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Social Stigma and Asset Value

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Abstract

I use the unique circumstances surrounding the 1999 Columbine Shooting to estimate the effect of a social stigma on asset value. Using a repeat sales framework, I find the immediate effect of stigma from the Columbine Shooting is 10 percent of a property's value and that a reduced stigma is still present 15 years later. This implies a $34,000 average decrease in housing value, which aggregates to a $19 million loss from property sales in the year 2000 alone. The results are robust to numerous specifications and a synthetic control placebo test. Social stigma can play a significant role in consumer preferences and this suggests policy makers take stigma into account when considering remediation for loss in asset value.

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1 Introduction

Social stigma is an important but unclear component of consumer preferences. Several economists have attempted to quantify the effects of stigma in recent years (McCluskey and Rausser 2003; Patunru et al. 2007), but have had difficulty untangling confounding mechanisms. When a market undergoes a negative shock, asset value is impacted through several channels such as physical damage and updated information to consumers about future risks. While much attention has been given to the impacts of physical damage and risk on assets, stigma has received less consideration because of its ambiguous nature. Even defining stigma properly can be difficult (Elliot-Jones 1996). In this paper, stigma can be thought of as a subjective distaste for a good not affiliated with any traditionally measured characteristic, including risk. Stigma is innate, difficult to pin-down, and is akin to a negative existence value (Krutilla 1967); a consumer receives disutility because they have a cognitive awareness that something distasteful happened. Stigma is therefore the direct effect of an event on a consumer's utility and is not mediated through any traditional product characteristic. This subjectivity makes the very existence of stigma difficult to identify, yet there is evidence that stigma is manifested in many goods such as a house that someone was murdered in, car models that become associated with infamous individuals, or airline tickets to a country that recently experienced an airplane crash.[1] In this paper, I show that social stigma can cause a sharp decrease in property value.

If social stigma has an effect on housing value the implications for the American economy could be substantial given the importance of the real estate market in the United States. Total housing stock in America is worth an estimated $25.7 trillion, or 145 percent of GDP (Hopkins 2013). At the macro level, the housing market bubble was a contributing factor to the Great Recession in the United States. At the micro level, property is the main store of wealth for many Americans, and any factor that can potentially alter the value of housing assets, such as stigma, is important to understand. Moreover, US policy makers often compensate homeowners for sudden property value losses; the potential losses from stigma raises the issue of whether those homeowners should also be compensated.

The costs of social stigma could be large. A non-rigorous estimate concluded that a house loses 10-15 percent of its value on average if someone is murdered on the property (Milford 2013). The correct policy responses to stigma caused losses in value are also difficult to assess. Should consumers be compensated if one of their assets undergoes devaluation because of a new social stigma? This is closely related to Portney's (1991) question about

[1] After Air Asia Flight 8501 crashed into the Java Sea, the Indonesian Government reported that sales of airline tickets had decreased from carriers not involved in the incident.

the residents of Happyville. He asks, if the residents of a fictional town are convinced that a naturally occurring chemical is a carcinogen and want to pay for a treatment plant, despite universal scientific consensus saying otherwise, what are the economic benefits to building the plant? Should a non-accurate perceived risk that generates real disutility be compensated? Likewise, if social stigma occurs after a negative shock and residents are compensated for physical losses of property, should they also be compensated for all losses in value, including loss caused by stigma? Should compensation vary based on how negatively residents perceive the stigma?

Economists have examined markets in attempts to identify stigma. For example, McClusky and Rausser (2003), Hurd (2002), Gayer et al. (2000) and Dale et al. (1999), quantify stigma by examining housing prices and other goods. Besley and Mueller (2012), Collins and Margo (2007) and Linden and Rockoff (2008) examine the stigma of local events such as the Troubles in Northern Ireland, race riots in America, or even the arrival of sex offenders to a neighborhood, respectively. These estimated stigma effects, however, likely include changes to the physical characteristics of the asset, possible changes in risk perception, or other tangible changes in the local area. While such studies have provided evidence that social stigma is a component of consumer preferences, more research is needed to confirm the existence of a stigma effect that can be disentangled from changes in risk or physical characteristics.

