdose from drug use to suicides by firearm, I want to focus on the latter and how that ties into mass shootings, violence, and economics. Case and Deaton outline how working-class Americans are dying from actions they are choosing as they suffer in their current lives. Drug use, alcohol abuse, and suicide are all linked to lack of economic opportunities and poor economic conditions, and as a result, people have no choice but to resort to methods such as these to stop feeling the pain. In my mind, this is a clear connection between how economic factors can play a significant role in why we see mass shootings so frequently in this country. Relating back to the previous paragraph around utility and mass shootings, the shooters may be planning to commit suicide, to become a death of despair, but in relation they also want to make a political statement and bring the community that put them in this position of pain down with them. Suicide by firearm makes up more than 50% of suicides, according to the Suicide Prevention Resource Center (SPRC). This is a clear link between gun violence, specifically suicidal gun violence, and economic circumstances. In addition, according to the FBI Crime Statistics, firearm homicides account for more than two-thirds of homicides each year, and these numbers are rising almost every year. According to the Pew Research Center, in 2020 America saw record numbers of homicide by firearm as well as suicide by firearm. 2020 was also the year we saw unprecedented economic conditions arise due to the COVID-19 pandemic. This seems to signal at the base level a correlation between economic conditions and gun

violence specifically. Of course, we know correlation does not mean causation, but this type of finding is on the key ideas that was used to develop the hypothesis around this paper. The remainder of this paper is about proving that this correlation between economic conditions and mass shootings is not just a coincidence but is a product of a genuine relationship between socioeconomic factors and mass shootings.

The next step is to examine the existing literature on mass shootings and what is known about them. Before the existing literature on mass shootings can be summarized, it is important to understand how mass shootings are defined in the academic space and the criminal justice world. *Table 1* provides a list of the mass shooting definitions that will be used for the work in this paper. The three definitions are the Mother Jones database definition, the Stanford Geospatial Center definition, and The Violence Project definition. Mother Jones defines a mass shooting as an incident with three or more people fatally injured, excluding the shooter, in a public place, and the number of mass shootings does not include crimes of armed robbery, gang violence, or domestic violence. The Stanford Geospatial Center defines a mass shooting as an incident where three or more people are injured, fatally or non-fatally, excluding the shooter, and does not include shootings that are identifiably related to gangs, drugs, or organized crime. Finally, The Violence Project defines a mass shooting as an incident where four or more people are fatally injured, excluding the shooter, in a public place, and the number of mass shootings in this definition does not include crimes of armed robbery, gang violence, or domestic violence. These are the three definitions and data sources that will be used later in this paper for the empirical analysis section. Most other definitions have similar criteria for

defining a mass shooting, the differences being in the number of people involved, whether victims were fatally injured or not, whether the motivation was indiscriminate or not, and whether the shooting was in a public space or not. Obviously defining a mass shooting has a significant impact on the number of data points available, and without a strict definition, researchers can choose which definition perhaps best suits their theory or arguments, and this makes the existing literature inconsistent in results. This paper uses three definitions and data sources to test one hypothesis about mass shootings and economics across multiple definitions to see how the results are affected. Each database forms its own definition of a mass shooting, to either tighten or loosen the range of evidence. Some definitions, like The Violence Project's definition, restrict the number of incidences in return for examining the more deadly incidents, whereas the Stanford Geospatial Center's definition is broader, to incorporate more incidents for analysis. These differences have large impacts on the number of observed incidents and will subsequently create changes in the empirical results of any regression analysis. With more observable incidents, like in the Stanford definition, evidence will hopefully be stronger that these relationships exist between socioeconomic factors and mass shootings. *Table 1*, which gives a detailed examination of the definitions used in this paper, can be found in the Data & Methodology section later in this paper. When it comes to mass shootings, there is already compelling evidence to support that gun ownership and accessibility is by far the biggest factor for mass shooting rates. The United States has significantly higher gun ownership than just about every other country in the world, and subsequently experiences far higher levels of gun violence than basically any other

country in the world. In a 2017 paper, Max Fisher and Josh Keller examine the US in comparison to the international community and how violence and gun levels differ. Fisher and Keller say, “Americans make up about 4.4 percent of the global population but own 42 percent of the world’s guns” (Fisher & Keller, Pg. 2) If gun ownership globally was distributed evenly in accordance with population, Americans own ten times the expected number of guns. Beyond this, Fisher and Keller cite a 2015 study by Adam Lankford that says, “From 1966 to 2012, 31 percent of the gunmen in mass shootings worldwide were American, according to a 2015 study by Adam Lankford” (Fisher & Keller, Pg. 2) Americans accounted for almost one-third of the world’s mass shooters despite making up roughly only four percent of the world’s population. Many researchers have indicated that this increase in level of mass shootings is related to the significantly higher gun ownership levels in the United States. In Lankford’s study, he also found that gun ownership rates in a country correlated with the odds of that country experiencing a mass shooting, and the relationship was true even if the United States was excluded as a statistical outlier. Fisher and Keller state

“More gun ownership corresponds with more gun murders across virtually every axis: among developed countries, among American states, among American towns and cities, and when controlling for crime rates. And gun control legislation tends to reduce gun murders, according to a recent analysis of 130 studies from 10 countries.” (Fisher & Keller, Pg. 3)

When comparing to other societies, critics of the gun ownership argument will point to death rate by mass shooting being lower in the United States than other developed countries. According to Fisher and Keller, from 2000 to 2014, United States death rate by mass shooting was about 1.5 per one million people, whereas these rates were 1.7 per one

million and 3.4 per one million for Switzerland and Finland, respectively. However, if the actual mass shootings across these 3 countries are examined, a different story is told.

Although the death rates by mass shooting for Switzerland and Finland were higher than the US, Switzerland only experienced one shooting during that time period, resulting in 14 total deaths, and Finland only experienced two shootings, resulting in 18 total deaths. In comparison, the US experienced 133 mass shootings during that same time period.

There is a massive difference here in the number of incidents, even if there is a significant difference in population, and the death rates for Switzerland and Finland are higher, but from just three isolated incidents across an entire 14-year period. That is only about one mass shooting every five years, but in comparison the United States experiences nearly 10 mass shootings per year during that same period. For further comparison to the international community, Fisher and Keller say,

“In 2013, American gun-related deaths included 21,175 suicides, 11,208 homicides, and 505 deaths caused by an accidental discharge. That same year in Japan, a country with one-third America’s population, guns were involved in only 13 deaths.” (Fisher & Keller, Pg. 5)

From this information, Fisher, and Keller state that America is 300 times more likely to die by gun homicide or accident than Japan, while America has gun ownership rates 150 times that of Japan. The difference between 150 and 300 indicates that gun ownership alone is not enough to explain the difference in violence between America and the rest of the world. America’s gun ownership controls are some of the loosest in the world. Fisher and Keller further explain

“Switzerland has the second-highest gun ownership rate of any developed country, about half that of the United States. Its gun homicide rate in 2004 was 7.7 per million people – unusually high, in keeping with the relationship between gun ownership and murders, but still a fraction of the rate in the United States.” (Fisher & Keller, Pg. 5)

The difference is Swiss gun laws. Switzerland has much stricter laws when it comes to who can own guns and what guns they can own. Switzerland basically believes that a person must earn the right to effectively own a gun, whereas the United States believes it is an inherent right of the citizen. It was written into the original laws of the country that every citizen has the right to bear arms, and this is not something the United States seems to have any interest in overturning or changing, despite the overwhelming amount of gun violence and mass shootings in America. Dan Hodges, a British journalist wrote a tweet saying, “In retrospect Sandy Hook marked the end of the US gun control debate, once America decided killing children was bearable, it was over.” (Dan Hodges, 2015)

America experienced its largest outcry for gun control after this incident, and nearly a decade later, there has been little to no change in gun acquisition and ownership policy federally in the United States.

