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The Sandy Hook Elementary School Shooting and Home Asset Value
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Section 1: Introduction

Social stigma is something that can hurt a community. It is a negative and widespread feeling of a location, an event, and in extreme cases, a culture. Due to this being a psychological phenomenon, economists have spent years figuring out ways to quantify social stigma and see its impact on asset price and value. The findings from early studies seem to suggest that a stigmatized event will cause a decrease in home asset value (Bond, 2001). Similar results are seen in recent studies as well (Gourley, 2019).

This paper will explore the concept of the social stigma impact on asset value in Connecticut. Stigma is created by events such as terrorism, crime, and natural disasters. However, not all social stigma occurs naturally. It is made within a community through media and politicians (Burns, 1999). Through this, it can stir the public up and increase the local economic consequences of the stigmatized events (Brodeur, Yousaf, 2019). These unintended consequences can cost communities millions in dollars in asset value (Gourley, 2019). The unknown factor is how severe the impact originally is.

This paper explores using the difference-in-differences statistical technique the social stigma impact of the Sandy Hook Elementary School Shooting which occurred on December 14th, 2012, on the single-family residential home's asset value in Sandy Hook, Connecticut. The impact of the Sandy Hook School Shooting is expected to have a negative effect on the asset value of single-family residential homes in Sandy Hook, Connecticut.

Studies also show that it is possible to reverse the negative stigma surrounding a local area if there are publicly known steps taken to fix the area's problems (Zussman, 2008). In the case of Sandy Hook, Connecticut, Sandy Hook Elementary School was torn down about ten months

following the shooting and was rebuilt in 2016 with a safer design in mind. The actions taken by the town make this study different from previous literature on school shootings and asset value. More specifically, this builds upon the recent study conducted on the Columbine shooting and the asset value impact it had on Columbine, Colorado (Gourley, 2019). While that study focuses on an incident that occurred in an area that did not change post-tragedy, the Sandy Hook Elementary School Shooting is unique in the sense that the town took action to show that it is safe.

The results from the study are inconclusive and there is no statistical significance seen to reject or fail to reject the original hypothesis. It is also found that regardless of either the treatment or comparison group, the results remain consistently inconsistent.

The paper proceeds as follows. Section 2 is a literature review defining what a stigma effect is and current studies on stigmas' effect on assets. Section 3 describes the area of Newtown, Connecticut, the events of the shooting, and the aftermath of the Sandy Hook School Shooting. Section 4 reviews the data collected. Section 5 reviews the empirical methodology and the statistical technique. Section 6 presents the results. Section 7 discusses the results. Section 8 concludes.

Section 2: Literature Review

Social stigma is a phenomenon that comes in multiple forms and can impact assets in communities. The initial shock of social stigma on assets can be severe, while the aftermath has the potential for further damages. Stigmatized events cause a chain reaction where the community has further costs for remediations (Wiltshaw, 1998). Literature also suggests that stigma is risk-perception driven (Chan, 2002). Meaning that each event has a unique impact on

the local community. For example, consider contaminated land. Chan suggests that "it is incorrect to assume that all contaminated land has stigma" (Chan, 2002). The idea is that not all contaminations are as severe as others. This same logic can be applied to different types of stigma-creating events. The perceived risk that derives from a school shooting will cause an increase in risk perception.

The following hysteria that the media creates reinforce this concept and quickly spreads it across a country (Burns, 1999). Nationally, it is shown "that the media coverage of mass shootings exacerbates their local economic impact" (Brodeur, Yousaf, 2019). It is this coverage that further raises the risk perception for a town and increases the damage to the local economy.

This paper reviews various settings in which stigma impacts asset values. The first subsection discusses school shootings and the creation of stigma. The second subsection discusses the stigma effects of terrorism. The third subsection discusses crime and stigma. The fourth subsection discusses the stigma behind natural disasters. The fifth subsection concludes the literature review section.