Using the unique circumstances surrounding the 1999 Columbine Shooting in Columbine, Colorado I isolate a pure stigma effect.[2] This tragic event enables me to identify a revealed preference stigma in a way that is not possible in other contexts for several reasons. First, the shooting was essentially random. The media often stated, "if it could happen in Littleton, it could happen anywhere" (Stout 1999; Young 1999), a paraphrase of Bill Clinton's remarks on the shooting, to illustrate how unpredictable the massacre was. Second, the attack on Columbine was a one-time occurrence. Unlike a natural disaster, a reassessment of risk or increase in probability of a repeat event probably did not occur. Third, there were no significant lasting physical effects from the shooting. The massacre occurred at the end of April, and the next school year began as scheduled the following August with no changes to school quality or neighborhood characteristics.[3] By analyzing how housing values changed within the Columbine Catchment Area (henceforth CCA), the houses located within Columbine High School's boundaries, I can determine the magnitude of the Columbine social stigma.

[2]Columbine High School is located in Columbine, CO, a census designated placed that is part of Jefferson County. Because the closest town is Littleton, CO (which is the county seat of Arapahoe County) and the mailing address of Columbine High School is in Littleton the media incorrectly stated that the school was located in Littleton.

[3]See Section 3.2 for a detailed explanation.

It is instructive to compare the Columbine Massacre to another negative shock to show why stigma is usually entangled with other factors. Consider the effects Hurricane Katrina had in New Orleans. Much of the city was physically destroyed. From a risk perspective, residents may believe the odds of a second devastating hurricane hitting the city is higher because their priors were too low.[4] Residents' perceptions about the effectiveness of local government also could have changed. Finally there could be a negative stigma of moving to a city that just endured a large tragedy. With a negative shock, all of these channels will result in a decrease in housing prices, meaning that both the existence and magnitude of stigma will be difficult to determine. If housing prices decreased by 20 percent, there is no way to pin-down how much of that effect is caused by a loss of physical amenities, how much was caused by a change in risk, and how much was caused by a nascent post-Katrina New Orleans stigma. Hurricane Katrina starkly contrasts with the Columbine Shooting, where there were no physically observable changes after the negative shock.

What exactly is stigma? It is an outgrowth of the feeling of disgust, which has been extensively studied in psychology over the last decade. One of the most salient examples of disgust is contact with death or dead bodies (Rozin et al. 2010). While knowledge of the Columbine Shooting is not enough to produce the revulsion associated with witnessing death first-hand, the association with the shooting and subsequent stigma could manifest itself in housing values. As detailed by Kelly (2011) in his book *Yuck!*, there is an evolutionary or instinctual component of distaste whose origins are probably an avoidance of poison or other pathogens. When this instinctual distaste is combined with contemporary social norms, the result can be "idiosyncratic, inefficient, or outright irrational." With regards to Columbine, even if home buyers think that the Columbine area is not dangerous, the distaste experienced from the shooting leads to a stigmatized asset value.[5]

Utilizing a data set that encompasses over 200,000 sales from 100,000 single family homes in Jefferson County from 1980 to 2013, I employ a repeat sales framework to isolate the effect of the Columbine Shooting on housing prices. By examining only within house variation, many unobserved variables that would otherwise confound results are eliminated. I find that properties located in the CCA experience a 10.1 percent decrease in price relative to other houses in Jefferson County the year after the shooting. The results are confirmed by

[4] At the same time, they may believe that the city is now safer because of stronger levies or because it is unlikely two hurricanes strike the city twice in a short time span.

