Mass Shooting Intervals

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Contents

1 Abstract

Lin et al. (2018) found that the time interval between mass shootings has been drastic decreasing in the past three decades, suggesting that the rate of shootings are increasing. I managed to replicate most of the graphics from Lin et al. (2018) with the exception of table 1, where I was unable to recreate the exact zero-inflated poisson model. My extension broke down the interval trends between different venues of shootings showing in figure 2 of Lin et al. (2018). What I found was that the interval trend of mass school shootings remained relatively steady while the interval of mass workplace shootings drastically decreased and the overall interval also decreased. This finding suggests that the 2008 financial crisis might have played a major role in the decreasing interval of mass shootings.

This project can be found in my Github repository.[1]

[1] GitHub

2 Introduction

Research surrounding mass shootings and gun violence has been rising in interest, especially among the youth, as survivors of mass school shootings have begun to enter college Jr. (2018) However, as mentioned in the paper, there is still relatively little research around mass shootings that have been published. One cause of this shortage of research might be due to the relatively small amount of data out there related to mass shootings. Out of the three goals in Lin's paper was to look at a few risk factors such as gun ownership and mental health to try and create a model to find a correlation between the factors and mass shootings. However, the results found were largely inconclusive. And one reason for this is just the small amount of data available surrounding mass shootings.

In comparison with other crimes, the actual number of mass shootings is relatively small. Depending on how one defines as mass shootings, there are roughly only a handful each year. A report done by the Everytown for Gun Safety Support Fund identified 194 mass shootings from 2009 to 2018, with is about 19 shootings a year. Gun Safety Support Fund (2019) However, the traumas of mass shootings extend far beyond just the victims and families directly affected by mass shootings. With the increased amount of media coverage around mass school shootings specifically, more and more students are fearing their safety at school. A 2018 survey conducted by the Pew Research Center found that 57 percent of respondents of U.S. teens ages 13 to 17 were somewhat worried or very worried about a shooting that could happen at their school. Graf (2018)

This increasing fear for safety among students is an alarming concern. With the importance of both mental and physical health for our children, there should be a lot more research going into mass shootings, their causes, and what we can do to decrease the number of them. In this project, I will be specifically using the time intervals between the shootings to determine if enough is being done to decrease the number of shootings and how the problem is worsening over time.

3 Literature Review

This study resulted from limited published findings in the past and wanted to identify some risk factors associated with mass shootings. As a result, the authors wanted to answer three specific questions related to mass shootings in this paper. 1. "What are the population-level factors associated with the probability of mass shootings?" 2. "Is the incidence rate of mass shooting increasing during the past three decades?" 3. "Is the online media associated with the probable 'contagious effect'?" The specific factors looked at in this paper include: "state-level gun ownership rate, serious mental illness rate, poverty percentages, and gun law permissiveness". To evaluate if there was an increase in mass shootings in the past three decades, the authors looked at data regarding "mass shootings that occurred within the U.S. in the past 30 years". The authors of the paper defined mass shooting "as an act of firearm violence that resulted in at least four fatalities (not including the perpetrator), at the same time, or over a relatively short period of time in the case of shooting sprees". The contagious effect is like a copy cat effect, where if one mass shooting occurs, it promotes the increase of "copy cats" or more mass shootings in the time that follows.

The authors findings ultimately reached inconclusive evidence for looking at the relationship between risk factors and mass shootings. One of the main difficulties with looking at risk factors for mass shootings is the relatively small amount data on shootings that researchers have to look at. However, they did find the the interval between mass shootings has been steadily decreasing for the past three decades. Further, they found evidence of possible relationship between the increasing amount of media coverage of mass shootings and this interval decrease. However, the research done by Lin did not look at the specific number of social media posts mentioning mass shootings, only Google search results and Google trends. This is an area where research should be done because of the increasing popularity of social media, especially among the youth. Overall, the research done by Lin provided important information around the decreasing intervals which can be useful for further research to see how the interval trends have changed since the paper's publication.