School Shootings and Creation of Stigma

The difference-in-differences statistical technique is utilized to understand the effect of a school shootings stigma on local areas. Previous research utilizing this technique has found that the 1999 Columbine High School Shooting caused a decrease of "5.7% of a property's value after one year. This implies a $13 million loss from property sales in the year 2000 alone" (Gourley, 2019). This is a significant amount of total value lost within a single year. The study of the Sandy Hook Shooting effect on asset value is framed around the technique that Gourley uses in his paper. Essentially, by using the catchment areas where the shooting did not occur as a

control group, Gourley shows a statistically significant impact on asset value for homes within the Columbine High School catchment area. The goal of this study is to attempt to replicate and discover the effect on Sandy Hook, Connecticut, after the 2012 Sandy Hook Elementary School Shooting.

In the United States, news of the Columbine school shooting spread frantically. In a sense, it was one of the first nationwide infamous school shootings which sparked in the media what is known as "generation Columbine"[1]. This name stems from the fact that this specific shooting was the turning point for schools across the United States. Not only did more and more schools begin instituting lockdown and intruder drills, but a handful of future school shooters would claim Columbine as their inspiration[1]. With the increase in drills, people began to associate a higher risk associated with schools. Furthermore, studies also show successful mass shootings have "significant negative effects on targeted counties employment and earnings" and also "decrease housing prices and consumer confidence and increase absenteeism" (Brodeur, Yousaf, 2019). It is necessary to keep all of this in mind as it shows that school and other mass shootings tend to have a negative economic impact on the local area.

Terrorism and Stigma

Random acts of terror can cause a significant decrease in a local economy and housing assets but will return to normal after some time. Acts of terror are connected to the stigma effect on local economies. Abadie and Gardeazabal (2003) found GDP decreased by 10 percentage points in Basque Country when compared to a control region that has not experienced terrorism. Not only this, but they also found that Basque Country had a positive impact on GDP when there

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[1] https://www.theguardian.com/us-news/2019/apr/19/columbine-parkland-how-mass-shootings-changed-us-schools

were credible actions taken towards a peaceful resolution and a negative impact when the ceasefire ended (Abadie, Gardeazabal 2003). This is not the only region where this impact is recorded.

In Gilo, Israel, "VAR estimations indicate that shooting events result in a lagged 9.8% reduction in Gilo house values", yet the effects were "largely reversed within 18 months" (Arbel et al, 2010). Next, a study conducted by Shlomie and Felsenstein on the Jerusalem housing market showed that the most impactful terrorist attacks on property prices were the ones that were seen as random (Shlomie, Felsenstein, 2007). As seen in literature, random acts of terror are economically impactful, but most importantly, the stigma effect is not permanent.

Crime and Stigma

Terrorism and school shootings are impactful on an area, but other events can place a stigma on a location. Crime historically has been commonplace in society. Two main types of crime are violent crime and property crime. It is believed that physical vulnerability assists in the creation of fear of crime (Killias, Clerici 2000). One of the most physically vulnerable groups in society is children. This potentially suggests that the fear created by crime has a larger impact on areas where the children population is larger.

Further, Besley and Mueller show that there is "a negative correlation between house prices and killings" (Besley, Muller 2012). This relationship is explainable because as killings (a type of violent crime) increase in an area, the risk of danger living there is apparent. The fear that someone is physically vulnerable to crime will make people think twice about living there. This stigma essentially decreases the demand for houses in an area and ultimately negatively impacts the price. When it comes to property crime, there is a similar impact. Gibbons claims that

property crimes such as "vandalism, graffiti and other forms of criminal damage" send "signals of community instability" (Gibbons, 2004). Regardless of how well a community is doing, if it looks damaged people will resort to a heuristic and fall victim to their biases. This bias may hurt a community for no reason at all. This suggests that crime must be visible for an impact on the price to occur. Ultimately, the stigma of crime, like terrorism and school shootings, overwhelmingly shows negative effects on asset value.