The other part of gun ownership and mass shootings that is concerning is the increase in firearm possession following mass shooting events. While there is public outcry for more gun regulations and reduced ownership after an event like that, there are also people who respond to mass violence by acquiring guns for themselves for the idea of protection. The logic behind that is sensible, as one would want to protect themselves if someone else was wielding a firearm against them, and in the past few decades there has been a substantial increase in gun ownership, specifically with spikes in ownership

after nationally covered mass shooting events. In a 2015 paper by Lacey N. Wallace, titled *Responding to violence with guns: Mass shootings and gun acquisition*, Wallace provides a quote from the Vice President of the National Rifle Association (NRA), Wayne LaPierre, who says “The only thing that stops a bad guy with a gun is a good guy with a gun.” (Wallace, Pg. 2) This sentiment is shared by a substantial portion of the community, as individuals feel a civic duty to obtain conceal and carry licenses in order to protect the community in the event of a spontaneous violent event. Wallace goes on to provide a statistic that “the NRA boasts 4.5 million members, claiming a substantial increase since the Sandy Hook shooting.” (Wallace, Pg. 2) As for the exact number of firearms owned in the United States, this is a tricky statistic to pin down. According to Wallace, there is no national firearm registry, so any data on gun ownership is typically drawn from survey data, and therefore must be taken with a grain of salt. In addition, gun ownership tends to be very highly concentrated, where an individual who reports owning a firearm is likely to possess multiple firearms. Wallace cites that there are about 310 million non-military firearms in the US, according to a 2012 report, and this number has almost certainly increased in the decade since that report. Although that comes to about one firearm per US citizen, the 2004 National Firearms Survey showed that only 38% of households reported owning at least one firearm, and only 26% of individuals reported owning one firearm. This shows that the hundreds of millions of non-military firearms in the United States are collectively owned by only about a quarter of the US population. This concentration of firearms is important when considering examining effected areas and mass shooting rates. Of course, the other issue with gun ownership rates is that there

are illegal weapons in the United States that will not show up in purchasing registries or survey data, and this makes any gun ownership statistics even less certain. This lack of accurate gun ownership data is something cited across much of the literature on mass shootings and gun ownership as a constricting factor that makes examination difficult.

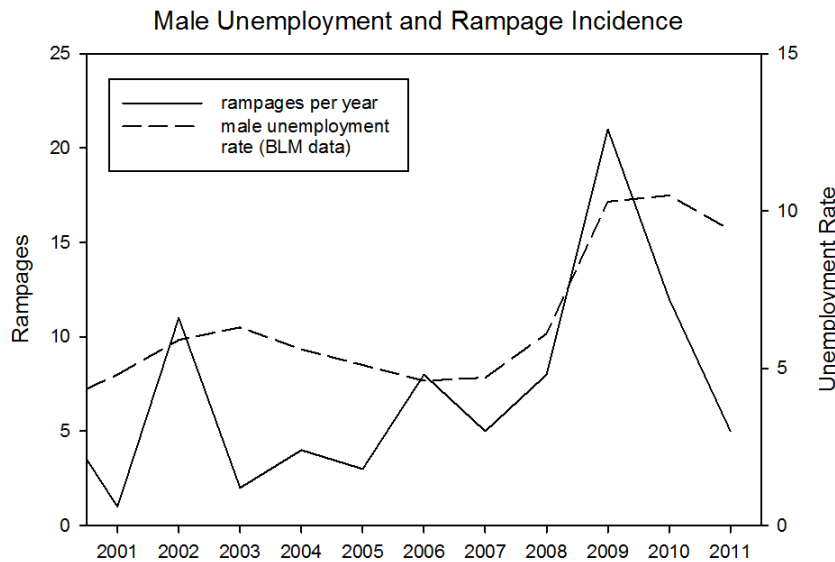
All of this is to simply summarize that the largest existing indicators for the US mass shooting rates are gun ownership and regulation, or lack thereof. These will be heavy factors for the entirety of the time where mass shootings are studied. This is not the main focus however of this paper, or a majority of economic analysis on mass shootings. Instead, there have been a few academics that are actively trying to examine how economic factors impact mass shootings like they effect normal crime.

Before diving into the academic papers that I use for support of my hypothesis, I want to discuss an article from Dr. Peter Turchin, an anthropologist at the University of Connecticut, who wrote an installment of a series that talked about mass shootings and economic conditions in America. Turchin believes that mass shootings are not just a form of crime, Turchin describes mass shootings as “a form of political violence” and claims that mass shootings are a result of individuals seeking revenge on their local community or society as a whole. Turchin’s beliefs on mass shootings led him to believe that these acts of political violence were a product of the conditions of the area or the perpetrator and led him to the exploration of mass shootings and economic conditions. In his article, *The Rise of Mass Shootings During the Decline of Economic Conditions*, Turchin explains the relationship that he has found between these economic conditions and mass shootings. Turchin says that mass shootings have increased over time while the ability for

Americans to cooperate has fallen, and that the increase of competition and status in our society is driving certain groups to be heavily victimized, and as a result a small number of these people resort to mass violence to make a statement about the conditions of this country. Turchin further explains that this is why the two most common place for shootings are workplaces and schools. Workplaces and schools are the two areas where an individual might feel the most alienated or marginalized when it comes to economic or social status, and therefore becomes the place where these individuals make their statement. Turchin does acknowledge that gun ownership is a significant factor in America's mass shooting epidemic, but he wants to explore the factors beyond gun ownership that may feed into the increase in societal competition and pressure. Turchin's primary example revolves around the Great Recession in 2008. During the Great Recession, there was a huge spike in unemployment rates, specifically male unemployment rates, across the United States. Shortly after this spike in male unemployment, there was a spike in shooting rampages in 2009. *Figure 1* shows the graphic that Turchin provided in his writing showing the spike in unemployment and the similar spike in rampages. The key reason I want to illustrate Turchin's findings is because it provides evidence that time allocation or time series models may not be the appropriate method of examining mass shootings and socioeconomic factors. In *Figure 1* it is easily visible that spike in mass shootings occur during similar spikes in unemployment. This graphic serves as evidence that helps me theorize that mass shootings may be the product of the exact economic conditions during that current moment, and not an evolving piece of evidence over time. As a result, Turchin's work

serves as backup for a decision in my methodology to not examine this issue through a time-series lens. Of course, there also need to be tests to make sure that this is not spurious correlation, but that will be discussed during the multicollinearity test portion later in the paper. Of course, correlation does not mean causation, but it is a starting point for investigating if unemployment rates are related to mass shootings rates, which is one of the main points of the hypothesis of this paper.

Figure 1



To build off of the work presented by Turchin, I will now transition to the academic literature and findings around economics and mass shootings. The main economic factors that have been examined in existing literature are income inequality and unemployment. The use of these factors is built on the basic relationship between economics and crime that is already well established. In a 2019 research article by Roy Kwon and Joseph F. Cabrera titled *Income inequality and mass shootings in the United*

States, Kwon and Cabrera recap their empirical dive into this relationship. Kwon and Cabrera conducted their analysis using data from 3144 counties between 1990 and 2015, compiling socioeconomic factors, control factors, and mass shooting data from three different databases on crime. Kwon and Cabrera presented the fact that mass shootings in the United States have been increasing over the past few decades, and during that same time there has been dramatic growth of income inequality in developed economies around the world. In the methodology of their paper, Kwon and Cabrera used

“panel I regression techniques where mass shootings over a 10 year-period are regressed on the first-difference of independent variables measured during the years 1990 to 2000 and 2000 to 2010, respectively (e.g., mass shooting 2000 to 2009 = inequality_{2000–1990} +- controls_{2000–1990}). The data are thus composed of county-decade observations.” (Kwon & Cabrera, Pg.2)

Kwon and Cabrera elected to use panel data for their examination of the question, and this serves as a primary support piece for why I use panel regression data later on in my methodology. In addition to using panel data, Kwon and Cabrera examined mass shootings with robust clustered standard errors, citing that this is a common technical practice when examining rare-events dependent variables, and mass shootings are rare enough to fall under this classification. In my own methodology later on, I employ the same technique of including robust clustered standard errors in my analysis. Kwon and Cabrera theorize that there could be a potential link between these two variables and why they have been increasing over the past few decades. For some numerical facts to go with these statements, Kwon and Cabrera say, “the number of mass shootings involving three or more victim-related injuries increased from a total of 8 in the 1970s, to 115 in the

current decade by the end of 2015.” (Kwon & Cabrera, Pg. 1) On the income inequality side of things, Kwon and Cabrera cite the United Nations saying,

“the increasing bifurcation of national income inequality is particularly acute in the United States, where the top 0.1%’s income increased by 4.0% annually between 1980 to 2011, while the bottom 99%’s income increased by only 0.6% annually from 1976 to 2007. Noteworthy in this regard is many scholars find income inequality linked to a number of social problems, such as increased crime and homicide rates.” (Kwon & Cabrera, Pg. 1)