[5] A couple I interviewed from Indiana that was looking to buy a house in Jefferson County said that even though they thought Columbine was just as safe as other schools in the area, they would never buy a home there.

an array of robustness checks that include synthetic control comparisons and a large scale synthetic placebo test. These results show that social stigma can exist and have a significant magnitude, in this case approximately $34,000 per house. Given the 558 sales that took place in the CCA in 2000, this translates to a $19 million loss in value for home sellers. Furthermore, some evidence also shows that the stigma from the Columbine Shooting is still present, albeit at a diminished magnitude, 15 years later. These results have both theoretical and policy ramifications. Economic agents do take stigma into account when valuing assets, and the effect is large. Models of consumer preference should take into account that social stigmas can reduce asset value and utility. Finally, if policy makers wish to compensate homeowners for all sources of housing depreciation, the effect of stigma should be considered.

The remainder of the paper is organized as follows. Section 2 describes the area surrounding Columbine High School. Section 3 develops a conceptual framework and frames the model in terms of existing literature. Section 4 describes the data and identification strategy. Section 5 lists the results along with robustness checks. Section 6 concludes.

2 The Area

Columbine High School is located in Jefferson County, Colorado, a mostly suburban area west and southwest of Denver city proper, although the western and southern portions of the county are rural and enter the foothills of the Rocky Mountains (See Figure 1). The county is made up of mostly white, upper middle class commuters to Denver. Popularly known as Jeffco, the county has a population of 534,543 and a household median income of $57,339 and a family median income of $67,310. Major employers include MillerCoors Brewing Company and the Colorado School of Mines, both located in the county seat, Golden, as well as the Denver Federal Center and Lockheed Martin. About 5 percent of the population is below the federal poverty line. The county is 90.59 percent White, 2.28 percent Asian, 0.89 percent Black, and 9.95 percent Latino of any race.

Jefferson County contains one school district, Jeffco Public Schools, that is congruent with the county. Jeffco Public Schools administers 17 high schools. Figure 2 displays each high school's catchment area. The present day enrollment is 86,547. The district has more qualified teachers and affluent base than most of Colorado, with 99 percent of their teachers ranked as "highly qualified" by No Child Left Behind standards.[6]

Columbine High School is located in Columbine, Colorado, a census designated place. Currently about 1,700 students attend the school and about 24,000 people live within the Columbine High School boundaries. Looking at Figure 3, it is clear that while the Columbine

[6]All statistics are provided by the Jeffco Public Schools website.

boundaries are not random, they are not determined by any clear demarcations. With the exception of the Southern boundary, which runs along the Chatfield Reservoir, the Columbine area is surrounded by similar residential areas. Houses east of Wadsworth Blvd with high school age children would attend Columbine High School, houses west are in the Chatfield High School Catchment Area, but otherwise the neighborhoods are indistinguishable from one another. This similarity helps remove concern about possible confounding variables when examining the effect of the Columbine Massacre.

In Table 2 I compare the means of several key variables for homes in the CCA to the control properties. Houses in the CCA sell for about $10,000 more on average and are several years newer than homes in the rest of Jefferson County. The difference in value however, is only 3.7 percent of the average sale price. Homes in the CCA are on substantially smaller lots than the average in Jefferson County, but this is driven by the number of homes not in the CCA that are located in the foothills and have much larger lots. The median lot size is actually about 10 percent larger in the CCA than the rest of Jefferson County. Overall the homes in the CCA are somewhat nicer than the rest of county, which is addressed by creating a synthetic control group in the results section of the paper.

There was only one redistricting that occurred during the time span studied. The neighborhoods north of Bowles Avenue, east of Wadsworth Boulevard, west of Sheridan Boulevard, and South of Quincy Avenue that were not already part of Denver County were reallocated to Dakota Ridge High School from Columbine High School in 2001. Otherwise the boundaries that determined the CCA remained constant. Along with the variation generated by the multiple sales of a property, this boundary change also allows me to identify the effect of a social stigma on asset value.

3 Conceptual Framework

Why is stigma so difficult to identify empirically? With most negative shocks consumer utility will be affected through several indirect channels such as physical change. I define stigma as the direct effect on utility because of the event itself, not through an intermediary such as changes in risk or physical attributes. In other words, the knowledge of the negative shock causes disutility for consumers. In this paper I argue that the Columbine Shooting isolates stigma because disutility from the shooting was only caused by knowledge of the event.