Natural Disasters and Stigma

Violence is not the only stigmatized event in the world. Natural disasters are more than capable of creating risk around an area which turns into stigma and ultimately impacts asset value. When looking after the 1989 Loma Prieta earthquake, it is suggested that there was a decrease in housing prices (Beron et. al, 1997). Beron et. al conclude that "consumers had initially overestimated the earthquake hazard" (Beron et al, 1997). In a different study, it was observed that homes located in a floodplain have "a lower market value than an equivalent house located outside the floodplain" (Bin, Polasky 2004). These studies build upon Chan's work on stigma being related to risk perception. When people overestimate the hazards that an area presents, their willingness to pay for the homes will decrease. The same logic can be applied to houses located in a floodplain. When an area is perceived as dangerous, people who can afford to do so will avoid the area and cause a shift in demand. This shift will consequently cause a decrease in prices.

Stigma Conclusion

Whenever a damaging event occurs, a stigma surrounding the local area can form. Even though the impact varies depending on what occurred, there is an observable and consistent

negative effect. Current literature would suggest that the stigma effect is more based on perceived risk versus people just not wanting to live in an area where something bad happens. This is seen through the differences in the actual impact. Ultimately, it does not matter how severe the event is. Rather, it is about the frequency of the events. A one-and-done event is perceived as something unlikely to happen again. In the short term, there will be a noticeable shock. The change, in the long-term, will eventually stabilize out. This will remain true under normal circumstances. But, in some cases, if the damage is persistent the negative impact will cause lasting effects. The biggest issues stem from the fact that stigma is a difficult topic to put a quantifiable number on. That is the ultimate struggle and something this paper attempts to resolve. Regardless, stigma is a damaging force that has immense control over the lives of the people who live in the affected area.

Section 3: Background Information

Sandy Hook, Connecticut, and Sandy Hook Elementary School are in Newtown, Connecticut. Newtown is an upper-middle-class residential area located in Fairfield County and has a population of 27,891with a median household income of $127,602 and a per capita income of $57,386. A reflection of this is the 2.4% population poverty rate. Newtown is 88.5% white, 5.3% Hispanic, 1.7% Black or African American alone, and 2.7% Asian. From a crime perspective, Newtown is relatively quiet. Up until the Sandy Hook shooting, there had only been one reported homicide over the previous decade.[2]

The Newtown, Connecticut elementary school system is broken up into four catchment areas, and all feed into Newtown Middle School. The first catchment area is Sandy Hook

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[2] https://www.census.gov/quickfacts/newtowntownfairfieldcountyconnecticut

Elementary, the second is Head O' Meadow Elementary, the third is Middle Gate Elementary, and the fourth is Hawley Elementary. In total, these schools serve approximately 1,318 children. Sandy Hook Elementary previously served over 600 children, but today only hosts about 364 students.

The events on December 14th, 2012, will forever live in the memory of the people of Newtown, Connecticut, and the entire United States. On this day at Sandy Hook Elementary School, a lone gunman took the lives of 26 individuals. Following this tragedy, a media storm took over Sandy Hook, Connecticut. This event became national news and is still used in gun control debates years later. The shooting fundamentally changed the Newtown school system. So much so, that Sandy Hook Elementary was torn down and rebuilt with a safer design in mind. The reconstruction of Sandy Hook Elementary began in September 2013. Students began returning to school in September 2016. During this period, the students at Sandy Hook Elementary School attended school at Chalk Hill Middle School located in the neighboring town of Monroe, Connecticut, which had closed several years before the shooting.

Table 1. Town Demographics

Town	Population	Median Household Income	Per-Capita Income	Poverty Rate
Newtown	27,891	$127,602	$57,386	2.4%
Southbury	19,571	$98,790	$51,446	4.6%

Source: https://www.census.gov/quickfacts/fact/table/southburytownnewhavencountyconnecticut/BZA010219
https://www.census.gov/quickfacts/newtowntownfairfieldcountyconnecticut

Table 1 compares the demographics of both Newtown and Southbury. The town of Southbury is in New Haven County. Due to its direct proximity to Newtown, it can be used as a control group. The demographics of Southbury are comparable to that of Newtown. Southbury,

Connecticut has a population of 19,571 and a median household income of $98,790, and a per-capita income of $51,446. The town also has a higher poverty rate of 4.6%. Race-wise, Southbury is 89.8% White, 1.7% black or African American, 2.2% Asian, and 5.3% Hispanic or Latino[3].