In the overall category of research related to mass shootings, there have been two areas of main focus, continuing to look at what risk factors relate to mass shootings the most and domestic violence restraining order (DVRO) prohibition laws. In the focus of looking at risk factors, many other papers have also reached inconclusive evidence on many of the same factors that Lin looked at. Other papers have cited similar a

similar issue with the lack of data to provide any substantive conclusions on risk factors. However, a recent Webster et al. (2020) paper found that more firearm purchaser licensing requirements are likely to reduce the number of mass shootings as it makes it more difficult for high-risk individuals to purchase guns. Daniel W. Webster (2020) Regarding the focus on DVRO, there was a lot of excitement around a paper by Zeoli et al. (2017) because he had found evidence that DVRO laws can significantly reduce the number of shootings related to domestic violence. April M Zeoli (2017) This would have been a huge finding since many mass shootings are related to domestic violence. However, the paper by Zeoli et al. was later retracted shortly after due to errors within dates they used which led to the significance of DVRO laws to fade. (**???**)

4 Replication

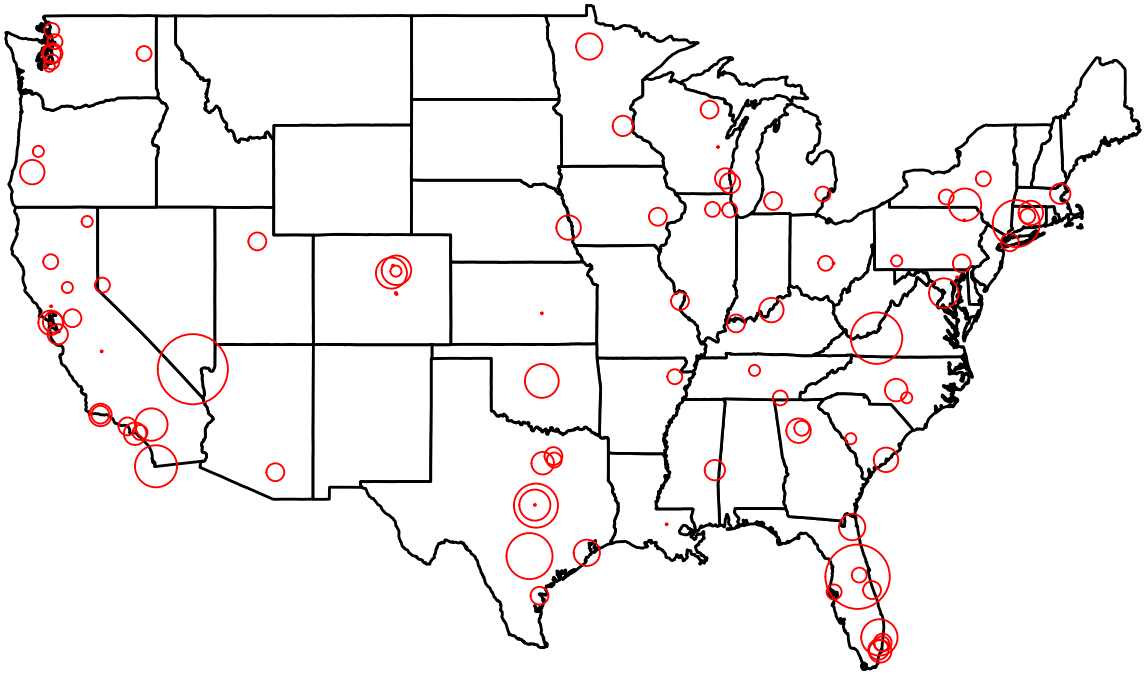


Figure 1. Geographic locations of shootings and respective fatalities (proportional to circle diameter) are presented.

Figure 1 highlights all the mass shootings within the Mother Jones' dataset that was used in Lin's paper. The number of fatalities is proportional to the size of the circles.