The characteristics of the property that affect utility consist of several factors, including attributes of the property itself, characteristics on the neighborhood as a whole, changes in risk, and stigma, or the the direct effect of the event on utility. A consumer's utility function

is as follows:

$$U_{ij} = U_{ij}(X_i,\ N_j(S_j(e), D_j(e), \Gamma_j(e)),\ R_j(e),\ e_j) \tag{1}$$

Where i indexes property and j indexes neighborhood. The physical characteristics of the house such as the square footage or number of bedrooms is denoted X_i. It is assumed that $\frac{\partial U_{ij}}{\partial X_i} > 0$ and $\frac{\partial^2 U_{ij}}{\partial^2 X_i} < 0$. Neighborhood characteristics, N_j, refers to observables that affect all houses in the neighborhood, but do not alter a property's characteristics at the unit level. While negative shocks, e_j, can affect both a neighborhood and a particular house, such as a flood that damages some homes but not others, in this paper I will focus only on shocks that do not affect any house individually, but are at the neighborhood level only. Neighborhood characteristics include school quality, S_j, the demographic characteristics of the neighborhood, D_j, and other neighborhood characteristics, Γ_j, such as environmental contamination that could result in adverse health, local infrastructure quality or the number of nearby parks. Consumers sort into neighborhoods that have their preferred demographic structure, so any significant deviation from the status quo will necessarily negative.

The utility a consumer receives from owning a property also depends on the risk, R_j, that another negative shock will occur. Risk in this case is perceived risk, which may or may not be equal to actual risk.[7] The final component, e_j, is the event or negative shock itself.[8] This last term in Equation 1 is the direct effect of the event on consumer utility, which I define as stigma because the effect is not being mediated through any objective change in the quality in housing.

Taking the derivative of Equation 1 with respect to e_j, a negative shock, yields the following:

$$\frac{dU_{ij}}{de_j} = \frac{\partial U_{ij}}{\partial N_j}(\frac{\partial N_j}{\partial S_j}\frac{\partial S_j}{\partial e_j}) + \frac{\partial U_{ij}}{\partial N_j}(\frac{\partial N_j}{\partial D_j}\frac{\partial D_j}{\partial e_j}) + \frac{\partial U_{ij}}{\partial N_j}(\frac{\partial N_j}{\partial \Gamma_j}\frac{\partial \Gamma_j}{\partial e_j}) + \frac{\partial U_{ij}}{\partial R_j}(\frac{\partial R_j}{\partial e_j}) + \frac{\partial U_{ij}}{\partial e_j}$$

where the result of a negative shock on school quality, is non-positive, $\frac{\partial S_j}{\partial e_j} \leq 0$. The effect on demographics and other neighborhood characteristics is also non-positive, $\frac{\partial D_j}{\partial e_j} \leq 0$ and $\frac{\partial \Gamma_j}{\partial e_j} \leq 0$, respectively. All three of these components are viewed by the consumer as changes in neighborhood quality, N_j. The change in perceived risk from a negative shock could be negative or positive, $\frac{\partial R_j}{\partial e_j} \lessgtr 0$. Risk could either be at the neighborhood or individual property level, and for this paper I will assume the latter. Finally, the negative shock has a

[7] There is a separate literature on whether policy makers should compensate consumers for actual or perceived risk. This paper abstracts from whether the perceived risk is equal to actual risk because that is irrelevant from the consumer's perspective.

[8] A shock could be positive, such as neighborhood being named the best in a city. This paper will assume the shock is negative.

direct effect on utility, $\frac{\partial U_j}{\partial e_j} \leq 0$, or social stigma.

The change in perceived risk of a future shock is unclear because negative shocks can increase or decrease the odds, real or perceived, that a repeat event occurs. Especially with consumers who have imperfect information, or use market information incorrectly (Case and Shiller, 1989), risk perceptions may not be accurate. Donovan et al. (2007) showed that housing prices were positively correlated with wildfire risk until wildfire risk assessments were published online, and the correlation then became negative. An actual wildfire in the area would have a similar effect. On the other hand, a volcano generally erupts only once in a short time frame, so after an eruption the perceived risk of a second occurrence could actually decrease.