Section 4: Data

The data utilized comes from an online database owned and maintained by the Connecticut Office of Policy and Management. The Office of Policy and Management receives this data from the grand lists of yearly sales from October 1st and September 30th each year. In this case, the period collected is 2001 – 2018. The catchment area data comes from Niche.com. The catchment area that each house is assigned derives from manually entering the address in the database and discovering which elementary school it feeds. Any split streets are observed on a map of the catchment area.

Summary of the Data Set

This data set is panel data. Each home address has a specific ID number, a year of the sale, and a sale amount. This is important as it looks at the change in price from before and after the shooting. The unit of observation is a parcel of land. The parcels sold during the designated period for at least $2,000. In total, the data set has 6,272 parcels of land which produces 8,611 observable sales of single-family residential homes. The sales are as follows. Eighteen are in Newtown, but they do not go into any Newtown Elementary schools. 1,621 sales make up the Sandy Hook Elementary catchment area, 1,344 sales make up the Head O' Meadow Elementary catchment area, 1,425 sales make up the Middle Gate Elementary catchment area, and 1,231

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[3] https://www.census.gov/quickfacts/fact/table/southburytownnewhavencountyconnecticut/BZA010219

sales make up the Hawley Elementary catchment area. The data collected for Southbury derives from the same source and generates 2,972 observable sales.

Table 2. Summary Statistics

	Observations	Mean	Standard Deviation
Year of Sale	8611	2010	5.52
Listing Year	8611	2009	5.51
Assessed Value	8611	$265,226	$178,741
Sale Amount	8611	$501,691	$288,995
Sandy Hook	8611	0.19	0.39
After	8611	0.35	0.47

Summary statistics are in Table 2. The average price for a house adjusted for 2018 dollars is about $500,000. There is a standard deviation of about $289,000. This standard deviation is potentially attributed to the study period. The 2007 - 2009 great recession caused a steep decrease in housing prices across the United States. Newtown and Southbury were not exempt from this housing crisis and as such, were negatively impacted.

The average year of sale and listing year plays into this due to the time frame. The average listing year was during the 2007 – 2009 great recession while the mean year of sale was directly following. The expectation is that the housing sales amount will already be heavily negatively impacted, years before the Sandy Hook Elementary school shooting ever took place.

Table 3. Sandy Hook Catchment Area and Comparisons Means

	Sandy Hook	Head O'Meadow	Middle Gate	Hawley	Southbury
Sale Amount	$473,458	$591,172	$515,935	$552,672	$450,478
List Year	2009	2009	2009	2008	2009
Year Sold	2009	2010	2010	2009	2010

In Table 3, I compare the different comparison areas in Newtown, Connecticut, and Southbury, Connecticut to Sandy Hook, Connecticut. When looking at the adjusted sales amount, it is interesting to note the differences in Newtown. The Sandy Hook Elementary catchment area has a noticeably lower mean than the rest of Newtown while maintaining an average sale and listing year within one year. The largest difference that exists is almost $120,000 with the Head O' Meadow catchment area. The Sandy Hook catchment area is also the only area in Newtown where the average sales amount is below $500,000. The only area that has a lower mean is Southbury.

A decrease in the demand for houses in Sandy Hook may be a possible explanation for why the mean sales amount in the Sandy Hook catchment area is lower than the rest of Newtown. One of the key aspects that people take into consideration when moving is the school system. The assumption I would assert in this situation is that people would want to move to a town that has a school located in that town rather than send their kids to another town's school. If this assumption holds, then it would be expected for the mean prices to naturally fall.

Limitations

There are multiple limitations to this data set. The first limitation is that there is a whole year of missing data. From September 30th, 2012, to October 1st, 2013, there is no data present in the current data set. The potential impact is that the period not being observed is about three months before and about ten months after the Sandy Hook shooting. This data does exist in the Newtown Tax Assessors office. After further examination of housing field cards provided by the Newtown Tax Assessors office, about 280 houses were sold at least once during this period.

Another limitation of the data set is that there was a lot of manual data collection. The manual collection of data is prone to error. The variables that were manually entered were the catchment areas each house is located and the specific ID number for each address. Since these key variables were inserted manually, there is a possibility of human error.