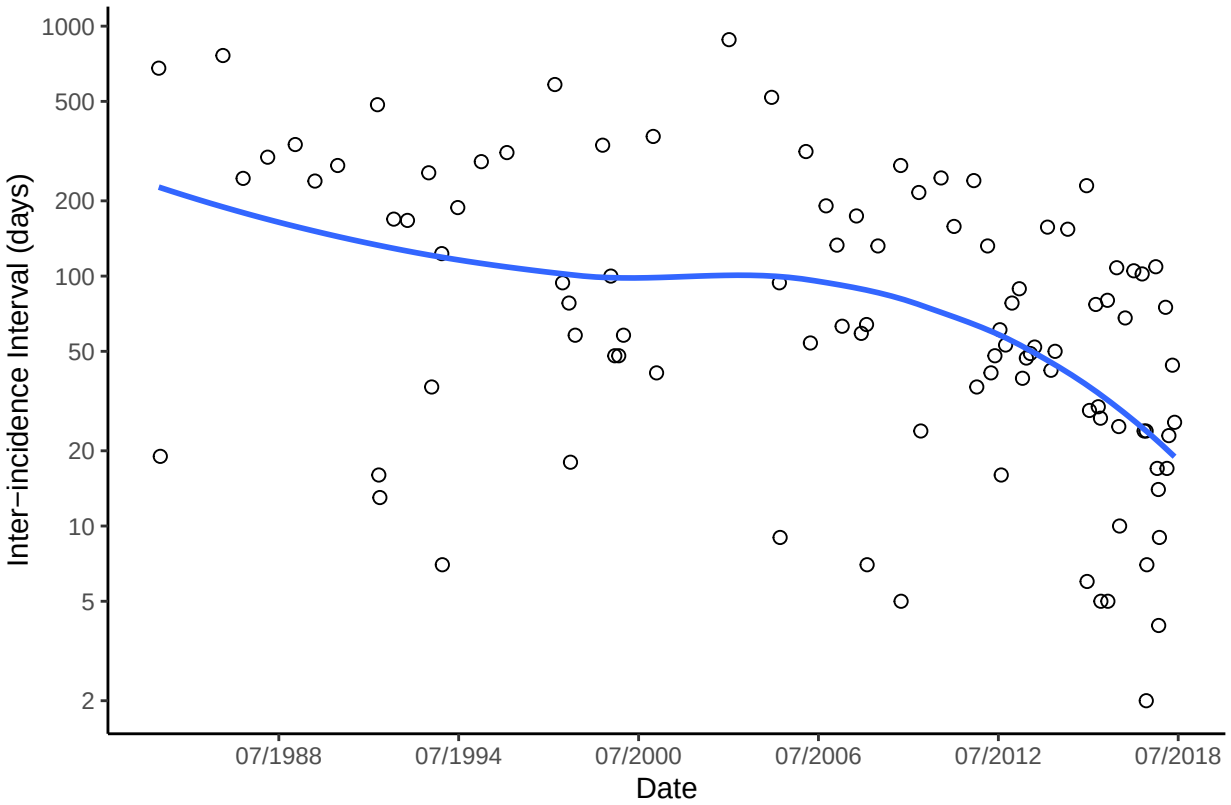


Figure 2. Interval time between mass shootings and its GAM fit for trend is shown.

Figure 2: Interval time between mass shootings and its GAM fit for trend is shown. This is also using the Mother Jones' data and it includes 100 mass shooting in the United States from January 1982 to May 2018. Ping-I Lin (2018)