When referencing these “social problems” in their work, this is a connection that can be made back to the milieu effects that were discussed by Chiricos in his examination of the literature on violent crime and economics. These milieu effects control for things that are not tangible in the social environment of communities. Milieu effects like these can be controlled for in something like panel data because many states or counties will have continuous social beliefs and intangibles facets, and this is further support to why panel regression methods are effective in this research. Kwon and Cabrera continue by saying that across research in the field of public health and epidemiology, there is substantial evidence that income inequality creates instability and hostility in the community. Based on the scholarly findings of crime and homicide being related to income inequality, Kwon and Cabrera then attempted to extend these finding to income inequality and mass shootings. They took an empirical approach to their research and analyzed panel data at the county level for mass shootings and levels of income inequality in those counties over two different 10-year periods. In their findings, Kwon and Cabrera state that

“during each time-period examined, counties experiencing a decrease of income inequality witnessed a mass shootings rate of 6 per 1000 counties, counties with a negligible change of income inequality experiences 30 per

1000, and counties with an increase of income inequality observed 35 per 1000.” (Kwon & Cabrera, Pg. 3)

This first result seems to be a pretty strong indicator that income inequality and mass shootings are related to one another, as counties with an increase in income inequality see a mass shootings rate of nearly six times the rate of counties experiencing a decrease in income inequality, and nearly a 17% increase over counties with a negligible change in income inequality. Kwon & Cabrera state that these preliminary results are not the end of their findings, but it does provide them with evidence that there is an association between the variables. Kwon & Cabrera wanted to make sure their findings were consistent regardless of mass shooting definition. They explain

“the findings indicate that regardless of whether a mass shooting is defined as three or more injuries (IRR = 1.43; CI = 1.24, 1.66; $P < .001$), or four or more deaths (IRR = 1.57; CI = 1.26, 1.96; $P < .001$), income inequality produces a significant positive association.” (Kwon & Cabrera, Pg. 3)

Regardless of whether they used a non-lethal or a more lethal definition of mass shootings, Kwon & Cabrera’s theorized relationship seems to be strong. They also explain that poverty rates do not seem to produce the same results as income inequality does, which shows that mass shootings are not related to poor communities, but rather communities that see a large gap between the upper-class and lower-class people. Even when they retested models while controlling for state-level gun control legislation, the results for income inequality were still significant, both with p-values smaller than .001. They also performed robustness checks on their models, and the results for income inequality were still significant, although the p-value here had changed to .05, so only significant at the 5% level, but still relevant even after robustness checks. After all of

their additional tests, Kwon & Cabrera conclude that their results indicate that socioeconomic factors such as income inequality are “the main driver of mass shootings in the United States” (Kwon & Cabrera, Pg. 5), but I think this conclusion is a little too generalized. Yes, income inequality seems to be a significant factor in the number of mass shootings that a county will experience but making the generalization that socioeconomic factors are the main driver doesn’t seem accurate, given the fact that Kwon & Cabrera even showed that poverty wasn’t significant across their models, as well as the overwhelming evidence that gun ownership rates seem to be the biggest factor in the United States mass shooting crisis. Regardless of this generalized conclusion, Kwon & Cabrera provide an important initial finding that shows that socioeconomic factors could be important in relation to mass shootings, and therefore it becomes worth investigating other socioeconomic and normal economic factors and mass shootings.

In a 2019 paper writing by Abel Brodeur and Hasin Yousaf, titled *The Economics of Mass Shootings*, they further investigate the relationship between mass shootings and economic variables. A crucial point about their paper is that it examines economic conditions both before and after a mass shooting. Brodeur & Yousaf found results about economic conditions leading to mass shootings, as well as long-term, lasting economic conditions that were a result of a mass shooting. The main takeaways from their paper in this literary review will be focused on their predictive findings but understanding the aftershock effects of mass shootings is important for analyzing if mass shootings just create a vicious economic cycle that communities struggle to get out of.

In the introduction of their topic, Brodeur & Yousaf mention that “several qualitative studies point out that for many perpetrators, who are already in a fragile emotional state, a termination of employment is the last straw (e.g., Meloy et. al. (2001))” (Brodeur & Yousaf, Pg. 2) The fragile emotional state of perpetrators can stem from a variety of areas, not just economic conditions, but the qualitative studies like Meloy’s in 2001 show that unexpected unemployment can be the thing that sets a perpetrator over the edge. To investigate this claim empirically, Brodeur & Yousaf documented the socioeconomic conditions around each perpetrator of a mass shootings between 2000-2015, and their definition of a mass shooting was four or more people killed in the event. These factors included age, education, employment status, history of mental illness, marital status, nationality, place of residence and race. They also included data on things they labeled as risk factors for the individual such as financial stress or social rejection, if available. From their data, Brodeur & Yousaf find “40% of shooters were in financial distress and that 45% were unemployed or out of the labor force at the moment of the shooting” (Brodeur & Yousaf, Pg. 3) Those percentages increase to 70% of perpetrators being in financial distress of some kind when only workplace shootings are analyzed in the data. This is a pretty strong starting argument for showing that unemployment rate as an economic condition could play a heavy role in mass shootings rates. Furthermore, Brodeur & Yousaf expand upon the economic conditions later in their paper, where they examine the shooters and the environments they lived in. In their findings, they say

“We see that counties with a successful mass shooting differ systematically from counties without a mass shooting in most dimensions. Specifically, we notice that counties with a successful mass shooting have

much higher jobs per capita, total real earnings per capita, and business establishments per capita.” (Brodeur & Yousaf, Pg. 15)

At first, this result seems to argue that better economic conditions lead to less mass shootings, but these three specific statistics are a result of most mass shootings happening in larger urban areas that will have more people and businesses than small rural areas, so the results should not be surprising, and they do not necessarily indicate that better economic conditions lead to more successful mass shootings. This does offer a cautionary note however, on an empirical approach, because simply comparing counties that experienced a mass shooting versus those that did not will be heavily favored towards larger counties that include major metropolitan areas. Brodeur & Yousaf conclude their determinants analysis by stating that employment factors and financial risk factors are important in examining mass shooting rates, and they suggest that there should be a focus on job-market intervention policies aimed at high-risk individuals, a policy idea first championed by Grogger in 1991 as a solution to violent crime rates. The slight difference between Brodeur & Yousaf’s proposal and Grogger’s is the age range of the targeted individuals, but their ideas are the same. Grogger’s findings seem more focused on the youth, implementing proactive socioeconomic policy in order to provide economic conditions for young individuals, whereas Brodeur & Yousaf are more focused on middle aged adult demographics, but again, the ideas are the same. If there can be proactive socioeconomic policy to improve the income and employment opportunities for communities, then the individuals in those communities, young or old, will have better maximizing opportunities through legal methods. As a result, violent crime, and mass shootings specifically, should decrease as a result of the targeted socioeconomic policies.

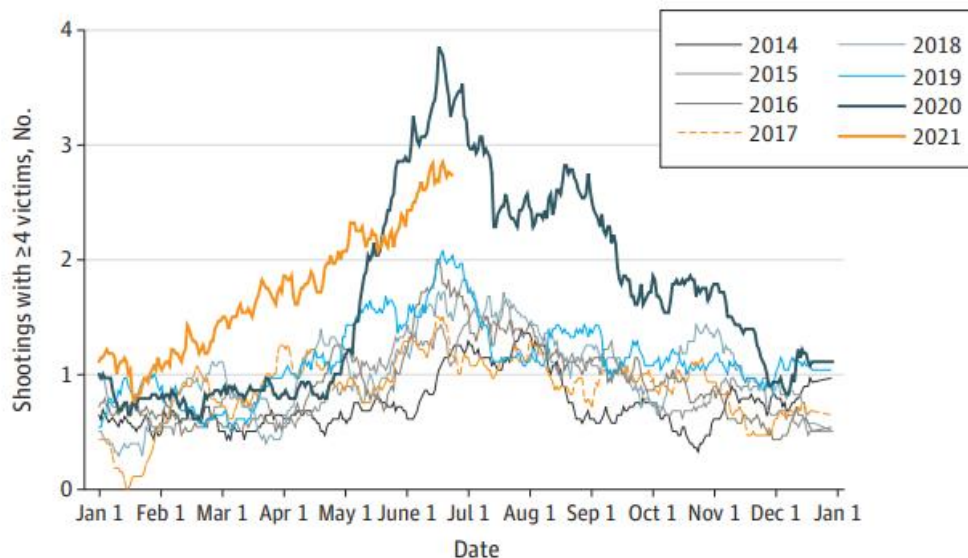
As for the economic consequences of mass shootings, to keep it short, Brodeur & Yousaf do find evidence that counties that experience a mass shooting will suffer long lasting consequences. These economic consequences include a permanent loss of jobs, as well as decreases in earnings by almost 2%. In addition, housing prices tend to decrease following a mass shooting as the community becomes less desirable as it is more susceptible to violence. As a result, the economic conditions in a targeted area will only get worse, and if the existing findings hold true, poorer economic conditions will push that area towards experiencing even more mass violence. This is where the issue between mass shootings and economics can become a cycle where each side feeds off of the other and then an area becomes stuck in a circle of violence and poor economic conditions. This is why there is a heavy push towards policy that targets employment, earnings, and housing prices to try and lift impoverished areas out of this cycle.