The third limitation is the accuracy of the data provided by the Connecticut Office of Policy and Management. After further investigation, a group of at least 100 sales were misclassified. These falsely labeled data points were either mobile homes or multi-family homes. The expansiveness of this error is unknown. It is also unknown if there is any significant impact that this limitation has on the results. As there is such a small number of known errors in the entire data set, it is unlikely that these changes will have a noticeable impact on the results.

The fourth limitation is the inclusion of a flag variable. This variable was included to account for certain data points that were included in the gathered data set but were suspicious in nature. As mentioned above, certain data points were not true single-family homes. Due to the size of the data set, anything that is suspected of not being a true single-family residential home

is flagged with a 1. A flag variable of 2 was set for any sales that were listed as just a street and not a specific address.

Section 5: Methodology

Using the difference-in-differences statistical technique, it is attempted to measure the social stigma impact of the Sandy Hook Elementary School Shooting on the single-family residential homes in Sandy Hook, Connecticut. The shooting is expected to have a negative effect on the local asset value. The difference-in-differences technique is selected because the Sandy Hook Elementary School Shooting was a completely random event. As such, this event is considered a natural experiment. The purpose of this technique is to attempt to show a causal relationship and isolate the impact the shooting may or may not have on the local area.

Experimental Design

This experiment is created through the following variables and groups. The independent variable is the event itself. The purpose of this paper is to see if the school shooting event impacted the sales price in Sandy Hook, Connecticut. For this study, this means that every home and their sales in the Sandy Hook Elementary school catchment area are considered the treatment group. The control group is the catchment areas that did not have a school shooting. The main comparison group is made up of the homes and their sales in the three other catchment areas (Head O' Meadow Elementary School, Middle Gate Elementary School, and Hawley Elementary School). The second comparison group is the area of Southbury, Connecticut.

Furthermore, the change in the average housing price for the following areas is taken. These areas are the Sandy Hook catchment area, the combination of the Head O' Meadow, Middle Gate, and Hawley catchment areas, the combination of Head O' Meadow, Middle Gate, and Hawley catchment areas and Southbury, and Southbury alone. This is done for further

inspection of the data, to attempt to see if the percent change in averages were different from each other in basic analysis.

Comparison Group Justification

The Sandy Hook catchment area is compared to different make-ups of the control group. The first specification is comparing the Sandy Hook catchment area to the rest of Newtown, Connecticut. The purpose of this is to see if there was a direct impact on Sandy Hook. Then, the Sandy Hook Elementary School catchment area is compared to the entire town of Southbury. This is done as an extra test for Sandy Hook, Connecticut. Lastly, the entire town of Newtown is compared to the entire town of Southbury. This was done to see if the Sandy Hook Elementary School Shooting impacted all of Newtown, not just Sandy Hook. All of this is done to test multiple options to see if there is some type of relationship.

Identification:

Using the difference-in-differences technique requires the researcher to separate the periods before and after the event, while also isolating each house to a certain area. To successfully account for this, several variables are introduced into the data set. The important added variables are: "Sales Price", "Sandy Hook", and "After". "Sales Price" is simply the sales amount adjusted into 2018 dollars utilizing the CPI. The "Sandy Hook" variable has a "0" if the house is not located in Sandy Hook, Connecticut, and a "1" if it is in Sandy Hook, Connecticut. This additionally assists in the creation of both the experimental and comparison groups and plays a significant role in the econometric specification described further below in the paper. The "After" variable determines if the sale occurred before or after December 14th, 2012. It is a "0" if the sale occurred before the shooting and a "1" if the sale occurred afterward.