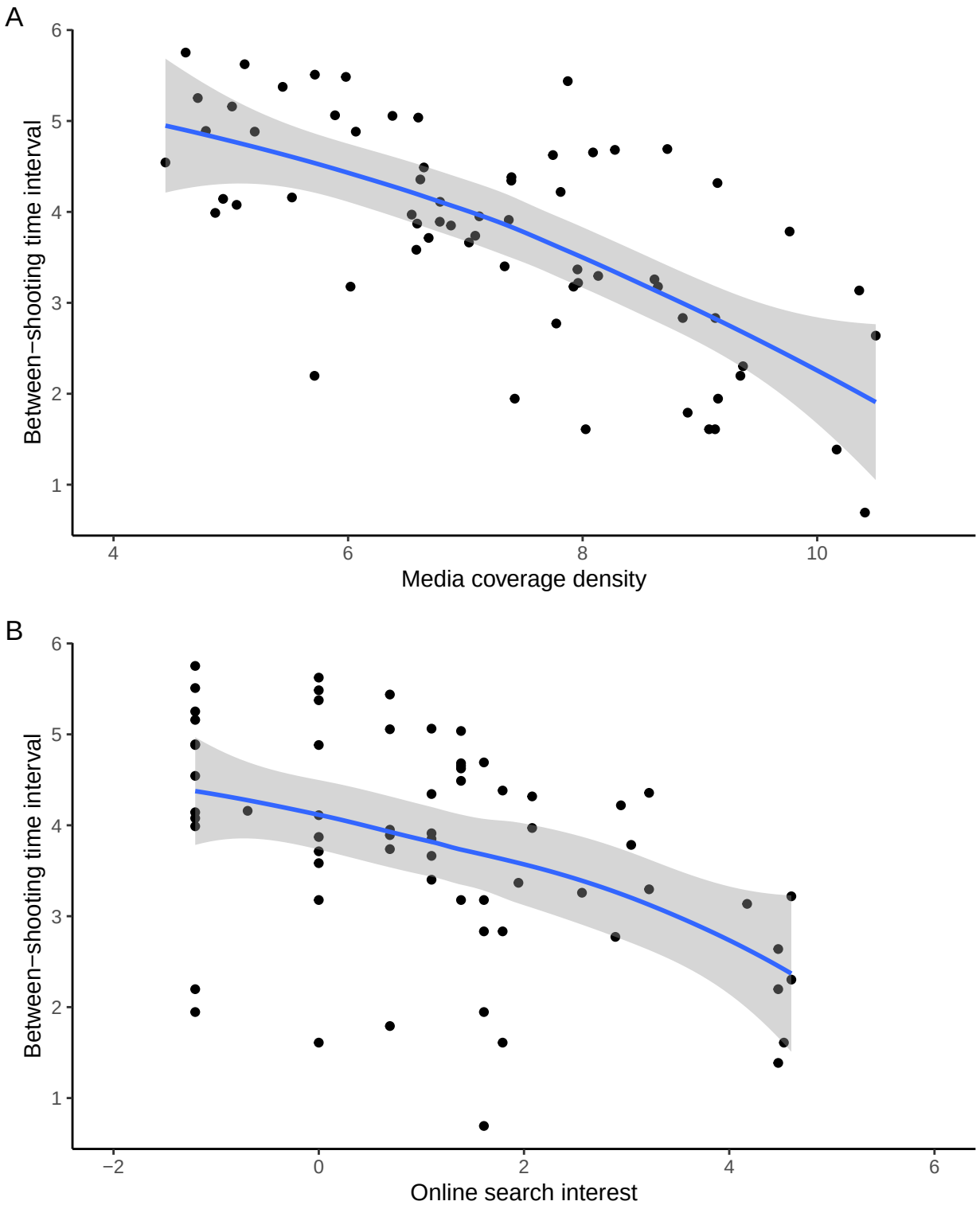


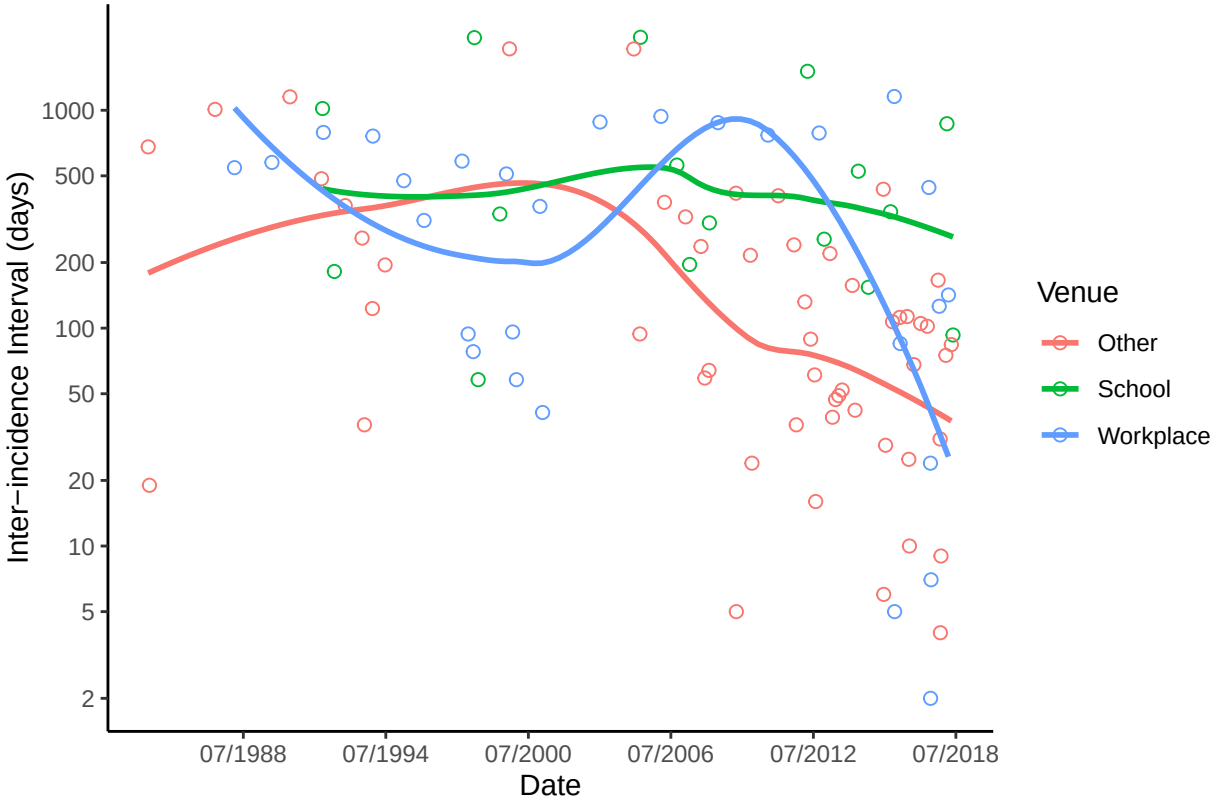
Figure 3 shows two plots related to online interest of mass shootings. The first graph highlights the trend between shooting interval and media coverage density. The second graph shows the trend between shooting interval and online search interest.

5 Extension

I extended Lin et al. (2018) by taking into account the venue of the mass shootings from 1982 to 2018 and visualizing the trends between the three largest categories: School, Workplace, and Other. Additionally, I downloaded the updated mass shooting dataset from Mother Jones' Mark Follman (2020) and created the same visualization with the three largest venues with data up to 2020.

5.1 Venue Categories

Throughout Lin et al. (2018), the authors categorized every mass shooting in the data into one. However, the shooters' motive is an important factor when studying the causes for mass shootings and trying to prevent future shootings. Looking at all the venues of shootings categorized in this dataset, it would be natural to assume that the shooters' would have varying motives: Airport, Military, Other, Religious, School, and Workplace. For example, a shooter who attacks a religious venue might have racist motives while a shooter who attacks a school might have been acting on revenge against bullies. So, I decided to break down figure 2 by Lin et al. (2018) into three venue categories: School, Workplace, and Other. I chose these three because they were the three most common venues and the others all had five or less shootings. To keep the number of datapoints that same, I put these smaller venues into the category of Other.