Another interesting development in the research of the subject has been the impact of COVID-19. The COVID-19 pandemic has had a significant impact on the entire world, and although the primary focus of concern has been the physical health of the public during the pandemic, the mental health and economic impacts of COVID-19 cannot be overlooked. This was exactly the motivation behind a paper published in September 2021 by Dr. Pablo A. Peña and Dr. Anupam Jena, *Mass Shootings in the US During the COVID-19 Pandemic*. Peña & Jena write “The COVID-19 pandemic imposed sudden and additional psychological and financial strains across society through fear of death, social isolation, economic hardship, and general uncertainty.” (Peña & Jena, Pg. 1) Peña & Jena wanted to examine how these sudden impacts changed the landscape of

mass shootings in the US, looking at mass shooting frequencies before the pandemic and during the ongoing pandemic. They analyzed mass shootings events from January 2014 to June 2021. Their results show that there seems to be a significant increase in homicides, suicides, and mass shooting occurrences during the times of COVID-19 compared to the same time periods in years before COVID-19. This just shows that COVID-19 has had an all-around impact on violence in America. Peña & Jena observe an increase in mass shootings after May 2020, which is roughly when COVID-19 really began to impact individuals and businesses in the United States. “For example, 88 shootings occurred in July 2020, 42 shootings occurred in July 2019, and 45 shootings occurred in July 2018.” (Peña & Jena, Pg. 2) There were more than double the amount of mass shootings in July 2020 as there were in July 2019, suggesting that the impact of COVID-19 could be significant in explaining this spike. *Figure 2* shows a graph of the separate times periods observed by Peña & Jena and the number of mass shootings in each month of each year from their data. Peña & Jena go on to say, “we estimated that following April 16, 2020, there were a mean of 0.78 (95% CI, 0.52-1.04) additional daily mass shootings, 0.49 (95% CI, 0.07-0.92) additional people killed daily, and 3.40 (95% CI, 2.07-4.72) additional people injured daily in mass shootings.” (Peña & Jena, Pg. 2) Not only were there more mass shootings observed during the times after COVID-19 began impacting the United States, but the mass shootings also appear to have become more deadly, as well as resulting in more injuries when compared to the same months in pre-pandemic times. In their brief summary of their study and analysis, Peña & Jena state that there were large increases in the number of mass shootings during the COVID-19

pandemic, and they theorize that this is due to the added social and economic impacts that have come from the COVID-19 pandemic. As the COVID-19 pandemic is still ongoing, the trend of increased mass shooting violence must be included as a factor in the data. It will become even more crucial to include a COVID-19 variable or condition for the future of this research to examine if there is a decrease in mass shootings when COVID-19 is hopefully in the past.

Figure 2



Beyond these references, there are few other academic papers that approach economics and mass shootings from an empirical standpoint. In Brodeur & Yousaf’s 2019 paper, they make the claim that their paper is the first detailed economic analysis of mass shootings. There are of course many articles and sources that theorize that economics may be a factor in mass shootings, but there is not much detailed research on the matter, and that is why the focus of this thesis paper is rooted in an empirical approach. If there is a chance that using econometric modeling and county level data can

provide at least an economic explanation for the mass shooting epidemic in the United States, perhaps it will encourage a surge of econometric analysis from the rest of the academic community. The sources that have been summarized in this chapter provide the necessary base to justify an econometric approach to the question of economics and mass shootings, and without the contributions of the researchers cited in this chapter, the work of this paper would not be possible.

Data & Methodology

This chapter summarizes the methodology used for the empirical analysis of this paper, covering both the data that was assembled, as well as the methods used for testing that data for results. For the empirical analysis of this paper, data was collected for all 50 states from 1982-2016. It is important to note that the District of Columbia was left out of the database due to limitations on collectible data on the socioeconomic variables for DC. The data is restricted to 1982-2016 because this range was the largest date range that could incorporate all the variables for all 50 states. The data for the empirical analysis was assembled at the state level rather than the county level for a few reasons. The main reason is that collecting the data on the socioeconomic variables for the large date range that was selected was more accessible when examined at the state level. For each of the factors, the date range would have become much more restricted if data were found at the county level, and there was no consistency on the date range that could have been available for all the variables at the county level. Of course, this does create a debate about the findings that may come from the analysis. Shootings mainly occur in urban counties, and there is so much variance across any state in terms of population concentrations, especially in states such as California, Texas, and Florida, which experience some of the highest numbers of mass shootings. In order to try and account for this, I used fixed effects for states and years across the data. In the fixed effects, I believe some of the relevant pieces include large urban populated states, such as

California and New York, as well as general social and political views that do not change much over time in these states but are relevant when it comes to any discussion around gun, politics, and economics. These fixed effects also include things like the industry types that are most relevant in every state, as many state economies revolved around a specific industry for extended periods of time, or the general economic culture of a state being blue collar or white collar. Other factors in the fixed effects include cultural beliefs, numbers of hospitals and schools, which may change slightly over long time period observations, but remain relatively constant, and are relevant in the discussion of economic conditions in a state. In my methodology, I prioritized a wider date range of available data over focusing on county level data. The purpose of my paper was to find a high-altitude view of the relationship between socioeconomic factors and mass shootings, and therefore I decided that more years of data at a broader level would provide a starting point for a discussion around socioeconomic factors and mass shootings.

Data on mass shootings was collected from three diverse sources: Mother Jones, Stanford Geospatial Center, and The Violence Project. Each one of these sources represents a different definition of mass shootings, and each source provided its own internal database on mass shootings. The objective of collecting data from these three sources is to see if different definitions of mass shootings produce different statistical results, rather than only focusing on one definition of a mass shooting. *Table 1* provides the three definition databases that were used and the differences in the characteristics of the definitions.

Table 1

Database	Core Definition	Location	Motivation
Mother Jones (MJ)	Three or more people fatally injured, excluding the shooter	Incident took place in a public location	The incident was indiscriminate (excludes crimes of armed robbery, gang violence, or domestic violence)
Stanford Geospatial Center (SGC)	Three or more people fatally <i>or nonfatally</i> injured, excluding the shooter	Incident took place in a public or private location	The incident was not identifiably related to gangs, drugs, or organized crime
The Violence Project (TVP)	Four or more people fatally injured, excluding the shooter	Incident took place in a public location	The incident was indiscriminate (excludes crimes of armed robbery, gang violence, or

The socioeconomic variables for analysis include unemployment rates, personal income per capita, and a Gini coefficient for income inequality. The data on unemployment rates for each state across the years came from the Bureau of Labor Statistics and was calculated as an annual average given the monthly unemployment rates of each state. As discussed in the literature chapter, there is existing evidence that unemployment rate plays a significant role in crime economics and have proven significant in other literature on mass shootings. In addition, there are a great number of mass shooting incidents that have taken place in workplace environments and provides evidence to theorize that changes in unemployment rates could impact mass violence

rates and is thus included in the socioeconomic variables for analysis. The personal income per capita data was acquired from the Bureau of Economic Analysis and is given in dollars. The reason this variable was specifically chosen was because it controlled for population growth over the years by focusing on per capita dollars and was a representation of the financial wealth of the entire population, not just working age individuals. There have been mass shooting incidents where the shooter was not a working age person, and therefore a theorized financial impact may be the result of their family's income situation, not just their individual financial situation. Adults and children alike may feel the pressures of changes in income levels, and therefore looking at the personal income per capita shows the true wealth of every individual, not just those capable of earning income. If individuals in a state have significantly low personal income, they may feel pressure to commit crime, or to lash out in an act of mass violence to fight the political or economic conditions they live in, and thus the inclusion of personal income was included in the analysis. In addition to personal income, a variable specifically for income inequality at the state level was included. The income inequality is represented by a Gini coefficient for each state each year. The data on the Gini coefficient for each state came from a database assembled by professors at Sam Houston State University. Dr. Mark W Frank and his colleagues Estelle Sommeiller, Mark Price, and Emmanuel Saez, created a database on Income Inequality measurements in the United States, using IRS income reporting data. This database is where the data on income inequality for this paper came from. Income inequality has been shown to have significance in crime economics as illustrated in the literature chapter and has also been