Under normal circumstances, the traditional difference-in-differences model would be used to this specification:

$$Ln(Sales\ Price)_{it} = \alpha + \beta_1(Sandy\ Hook)_{it} + \beta_2(After)_{it} + \beta_3(Sandy\ Hook * After)_{it} + \epsilon_{it} \quad (1)$$

where the sales amount of property i in time t is regressed on a difference-in-differences model. To calculate each of the means, the regression coefficients are broken up as follows. For Sandy Hook, before the shooting the mean is $\alpha + \beta_1$. The regression coefficient for Sandy Hook after the shooting is $\alpha + \beta_1 + \beta_2 + \beta_3$. Lastly, the Sandy Hook difference regression coefficient is $\beta_2 + \beta_3$. For the comparison group, the regression coefficients are going to be different. Before the shooting, the regression coefficient is α. After the shooting, the regression coefficient is $\alpha + \beta_2$. Lastly, the comparison group difference is simply β_2. The last important group of regression coefficients needed are the ones used to calculate the means differences. Before the shooting, only β_1 is required. After the shooting, the coefficient is obtained by $\beta_1 + \beta_3$. Lastly, the difference-in-differences regression is simply β_3. All of this is needed to calculate the means that come out of the above specification.

The situation that surrounds the Sandy Hook Elementary school shooting creates a unique scenario for the econometric specification. This uniqueness comes from both the timing of the shooting and the house fixed effects. By a physical change occurring in the town, there is an opportunity to explore if these actions assisted in preventing a stigma from occurring.

The primary econometric specification is:

$$Ln(Sales\ Price)_{iy} = \alpha + \beta_1(Sandy\ Hook * After)_{iy} + \theta_i + \delta_y + \epsilon_i \quad (2)$$

where the sales amount of property i on year y is regressed on a difference-in-differences model. In $\beta_1(Sandy\ Hook * After)_{iy}$, some properties will equal "1" or "0". This is done to account

for homes that have sold before and after the shooting. By doing so, variation is created between the variables. This variation is required to ensure the model runs properly. In equation 2, θ_i represents the house fixed effects. This accounts for anything that does not change to the house. In this case, the houses do not change catchment areas throughout the study period, so the homes in the Sandy Hook Catchment area will always be assigned a "1". Essentially, θ_i controls for all time and variant characteristics of the property that does not change overtime. θ_i takes over for $\beta_1(Sandy\ Hook)_{it}$ from equation 1. δ_y in equation 2 represents the year fixed effects. By using this, $\beta_2(After)_{it}$ from equation 1 is accounted for. I am taking the year fixed effect to allow for more flexibility. ϵ_i simply represents the error term in the data. The impact of the Sandy Hook shooting is identified by β_1 in equation 2.

Change in Averages:

To further investigate any potential relationship, the housing costs averages were taken and compared. In this simple process, the average adjusted sales amount for the houses in the Sandy Hook catchment area, the rest of Newtown, and Southbury were taken for before and after December 14th, 2012.

Section 6: Results

Table 4. Difference-in-Differences Comparisons

Values	Sandy Hook & Newtown	Sandy Hook & Southbury	Newtown & Southbury
Interaction Term	0.008	0.034	0.022
Robust Standard Error	0.044	0.048	0.035
t value	0.19	0.71	0.64
p value	0.847	0.475	0.523
95% Conf. Interval	$-0.078 \leq \mu \leq 0.094$	$-0.06 \leq \mu \leq 0.129$	$-0.046 \leq \mu \leq 0.091$

Table 4 shows the results derived from the main specification, equation 2. The first column of results compares the Sandy Hook catchment area to the rest of Newtown. The most important aspect of this column is the large p-value. In this comparison, the p-value is 0.847. Since this value is greater than 0.05, this signifies that there is no statistical significance in these results whatsoever. The only thing that this column potentially shows is that there is a 95% chance that the impact of the Sandy Hook Elementary School Shooting caused between a 7.8% decrease and a 9.4% increase in home asset prices.

Sandy Hook and Southbury

In the second column of Table 4, the results of comparing the Sandy Hook Elementary School catchment area and the town of Southbury, Connecticut is shown. Just like in column 1, the p-value is large: 0.475. Since this is the case, there is no statistical significance to these results. Like in column 1, there is no possible conclusion to draw. The only potential known

thing is that there is a 95% confidence interval that the Sandy Hook shooting impact is somewhere between a 6% decrease and a 12.9% increase to the home asset value.