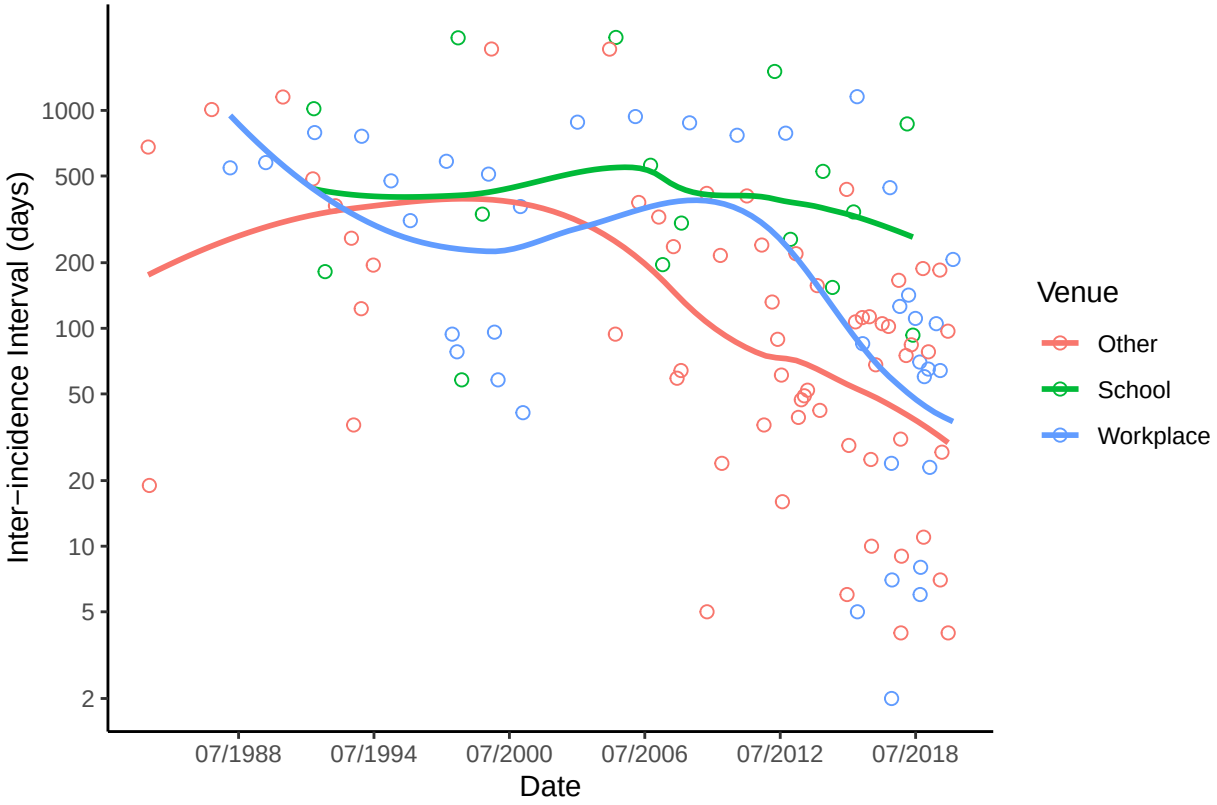
igure 4. Interval time between mass shootings based on venue. Trends using method = 'loess'.

The results reveal some interesting information. When broken down into more specific categories, the trends show that not all venues have seen an equal downward trend in intervals between shootings. The trend looking at mass shootings at schools is perhaps the most intersting, as it shows only a slight decrease overall. This suggests that the number of mass shootings at schools today might not actually be much different than in the 80s. The trend seems to hover around every one year. On the other hand, the interval between mass shootings at workplaces has drastically fallen since around 2008 from one every few years to one every month in 2018. Before that, the interval seemed to be increasing from one every 200 days in 2000 to one every few years in 2008. This is an intersting trend because it might suggest a link between the financial crisis of 2008

and an increase in mass shootings at workplaces. Looking at shootings that occured in other venues, the trend aligns closer to the overall trend in figure 2 by Lin et al. (2018) of an overall decreasing trend in the interval between shootings.

5.2 2020 Data

Bringing in the new data on mass shootings from Mother Jones' Mark Follman (2020), I created the same three categories of venues and created a similar visualization. Since 2018, there has been no new mass shootings that occured at a school, so that trend does not chagne. The trend on workplace mass shootings has decreased slightly from every month to about every month and a half. This might suggest that the trend is flattening out. Since President Trump entered office in 2016, the unemployment rate has decreased significantly and the US economy has continued to grow (excluding the COVID-19 pandemic) Cohen (2019). This could be a potential cause of the flattening trend.



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6 Discussion

7 Bibliography

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Appendix

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Fri, Apr 17, 2020 - 11:54:23 PM

Table 1: Effect of Treatment, Time Length, and their Interaction on Change in attitude

Statistic	Mean	St. Dev.
Intercept	1.743	1.960
FS/S	−0.008	0.010
Serious mental disorder rate	−0.091	0.086
Poverty rate	0.060	0.037
Gun law permissiveness	0.188	0.140

Table 1: This is a poisson model I created in attempt to replicate the zero-inflated poisson model in the paper. I was unable to fully replicate the model as the code for this paper was not made publicly available.

Within months (t)	P of a shooting Using constant rate	P of a shooting Using regression model
1	0.203	0.374
2	0.365	0.608
3	0.494	0.754
6	0.744	0.940
9	0.870	0.985
12	0.934	0.996

Table 2: This table predicts the probability of at least one mass shooting within the given number of months using the trend the authors found in the paper