shown to be significant in previous papers on mass shootings. Income inequality has been an issue across the United States for decades now and is essential when talking about socioeconomic variables in this country. Like unemployment or personal income, large enough income inequality in a state may lead a shooter to lash out in response to political or economic conditions to send a message about the state of affairs. Due to prior evidence of significance, income inequality needed to be included in the analysis of this paper. Finally, a household firearm rate was included in the analysis to control for the prominence of gun ownership in all mass shootings analysis. The HFR variable, which represents household firearm ownership rates, comes from the RAND Corporation, and was designed specifically for inclusion as a control variable for researchers needing to control for gun ownership, without it being the main variable of focus for analysis. Although gun ownership is not a socioeconomic variable by nature, it is necessary to control for it in any analysis around gun violence. Guns are by far the strongest variable for evidence about mass shooting violence in the United States and excluding it from analysis would result in significant omitted variable bias in the models. However, there could be an argument made that gun ownership is also a representation of economic standing. Guns are quite expensive, whether it is a pistol or something as big as an assault rifle, and purchasing a gun is a significant financial investment. In this way, there could be evidence that gun ownership levels also align with the financial wealth, or lack thereof, in states, and therefore becomes a socioeconomic variable in that way. Regardless of if this speculation is true, gun ownership must be controlled for, and is therefore included in the regression analysis of this paper.

Table 2 provides a summary of the variables used in the analysis, as well as brief descriptions of the variables and their measurements.

Table 2

Variable	Description & Measurements
State	The name of each of the 50 states, this variable does not include the District of Columbia.
Year	A year for every state for the years from 1982-2016.
Mass Shootings (MS)	A count of the number of mass shootings in each state each year. The data for this is different across the three different data base definitions that were used: Mother Jones, Stanford, and The Violence Project.
Total Victims (TV)	A count of the number of the total victims from all mass shooting incidents in each state each year. The data for this is different across the three different data base definitions that were used: Mother Jones, Stanford, and The Violence Project.
Unemployment	This is a measurement of the average unemployment rate in each state each year, represented as a decimal number. The data for unemployment came from the Bureau of Labor Statistics (BLS).
Personal Income Per Capita (PIPC)	This is a measurement of the Personal Income Per Capita in real dollars for each state in each year. The data for PIPC came from the Bureau of Economic Analysis (BEA).
Income Inequality	This is a measurement of the income inequality in each state in each year, represented as a Gini Coefficient. The data for Income Inequality came from a database assembled by Dr. Mark W Frank and his colleagues at Sam Houston State University. Their Gini Coefficients are generated from IRS income reporting statistics.
Household Firearm Rate (HFR)	This is a measurement of the Household Firearm Rate for each state each year. This measurement is represented as a decimal number that represents a factor score. The RAND Corporation created this variable to function as a proxy for gun ownership in the United States across the years.

Beyond the descriptions of the variables, *Table 3* provides some basic summary statistics on each of the socioeconomic variables and the mass shooting variables.

Table 3

Variable	Mean	Std. Error	Min	Max
Mass Shooting (Mother Jones)	0.0467	0.217	0.00	2.00
Mass Shootings (Stanford)	0.185	0.723	0.00	12.00
Mass Shootings (The Violence Project)	0.071	0.270	0.00	3.00
Unemployment (%)	5.940	2.098	2.108	17.233
PIPC (\$)	28,509.29	12,047.63	8,395.00	68,680.00
Income Inequality	0.573	0.045	0.464	0.711
HFR	0.437	0.144	0.034	0.778

This table shows the extreme ends of some of the data. Of course, many of the observations of each state in each year will have a minimum of zero for mass shootings since there are many states that did not experience any mass shooting incidents in a year. The maximum number of mass shootings in any state in any definition is 12 mass shootings. This observation is Florida in 2016 based on the Stanford definition, which is the loosest of the three definitions. Of course, outliers like this one will have a slight skewing effect on the results of the data, but with 1750 observations in total and the

infrequency of these extreme outliers, the impact should not be significant enough to remove those outliers from the analysis.

Furthermore, it should be explicitly stated that the methodology of regressions for this paper is not a time series analysis. There is much evidence that over the last 30 to 40 years, there has been a significant rise in the number of mass shootings the United States has experienced, and some researchers have conducted time-series analyses of this to examine the drastic increase over the years. The objective of this paper, however, is to examine mass shooting events as independent occurrences and to examine the specific socioeconomic conditions at the time of the incident. By isolating the incidents in this way, the analysis is focused on just the present conditions at the time of the incident unique from changes of factors that occur over the decades. In addition, in the loosest definition of mass shootings, the Stanford definition, which has the most observations of mass shootings, some states only experience one mass shooting between 1982 and 2016 (i.e., Alaska, Connecticut, Hawaii, etc.) so there is no sequence of data points to examine in a time series sense. Although there is evidence that mass shootings in the US have increased over the years, this may not be true for each individual state, and therefore time series analysis may not be proper for state level analysis. In the stricter definitions of mass shootings, there are states that do not experience a single incident from 1982 to 2016, and this is relatively common in those definitions for many states. This means that there is no change in the data of the mass shootings over time, and this would make a time series analysis of the problem weaker, which provides further reasoning as to why this paper isolates the data to the individual observations as snapshots in time, rather than

using time series analysis. As a result, the regression analysis conducted on these variables is controlled for panel data and fixed effects unique to the states and years. In addition, the standard errors produced in the results in the next chapter are clustered standard errors, which is the common method of producing the standard errors in panel data models. When observing the states across the years, there are many factors about the states that will not change over the years as data is observed for the state. The geography and many of the demographic attributes of the states have little to no significant change over the years, so by controlling for these fixed effects, the analysis is observing and acknowledging consistent factors at the state level that may not be explicitly stated in the models. For the regression analysis, there are a total of three models that were analyzed. Each model includes all of the socioeconomic variables that were gathered, and then each model uses a different mass shooting definition for the data on the number of mass shooting incidents.

Results & Analysis

This chapter provides a summary of the regression results of the three models that were illustrated in the data and methodology chapter. The results of the empirical tests provide many useful pieces of information regarding the hypothesis, the support or existing literature, and the strength of the methods used for this paper's analysis. In brief, the actual coefficients and significance of the variables are not incredibly noteworthy. However, even though there is not much consistency in the statistical significance, the signs of the variables support most of the existing literature, and the lack of results in this paper supports the methodology of other papers in the literature. In this chapter, there will be a discussion about the numerical results of the models, what these results say about the hypothesis, how the results support the existing literature, and finally the limitations of these results.

Before diving right into the results of the three models, there are a couple of notes that should be established. The first is that the R^2 for each of the models is quite low, and therefore it can be concluded that these models are not the most sufficient illustration of the issue around socioeconomic factors and mass shootings. As a result of the R^2 values, there was a check for multicollinearity between the variables using variance inflation factors. Between most of the variables, the VIF scores are not high enough to imply any significant multicollinearity, except for the variables for PIPC and HFR. The main reason

the VIF scores are so high for these variables is due to natural increases over time, and therefore they are heavily correlated to the year variables in the data. PIPC increases most years due to natural inflation, and HFR is heavily correlated with the year variables because gun ownership tends to rise after mass shootings, and as mass shootings have increased over the past few decades, so has gun ownership rates, and this is why we see highly inflated VIF scores for PIPC and HFR in the models. A potential fix for this in future work would be using Real PIPC which has been adjusted for inflation over the years, and this would reduce the VIF score for that variable in the models and could provide stronger results in future work.

In *Table 4*, the results of each of the models constructed are illustrated, providing the coefficients, the clustered standard errors, and the p-value significance of each of the variables used in the models.