Newtown and Southbury

In the third column of Table 4, the results of comparing all of Newtown and Southbury is shown. As in the previous results, the p-value is large and shows no statistical significance. A conclusion cannot be drawn from these results. The only thing this potentially shows is that there 95% chance that the Sandy Hook shooting had between a 4.6% decrease and a 9.1% increase on the home asset value in all of Newtown, Connecticut.

Sales Amount Percent Change

Table 5. Sales Amount Percent Change

Average Sales Amount	Sandy Hook Catchment Area	Rest of Newtown [1]	Southbury	Rest of Newtown & Southbury [1]
Before Shooting	$529,454	$618,893	$503,068	$570,456
After Shooting	$365,513	$425,105	$358,094	$395,491
Percent Change	-31.34%	-31.31%	-28.82%	-30.67%

1: Rest of Newtown refers to the combination of the Head O' Meadow, Middle Gate and Hawley Elementary school catchment areas

Table 5 represents the average sales amount percent change for Sandy Hook and the comparison groups. Even though the rest of Newtown has a higher average sales amount before and after the shooting, the decrease is comparable across the board. Southbury saw the smallest decrease in average sales amount, but by only about a 3% difference when compared to the other regions. This aspect of the data is looked at as an extra measure to see if one area had a drastic

difference compared to the others to potentially suggest an answer. Based on the results of this comparison, no area was significantly impacted more than another.

Section 7: Discussion

Inconclusive results are always a possibility when conducting research. In this case, there are a few potential explanations on why each comparison resulted as inconclusive. The first potential explanation is that due to the shooting occurring right after the great recession of 2007 – 2009, the impact of such an event absorbed any impact the Sandy Hook Shooting would have had. Due to home prices throughout all of Connecticut decreasing, probably, no relationship between the stigma effect of the Sandy Hook shooting and home asset prices is visible.

The second explanation is that demolishing the school and sending the students to another town, gave people a sense of security to continue living in the area and prevented a stigma from forming in the first place. Since the test results are not statistically significant, there is no way to prove that this is the case. Rather, this serves as a possible data disruptor, as past literature on stigma has been done on areas that did not see physical changes to a location. This then ties into another explanation: people just may have become numb to tragedies such as school shootings, and in simple terms, may not care that they live in an area where one occurs anymore. When Gourley (2019) conducted his study on the Columbine shooting, this was the first major, modern-day school shooting. From then (1999) until the Sandy Hook shooting in 2012, there were 94 school shootings across the United States. It is possible that people became so used to hearing about school shootings, that there was never a stigma and the effects observed were all due to the great recession. Further study would need to be done on this to support or disprove this, but rather this is a potential explanation on how the results are inconclusive.

It is important to note that a random sample of 400 single-family residential homes was hand-collected and ran using equation 2. In this version, there were 100 homes in each of the four catchment areas. The conclusion from this version of the experiment is that with moderate confidence, it could be said that the Sandy Hook Elementary school shooting caused a decrease of about 7% in single-family residential home asset value. When using a smaller sample size of more accurate data (data with fewer limitations than what was used), there was some statistical significance. The ramifications of this are potentially severe. It is possible that the limitations and errors in the data set provided by the Connecticut Office of Policy and Management were so impactful and severe that the experiment produced poor results. In other words, poor data could result in not statistically significant results. For further study, the same difference-in-differences model should be used, but rather the data should be completely collected by hand for all the single-family residential homes in Newtown that were sold once before and once after the Sandy Hook Elementary shooting. Even though this may be time-consuming, it may end up being worthwhile.

Another way to look at this experiment is to make a regional comparison. This would include comparing Fairfield county as a whole and compare it to the rest of the Connecticut counties. Since everywhere in Connecticut saw a negative impact on home values during the recession, any significant differences between Fairfield and the rest of Connecticut could be explained by the Sandy Hook shooting.

Throughout this experiment, multiple methods were attempted to find a statistically significant result with the data given, but no statistically significant results were found at any point. These methods included the following. The first way was excluding the top and bottom extremes of the data. Another way was using homes that only sold after the events of the great

recession. A third way of exploring these results that were conducted was using the homes that sold between 2001 – 2006 and between 2010 – 2018. In this attempt, I tried to take away the time associated with the great recession, but nothing significant was discovered. Lastly, only homes that were sold once before and after the shooting were run using the model. After multiple attempts to find some type of causal relationship between the stigma effect of the Sandy Hook Elementary School Shooting and the asset value of single-family residential homes in Sandy Hook, Connecticut, nothing statistically significant was discovered with the data set used.