Given this framework I now argue that the past literature identifies stigma effects that comprise changes in risk or physical characteristics. I then show how the Columbine shooting allows me to isolate $\frac{\partial U_{ij}}{\partial e_j}$.

3.1 Previous Papers and Stigma

Several papers attempt to isolate stigma, but combine $\frac{\partial U_{ij}}{\partial e_j}$ with other effects. Collins and Margo (2007) illustrates how difficult pure stigma effects are to untangle. They examine the effects that 1960s race riots across the USA had on current housing prices. While it is sensible that a neighborhood that had a highly publicized riot, such as the Watts area of Los Angeles, experiences a direct stigma effect ($\frac{\partial U_{ij}}{\partial e_j}$), the riot had other impacts as well. Large amounts of the neighborhood were destroyed ($\frac{\partial \Gamma_j}{\partial e_j}$), and the demographics of the neighborhood permanently shifted ($\frac{\partial D_j}{\partial e_j}$). All three effects are negative, making it difficult to say if there is any lasting pure social stigma, or if the decrease in housing prices is entirely due to the neighborhood effects.

McCluskey and Rausser (2003) defines stigma as a decrease in housing prices after cleanup of a hazardous waste area is declared complete, which implicitly assumes that residents agreed with the assessment and ($\frac{\partial R_j}{\partial e_j} = 0$) . This is one of several papers that assumes consumers believe an environmental cleanup was 100 percent successful and there is no increased perceived risk after cleanup (Bond 2001 and Elliot-Jones 1996). If consumers do not believe that cleanup is truly complete though, then their perceptions of risk will change. Locations such as the Rocky Flats Plant in Colorado have shown that despite government claims to the contrary, complete environmental cleanup is not always achieved (Flynn et al., 1998). Locals were also highly skeptical of government reports that cleanup was complete in Love Canal, New York. Even if environmental cleanup is successful, a skeptical population may still increase their risk perception. While both perceived and real risk can be used to

assess welfare changes (Salanie and Treich 2009; Johannsson-Stenman 2008), the effect from the additional risk may be several orders of magnitude larger than a pure stigma effect.

The combination of risk and stigma is seen clearly in Dale et al. (1999), which examines the loss in property values after a nearby smelter closes and cleanup has supposedly been successfully completed. If the direct effect of the now non-existent smelter on neighborhood housing values was acting alone, the gradient of impact would be shallow; that is, homes throughout the neighborhood would be more or less equally affected because all homes in close proximity have the same association with the smelter. Instead, the distance to the former smelter within the same neighborhood is strongly correlated with the change in housing prices, indicating that stigma is not the only causal factor. Instead, a change of perceived risk ($\frac{\partial U_{ij}}{\partial R_j} \cdot \frac{\partial R_j}{\partial e_j}$) by consumers, who most likely believe that the cleanup was not successful, is working in concert with stigma. A similar situation is also seen in Naoi et al. (2009) and Harrison et al. (2001).

Bond (2001) examines housing markets near environmentally contaminated sites. Stigma is defined as "the residual loss in value after all costs of remediation, including insurance and monitoring, have been allowed for". This implies that stigma is assigned by the accuracy of remediation; the same event could lead to either negative or positive social stigma if policy makers under or over estimate the effect of a negative shock, respectively. That is, if policy makers overcompensate home owners by paying them more than the decrease in their housing stock, the event would be said to have a positive stigma. This is not stigma at all, but a testament to the uncertainty of damages that a neighborhood level negative shock can cause. Compensation for stigma does not remove the stigma, but corrects for it. This and the previous examples show how difficult pure stigma effects are to isolate.