Table 4 – OLS Regression Results

	MJMS	SGCMS	TVPMS
Unemployment	0.006 (0.005)	0.004 (0.01)	0.007 (0.009)
PIPC	3.1e-06 (2.0e-07)	-1.7e-05+ (9.6e-06)	3.9e-06+ (2.2e-06)
Income Inequality	0.531+ (0.277)	2.090** (0.716)	-0.173 (0.166)
HFR	-0.178 (0.157)	-1.660** (0.613)	-0.061 (0.196)
Cons	-0.256 (0.206)	0.352 (0.440)	0.036 (0.174)

SEs shown in parentheses + p<0.1, * p<0.05, ** p<0.01

This first model is focused on the number of mass shootings in each state across the time period, and the count of mass shootings is based on the definition from Mother Jones. From this model, there is only one result that shows some level of statistical significance. In this model, Income Inequality is statistically significant, but only at the 10% level, which is not usually considered strong enough to use as relevant findings, but it is still worth pointing out considering the rest of the variables do not display significance. According to the model results, an increase of 0.10 in a state's Gini Coefficient for income inequality would lead to an extra 0.531 expected mass shootings in that state in a year. The results from this variable are supportive of the existing findings in the literature that higher levels of income inequality point towards higher

levels of mass shootings. As for the other variables, they may not be statistically significant, but their coefficients signs can still provide support to the existing literature. Although the Unemployment coefficient is pretty small, indicating that a 1% increase in the unemployment rate would point towards an additional 0.006 expected mass shootings in a state, the sign is positive, which supports the theory that higher levels of unemployment would lead to higher mass shooting rates. The other two variables in the models, PIPC and HFR, provide the most inconsistent and controversial results across all of the models. In this model with the Mother Jones definition, neither of these variables are statistically significant, and the signs of their coefficients go against the theoretical relationship that exists in most of the existing literature. According to the coefficient for PIPC, higher levels of Personal Income Per Capita point towards higher levels of expected mass shooting incidents. The results show that a \$1,000 increase in PIPC would lead to 0.031 more expected mass shootings in a state in a year. This goes against the previously theorized relationship that lower levels of income would lead to higher mass shooting rates. Some of this discrepancy is due to states like California and New York, which have high PIPC levels, but are also the most populous areas of the country and are more likely to experience mass shootings compared to many other states. This relates back to the potential importance of collecting county level data rather than state level, because the state level may be a bit too broad and produce results like the coefficient for PIPC in the Mother Jones model that do not follow the existing literature and findings. As for HFR, the coefficient is a very controversial results from the OLS model. According to the coefficient for HFR, higher levels of gun ownership would lead to less expected mass

shooting rates in a state. From the results, a 0.10 increase in HFR would predict 0.178 fewer expected mass shootings in a state in a year. This finding violates all of the existing knowledge that mass shootings are very obviously linked to the high levels of firearm ownership that the US has. The other results will be discussed in the remaining paragraphs for the other models, but this result for HFR holds consistent across all of the models. My conclusion is that the HFR variable from the RAND Corporation does not serve as a sufficient control variable for firearm ownership rates. In the development of this variable, it must incorporate too many unique factors that would be relevant to have broken out into the analysis when controlling for gun ownership, and thus these internal factors are leading to results that completely go against the understanding of firearm ownership and mass shooting rates. In future work, it would be beneficial to find a different indicator of household firearm ownership levels because there is clearly some included factor in the HFR that causes it to violate most of the existing literature.

The next model is constructed around the data for the Stanford definition of mass shootings. As a reminder, the Stanford definition is the loosest definition, which provides more mass shooting incidents recorded over the years. This difference in recordable incidents is significant because the results of the Stanford model are quite different from those in the Mother Jones model. In comparison to the Mother Jones model, the Stanford data set contains about 140 more total mass shooting incidents, so the observed data in this definition is drastically different compared to the Mother Jones dataset. The results from this model are fascinating, but that is not necessarily a positive thing for the hypothesis of this paper. In the Stanford model, three of the four independent variables

show some level of statistical significance. PIPC is significant at the 10% level, which is not as relevant as 5% significance, but Income Inequality and HFR are both statistically significant at the 1% level which is very relevant for the findings. In the Stanford model, the Unemployment variable remains insignificant, but the coefficient's sign is still positive, which continues to at least support the theorized relationship between unemployment and mass shootings. For PIPC, the coefficient is now negative, compared to the positive result in the Mother Jones model. So now the results are telling us that higher levels of PIPC would predict fewer mass shootings, which does support the theorized relationship. The coefficient indicates that a \$1,000 increase in PIPC would lead to 0.17 fewer predicted mass shootings in a state in a year. Again, this is only significant at the 10% level, but it is especially worth pointing out since the relationship of PIPC to mass shootings has flipped between the models. This change in relationship is partially due to the additional observed incidents that come from the Stanford definition. With the looser definition, there are more data points of mass shootings to analyze the independent variables against, and these additional observations have led to the model predicting a different relationship between PIPC and mass shootings. Next, the model tells us that Income Inequality is highly significant in observing mass shootings with the Stanford definition. The coefficient for Income Inequality is much higher in this model, indicating that a 0.10 increase in the Gini Coefficient for a state would lead to 2.09 more expected shootings in a state in a year. This is a very big finding if true because two whole additional shootings for an increase of 0.10 in income inequality has major real-world implications and reinforces the idea that socioeconomic policy could literally be

saving lives if the theorized relationship is true. As for HFR, the coefficient is still negative, but the magnitude of the coefficient is much larger than in the Mother Jones model. According to the Stanford model, a 0.10 increase in the HFR of a state would predict 1.66 fewer expected shootings in a state in a year. This also has very big implications for the real world, but again, this result is highly questionable considering it violates the known existing relationship between firearm ownership and mass shootings. Across the Stanford model, the results for PIPC, Income Inequality and HFR all have larger magnitude coefficients, and exhibit higher levels of significance than in the Mother Jones model, as well as a changing relationship between PIPC and mass shootings. The explanation must just be that the increased number of observations of mass shootings in this specific dataset's definition leads to the drastically different results. This is an instance where it is worth noting how the different definitions of mass shootings can play a significant role in affecting the empirical analysis and discussion around socioeconomic variables and mass shootings. The difference in results between the Mother Jones models and the Stanford models is drastic in many ways, even though both definitions are tracking the same variable in theory, even if the other data around the definitions is limited, i.e., state level data rather than county. This is just something that is important to consider around all future literature regarding socioeconomic factors and mass shootings, and this also indicates that determining a universal definition or source for academic analysis could be beneficial to the study of this subject.

The last model that was constructed is based around the definition of mass shootings defined by The Violence Project. The definition from The Violence Project is

similar to the definition from Mother Jones, but it has some slightly different parameters, and therefore the counts of mass shootings is slightly different, but close to the Mother Jones dataset. The Violence Project data set has about 40 more mass shooting incidents in comparison to the Mother Jones dataset, which is significantly closer to the Mother Jones data than the Stanford data was. In the TVP model, only one variable shows any kind of significance, similar to the results of the Mother Jones dataset. Only in this model, the one variable with significance is the PIPC variable, and it is only significant at the 10% level, and the coefficient has become positive once again, which goes against the hypothesized relationship. According to the results, a \$1,000 increase in PIPC would lead to 0.036 more expected shootings in a state in a year. As for Unemployment, the coefficient is still rather small and not significant, but the sign on the coefficient has remained consistent across all three of the models and does support the hypothesis that higher unemployment levels would lead to more expected mass shootings. In the TVP model, Income Inequality's results differ from the previous two models. In the TVP model, Income Inequality now has a negative sign in front, which is very surprising. According to the TVP model, higher levels of income inequality would predict fewer mass shooting incidents in a state. This is surprising because it goes against many of the findings in the academic community, and it is a different result from my previous two models. From the results, the coefficient tells us that a 0.10 increase in the Gini Coefficient would lead to 0.173 fewer expected shootings in a state in a year. This change in relationship is hard to pinpoint, but it is likely due to the additional 40 recorded incidents in the TVP definition compared to the Mother Jones data. The location and

conditions of these additional 40 observations must have been in areas that had with smaller income inequality rates, causing the model to predict that areas with higher levels of income inequality see less mass shooting violence. Once again, I think this result provides support for a universal definition of mass shootings. With another different definition, the resulting relationships have once again shifted to provide entirely different conclusions. This further supports the idea that researchers could focus on one definition that ultimately gives them the results that they would want for their hypothesis because the results change so much across different definitions. This constant change across definitions also makes it harder to establish a clear relationship between socioeconomic factors and mass shootings and makes it even more difficult to prove that socioeconomic policy could be an effective tool for fighting the mass shooting epidemic that America is experiencing. The final variable in the model is HFR. In the TVP model, the coefficient for HFR is still negative, and the magnitude is now smaller than even in the Mother Jones model. From the results, the model predicts that a 0.10 increase in HFR would result in 0.061 fewer expected shootings in a state in a year. In this model, it is not statistically significant, and the coefficient has gotten smaller, but it still goes against the known relationship between firearm ownership and mass shooting rates and continues to support my conclusion that HFR is not an adequate control for gun ownership. It is not entirely surprising that Unemployment and PIPC align with the Mother Jones models considering there is not a drastic difference between the total number of mass shootings across the two data sets, but the differences across the data sets may be where those shootings are located, and the corresponding socioeconomic data at the times of those additional

shooting observations. This is likely what impacted the results for Income Inequality that do differ from the Mother Jones model.