Section 8: Conclusion

In this paper, I utilize the difference-in-differences statistical technique to see the social stigma impact of the Sandy Hook Elementary school shooting which occurred on December 14th, 2012, on the single-family residential home's asset value in Sandy Hook, Connecticut. In this experiment, I use homes in the Sandy Hook Elementary school catchment area and compare them to homes in the rest of Newtown, Connecticut, and in Southbury, Connecticut. It is problematic that the shooting occurred right after the great recession of 2007 – 2009.

Not only does the great recession cause problems, but the fact the school was torn down may also make way for problems. Based on the basic assumption that not having a school in a town may make the town less appealing for families to move to, it would be expected that prices naturally fall. From a policy standpoint, based on the inconclusive results there is no way of knowing whether tearing down and rebuilding Sandy Hook Elementary reversed any potential stigma effect. It is noteworthy that an investigation into this policy would require an understanding of the impact the shooting had on the town. Until that is answered, then there is no real way of knowing if the social stigma effect on asset values is preventable.

Quantifying stigma is a difficult task that economists have spent decades trying to figure out. After multiple attempts, the results from this experiment are not statistically significant. Based on these results, there is no affirmative answer in whether the Sandy Hook Elementary School Shooting had an impact on home asset values in Sandy Hook, Connecticut, or Newtown, Connecticut.

References:

Abadie, A., & Gardeazabal, J. (2003). The economic costs of conflict: A case study of the Basque Country. *American economic review*, *93*(1), 113-132.

Arbel, Y., Ben-Shahar, D., Gabriel, S., & Tobol, Y. (2010). The local cost of terror: Effects of the second Palestinian Intifada on Jerusalem house prices. *Regional Science and Urban Economics*, *40*(6), 415-426..

Beron, K. J., Murdoch, J. C., Thayer, M. A., & Vijverberg, W. P. (1997). An analysis of the housing market before and after the 1989 Loma Prieta earthquake. *Land Economics*, 101-113.

Besley, T., & Mueller, H. (2012). Estimating the Peace Dividend: The impact of violence on house prices in Northern Ireland. *American Economic Review*, *102*(2), 810-33.

Bin, O., & Polasky, S. (2004). Effects of flood hazards on property values: evidence before and after Hurricane Floyd. *Land Economics*, *80*(4), 490-500.

Bond, S. (2001). Stigma assessment: the case of a remediated contaminated site. *Journal of Property Investment & Finance*.

Brodeur, A., & Yousaf, H. (2019). *The Economics of Mass Shootings* (No. 12728). IZA Discussion Papers.

Burns, R., & Crawford, C. (1999). School shootings, the media, and public fear: Ingredients for a moral panic. *Crime, law and social change*, *32*(2), 147-168.

Chan, N. (2002). Stigma assessment: a multi-criteria decision-making approach. Pacific Rim Property Research Journal, Vol. 8, No. 1, pp. 29-47

Gibbons, S. (2004). The costs of urban property crime. *The Economic Journal*, *114*(499), F441-F463.

Gourley, P. (2019). Social Stigma and Asset Value. *Southern Economic Journal*, *85*(3), 919-938.

Killias, M. and Clerici, C. (2000), 'Different Measures of Vulnerability in Their Relation to Different Dimensions of Fear of Crime', British Journal of Criminology, vol. 40, pp. 437-450.

Hazam, S., & Felsenstein, D. (2007). Terror, fear and behaviour in the Jerusalem housing market. *Urban Studies*, *44*(13), 2529-2546.

Wiltshaw, D. G. (1998). Stigma, perception and the remediation of contaminated land. *Journal of Property Research*, *15*(4), 285-303.

Zussman, A., Zussman, N., & Nielsen, M. Ø. (2008). Asset market perspectives on the Israeli–Palestinian conflict. *Economica*, *75*(297), 84-115.