Across all of the models that have been analyzed, there are only a few universally consistent results. Unemployment is consistent across all three models, producing a positive, but small and insignificant, coefficient across all three of the models. The results of the coefficient do at least provide support to the hypothesized relationship that higher unemployment levels lead to more mass shootings. The consistent result is a positive sign for the discussion around socioeconomic factors and mass shootings, as the relationship did not change despite the large variety in the definitions and the number of recordable incidents. Although it was the only variable to never exhibit statistical significance, it is perhaps the variable that provides the most support to the existing literature's findings because the relationship is consistent, and in future work the results could prove more significant if data were collected at the county level. For PIPC, the results varied across all three of the models. In the models with fewer observed incidents, Mother Jones and The Violence Project, the coefficient for PIPC was positive and had a relatively small magnitude. The variable also showed some statistical significance in the TVP model, at the 10% level. However, in the Stanford model, which has significantly more observations, the sign on the coefficient became negative, therefore flipping the relationship between PIPC and mass shootings. In the Stanford model, the result for PIPC supported the hypothesized relationship that higher levels of income would lead to fewer expected mass shootings. The inconsistency across the models is likely due to the variance of observations across the three different definitions. This variance also leads to

changes in results and the relationship between Income Inequality and mass shootings. In the Mother Jones and Stanford models, the coefficient is positive for Income Inequality, indicating that higher levels of income inequality would lead to more mass shootings, supporting the hypothesized relationship. However, in the TVP definition, this relationship changes and indicates the opposite result. The change in definition and the location of recordable incidents has drastically changed the results relationship. My conclusion is that the largest takeaway from the PIPC and Income Inequality results is the need for a universal definition of mass shooting for academic analysis. The resulting relationships have too much variance across different definitions, and therefore establishing a clear argument for or against socioeconomic policy as a tool for preventing mass shootings is difficult.

Across the models, the result for HFR was consistent, but not in any of the expected ways. HFR proved to be very statistically significant in the Stanford model but was insignificant in the other two models. Much of the existing literature indicates that gun ownership is by far the most highly correlated variable with the level of mass shooting rates this country sees, so it is very surprising that HFR was not statistically significant across all three of the models. In addition to the lack of universal significance, the coefficient for HFR was negative across all three of the models, which goes against the known relationship between gun ownership and mass shootings. In all three of the models, the predicted results are that higher HFR levels would predict fewer expected mass shootings in a state in a year. My conclusion around this lack of consistency, and deviation from existing literature, is centered around the fixed effects that are wrapped up

into the state data, and how those fixed effects are likely wrapped into the HFR data as well. As a result, these invisible fixed effects are virtually appearing twice in the data, and therefore making a portion of the HFR variable redundant, thus limiting its significance. In future work, there probably needs to be a better way for controlling for gun ownership, as it cannot be omitted from the analysis, but the results from HFR clearly indicate that the relationship in these models is flawed. Determining the proper control variable is very difficult though, as the nature of measuring gun ownership is of course a gray area, as it was illustrated in the literature review. Gun ownership data is largely based on self-reported information in surveys, and there are illegal weapons that cannot be measured either. As a result, creating a variable like HFR that is a decimal representation of household firearm rates makes many internal assumptions around gun ownership and the associated communities, and leads to flawed relationships in the econometric analysis using this variable. The results may also have been insignificant due to the limitations of the data that have already been described, such as the issue of state versus county level data.

One last addition that I would like to discuss in the results and analysis section is the results of another model as support for what I have found so far. As an additional test of the data and my theory, I analyzed the three models as Poisson regressions to examine the data through the count data lens. Table 5 provides a summary of the Poisson model regression results.

Table 5 – Poisson Regression Results

	MJMS	SGCMS	TVPMS
Unemployment	0.184 (0.128)	0.124+ (0.065)	0.109 (0.096)
PIPC	5.2e-05 (3.5e-05)	-7.1e-05** (2.6e-05)	6.8e-05+ (3.7e-05)
Income Inequality	0.784 (8.84)	-1.68 (3.69)	-1.52 (2.63)
HFR	0.226 (4.46)	-1.420 (2.14)	1.18 (3.21)
Cons	-26** (6.19)	-1.73 (2.53)	-5.31+ (2.72)

SEs shown in parentheses + p<0.1, * p<0.05, ** p<0.01

When it comes to mass shootings, it is not possible for the count of mass shootings to be negative, which is why I considered using a Poisson model for my analysis. By examining the dependent variable through a count data lens, I had hoped to create more statistical significance or clarity to the results. The results of the Poisson analysis did not change much of the significance, and I believe that this could be due to mass shootings not being entirely independent observations. For a Poisson regression, the events must be independent of other observations, so that one observation does not impact the likelihood of seeing another observation. I believe when it comes to mass shootings, they are not completely independent of one another, due to imitations and socioeconomic links. If mass shootings are connected to one another, and the occurrence

of a mass shooting leads to imitations and other violent outbreaks, then they are not entirely independent observations, and therefore the Poisson model does not provide results that are significantly different from the standard OLS regression. The biggest changes between the OLS results and the Poisson results are the magnitudes of the coefficients and the standard errors. When mass shootings are represented as count data, some of the significances change as well. In these results, Income Inequality and HFR never come up as statistically significant at any level, and the signs on the coefficients are changing across models, continuing to display that the differences in definitions and recordable incidents play a huge role in the resulting relationships between our socioeconomic variables and mass shootings. Across the three models in the Poisson regression, Unemployment comes up as significant at the 10% level in the Stanford model but is still insignificant in the Mother Jones and TVP models. Similar to the OLS results, the coefficient does remain positive across all three models, and continues to provide support for the hypothesized relationship. Finally, the results for the PIPC variable are inconsistent across the models but produce results similar to the OLS models. In the Stanford model, PIPC's coefficient is negative, but the coefficient is positive in the Mother Jones and TVP models, just like in the standard OLS regressions. Another consistency in the results is when PIPC is significant. In both the OLS regressions and the Poisson regressions, PIPC is significant in the Stanford and TVP models, but remains insignificant in the Mother Jones model. There are some consistencies across the two methods of analysis, but overall, the resulting relationships continue to be inconsistent

across the three definitions, which I believe further emphasizes the need for a universal academic definition of mass shootings.

The results of this empirical analysis do not provide the same hard evidence of the relationship between socioeconomic variables and mass shootings like papers from Kwon & Cabrera or Brodeur & Yousaf, but the results show how it is important to focus on what data is being used, and how the dependent variable is defined. This also goes for the data size and collection method. The definition of mass violence is important, but this paper also shows that examining data at the state level is not enough. In media and politics, there is a tendency to look at issues at a macro level, and the findings can be generalized to represent a state or even the country as a whole. But examining the issue at the state level like this paper did is not a sufficient examination of the problem. The models are incomplete, and the state level analysis is too broad. The diversity in The United States extends all the way to a county-by-county level, and therefore any research in the future on this subject must be done at the state level. The results of this paper's empirical analysis are weakened by the lack of county level data, but the results do provide an emphasis on the importance of county level collection like the work done by Kwon & Cabrera and other researchers. Examining the data at the state level is too generalized, and across my research I have come to see that it is not enough to examine this subject on a state-by-state level. With more time and resources, the results of this paper could be significantly different if data were collected at a county level. But for the purpose of this thesis, the examination was conducted at the state level, and I acknowledge that this does weaken the validity of my results and claims. However, the

limitations of this paper's methods do not mean that the hypothesis and the results do not provide support to the field of research. A majority of the results do support the hypothesized relationship between socioeconomic variables and mass violence, and if the data were expanded to the county level, the strength of these findings would likely support the findings of researchers like Kwon & Cabrera and Brodeur & Yousaf. In future empirical analysis, it would be beneficial to focus on data at the county level, as well as homing in on one definition, for consistency in the dependent variable. I do believe that this paper's results provide support for the existing literature in the academic community, as this paper shows that state level analysis is not sufficient, but that the hypothesized relationships are mostly consistent with that of the findings in the existing literature. However, just because the results do not come out entirely statistically significant does not mean that they do not carry economic importance. This is an idea that has been championed by Dr. Deirdre N. McCloskey and Dr. Steve Ziliak. In their paper *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives*, they discuss how the focus on statistical significance is detrimental to our development and understanding of certain aspects of economics and other subjects. Their main argument is that although something is not statistically significant when it pops out of a model, does not mean that it does not carry significant importance in the real world. They emphasize a need for focusing on scientific inference and rational decision making. If a result is not statistically significant at the 5% level, many times it is thrown out as irrelevant, but if that result indicates that there could be higher levels of mass shootings for example, then that result carries the implication that many real-world lives could be

drastically impacted, even if it is not flagged as statistically significant. This is not to say that my results indicate a level of real-world significance that cannot be ignored, as many of the coefficients are small, but I want to illustrate that results should not be disregarded just because they do not hit some statistical threshold. I believe the results I found in my analysis do support the developing theory around socioeconomic factors and mass shootings, and that the coefficients, however small they might be, do carry the weight of life and death, literally. Any additional chance or predictability around mass shootings holds people's lives in its hand, and just because a result does not meet a 5% threshold does not mean we can overlook its importance when it comes to the lives that may be saved if we can prove this relationship exists.

The largest takeaway from these results is my idea for a universal definition. When it comes to data for variables around economics or crime, there are universally accepted sources of data, and governing authorities for this data, such as the Bureau of Economic Analysis or the Department of Justice and the FBI. These are federally created agencies and organizations that become the leading authorities on definitions and data collection for their respective subjects. But when it comes to mass shootings, there is no federally backed organization that is solely dedicated to the research and understanding of these incidences of mass violence that are so much more prevalent in our country than anywhere else in the world. The results in my analysis show the vast differences in observations and results around mass shootings when examining the data across just three different definitions. As a result, any research on the subject can be easily manipulated to fit a researcher's ultimate goal, or what they want to prove with their research just by

choosing a definition that gives them the best outcome. This makes it very difficult to draw real conclusions about mass shootings and socioeconomic factors, given how ambiguous the results can be. That is why I propose a universal governing body be created by the federal government that is dedicated to tracking and studying mass shootings, as well as the perpetrators. With a governing body like this, the academic community would have a definition to rally around for the study of the subject, as well as deeper data about the incidents and the shooters, and with this deeper data, hopefully there would be genuine findings that could be accepted as clear indications about whether socioeconomic factors are relevant when it comes to studying mass shootings.

Conclusion

The hypothesis of this paper was that socioeconomic factors must play a role in the amount of mass violence, specifically mass shootings, that America sees every year. The work of this paper was built off of the theoretical framework of the studies around crime and economics. In the literature for crime and economics, there is a clear connection between factors such as unemployment and income inequality and violent crime levels. I used this connection, as well as many of the theoretical assumptions made by previous researchers, to develop my own theory that mass violent crime like mass shootings, must also have a clear connection to these socioeconomic factors. Once I had established my own hypothesis on the matter, I examined the existing literature that discussed mass shootings and economics. This literature concluded that mass shootings shared a relationship with poorer economic conditions, showing a strong empirical connection between unemployment, poverty, and income inequality to mass shootings across the United States.

After I had examined the literature on the subject and developed my hypothesis and approach to researching the topic for myself, I developed my database for my empirical analysis of the subject. In my data, I collected mass shooting data from three different sources in order to examine my theoretical question across different definitions to see if the results were universal across the sources. I collected data on the number of

mass shootings between 1982-2016 under each of my chosen definitions. For my independent variables, I collected data on Unemployment, Income Inequality, Personal Income Per Capita, and I had a control variable for firearm ownership, which is empirically the most significant variable in the existing literature on mass shootings. I examined these variables across my six models, using mass shooting occurrences and total victims, to see if my data and methodology supported the existing literature. Across all three of the OLS models results, as well as the Poisson models results, Unemployment displayed a positive relationship to mass shootings, supporting the hypothesis that higher unemployment levels would predict more mass shooting incidents, but the variable was only statistically significant at the 10% level or better in one of the Poisson models, and never significant in the OLS models. PIPC had inconsistent results across the models, whether it was examined through OLS or Poisson. In both sets of results, PIPC was statistically significant at the 10% or better level in the Stanford and TVP models, but never in the Mother Jones model. In addition, the resulting relationship between PIPC and mass shootings changes across the definitions. In the Mother Jones and TVP models, PIPC indicated that higher PIPC would predict more mass shootings, which went against the hypothesized relationship, but in the Stanford model, the relationship was supported when the coefficient for PIPC came out as negative. This variance is likely due to the difference in recordable incidents and the location of incidents across the definitions. Income Inequality was also inconsistent across the models regardless of whether it was the OLS models or the Poisson results. Income Inequality appeared as statistically significant in the Mother Jones and Stanford models in the OLS regressions, but never in

the Poisson regressions. In addition, the resulting relationship was also flipping back and forth across the different definitions and databases. This further emphasizes the need for a universal definition in my opinion. The final independent variable was the firearm ownership rate. This variable was not significant in every model, despite it being the most obviously correlated variable to mass shootings in the existing literature. In addition, the coefficient for this variable was negative across all three of the OLS models results, indicating that higher firearm ownership results in fewer predicted mass shootings. This finding violates most of the existing literature's findings and leaves a lot of question around HFR and mass shootings. My conclusion from this result is not that HFR is a poor measurement of firearm ownership for a control variable, but that there are many factors that are wrapped up into the HFR that are also existing fixed effects in the state and year variables in my analysis. In this way, the variables are connected, and the double dipping effect of these fixed effects pushes the HFR variable away from statistical significance or logical sense based on what we already know about mass shootings and gun ownership levels. In future work, it would be beneficial to use a different variable for firearm ownership and using one that does not have the same intrinsic fixed effects wrapped into it like HFR seems to.

I believe in all future work on the study of mass shootings, there needs to be an emphasis on defining whether mass shootings are the actions of an individual market participant, or if mass shootings should be seen as a decision made by a firm, i.e., a state or county. Most of the socioeconomic factors we can examine are captures of the economy of a community as a whole, and therefore if there is a link between mass

shootings and these broad socioeconomic factors, then mass shootings could be an action or decision being made by that firm, or community in this study. Or, researchers can focus on the individual mass shooters and their economic standing, but as a result, the economic variables for analysis need to be more individualized, rather than being examinations of a community as a whole. This leads to another important takeaway from the results is the importance of mass shooting definition. Across the three definitions used, the results did vary in terms of magnitude and even relationship. This shows that researchers could choose a definition that best supports their hypothesis, and I think it shows that there is a strong need for a universal definition of mass shootings for use in the academic community. I think that there needs to be a push for a governing body, supported by our federal government, which is the source of truth for the data and definition of mass shootings, similar to how the BEA is the federal authority for economic factors, or the Department of Justice for crime statistics in general. With a federally backed governing body, there could be deeper data collection, as well as a universal definition for mass shootings that would make the study of the subject more universal when it comes to the data, and therefore the results become less ambiguous. In addition to the governing body's universal definition, the study of this subject could benefit from data collection at a deeper level about the mass shooting incidents, and the shooters that commit them. With a deeper understanding of the social and economic characteristics of the shooters, perhaps clearer conclusions can be drawn from the data. The last important takeaway from my results is the importance of county level data over time period data. In many other academic studies, they used shorter time frames in order

to find data at the county level. In my methodology, I reversed this decision, in order to see how this would change the results. Although many of the relationships proved to be consistent, the lack of statistical significance seems to provide evidence that it is more important to focus on county level data. State level data is too coarse grained and does not provide enough detail for the empirical examination. With county level data, the number of observations in total would be increased significantly, having observations for each individual county over a period, and would therefore drastically increase our ability to draw conclusions from any econometric analysis.

My hope is that my paper provides the academic community with a few of these key takeaways; a universal definition and governing authority on mass shootings will make academic research more consistent, because there is large variation in the results across different mass shooting definitions, and that county level data is worth sacrificing additional years of data because this kind of issue needs to be examined at a more detailed level in order to provide sufficient results. With sufficient results in the future, perhaps this discussion of socioeconomic factors and mass shootings could lead to socioeconomic policy that is targeted at improving conditions for individuals, and therefore reduce the mass shooting violence that we see in America.

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