3.2 Columbine and Stigma

Contrary to these previous examples, the Columbine Shooting is unique in several ways. First, it was random and unpredictable. Second, there were no short or long term effects to the neighborhood surrounding Columbine High School. There was no physical damage to any parks, houses, or neighborhood infrastructure. In the terms of the model, ($\frac{\partial \Gamma_j}{\partial e_j} = 0$). Third, neighborhood demographic changes would take years to shift, meaning that in the immediate aftermath of the shooting $\frac{\partial D_j}{\partial e_j} = 0$. Third, as a corollary to the randomness of the shooting, there is no reason to believe that residents feared a second shooting. In fact, several people I have spoken with had a "lightening never strikes the same place twice" mentality, and believed that a shooting was no less likely since on had already occurred, meaning that $\frac{\partial R_j}{\partial e_j} \geq 0$, which will either not affect an estimated stigma or provide a positive bias, leading

to an understated stigma effect.

Finally and most importantly, school quality also did not change ($\frac{\partial S_j}{\partial e_j} = 0$). Physically, the library, where many of the deaths occurred, was walled over but otherwise the school was completely repaired by the following school year. No teachers retired in the year after the shooting and only one was killed. The principal and public face of Columbine High School in the wake of the massacre, Frank DeAngelis, vowed to stay at his position until those that were Freshman during the 1998-1999 school year graduated. He remained principal of Columbine High School until retiring at the end of the 2013-2014 school year. In the wake of the shooting, there were concerns about the strength of security in the schools. All schools in Jeffco went through the same procedural changes however. Columbine was not singled out for more security than any other high school. Enrollment did decline in the years after the shooting, a peak year of 2000 had already been projected due to lower attendance in the Elementary and Junior High schools that feed into Columbine. Most tellingly, the number of students who chose to enroll at Columbine under Jeffco School's open enrollment program stayed constant in the years after the shooting.[9] This also provides circumstantial evidence that the decrease in housing values was caused by people moving into Jefferson County from another area. That is, people that had no knowledge of Columbine's existence until the Massacre were more stigmatized than those who already knew about Columbine High School.

In summary, many authors have examined stigma, with most attention being given to environmental disasters and subsequent cleanup. All previous papers however, either assume that risk remained constant, include risk as a component of stigma, or include other changes as components of stigma. While this information is still useful, a pure stigma effect has never been calculated. The Columbine Shooting is unique in that housing prices were affected directly by the shooting with no intermediary mechanisms, allowing me to isolate $\frac{\partial U_{ij}}{\partial e_j}$.

4 Data and Identification Strategy

The data are provided by the Jefferson County Assessor's Office. The assessor provides information on the last four sales of every parcel of land in the county. This includes commercial properties, apartment complexes, government land, and any other property within the county lines that has been sold. Figure 4 displays the number of sales of single family

[9] While Jeffco Schools records the number of students who enroll at each high school under the open enrollment program, it does not record where those students come from. Therefore it is unknown how many students open enrolled out of Columbine High School in any year.

homes by year in Jefferson County. Figure 5 shows the number of sales by year of homes only in the CCA. While the late 1990s have more sales both in the CCA and in Jefferson County overall than the early 2000s, the drop is greater in the CCA, perhaps because homeowners recognized the possible loss in value to their homes after the Columbine Shooting and delayed selling their property.

A key aspect of the data is that the last four sales are included regardless of the time span. If a property sold four times in the last 10 years, then no sales before that are included. If a property has been sold four times in the last 100 years, then those four sales are included. The disadvantage to this data arrangement is that any property that has sold four times since the Columbine Shooting will not have a before the shooting sales observation. All properties in Jefferson County are reported by the County Assessor's Office, but for this paper I use only single family homes. The resulting Data Set consists of sales that occurred between 1980 and 2013.

Summary statistics are provided in Table 1. There are a total of 211,205 sales of homes that were built no later than 1999. All prices have been converted to 2010 dollars. The average price of a home is just under $270,000, and prices have a great degree of dispersion. The fifth and ninety-fifth percentile are $133,000 and $418,000 respectively, and the standard deviation is approximately $225,000. A large part of this dispersion is based on the length of time over which the observations are observed. The housing boom in the 1990s led to an immense increase in real prices. In Jefferson County, the average sales price of a single family house more than doubled from 1990 to 1993 alone. During the Great Recession of 2007-2009, housing prices and number of sales dropped steeply.

4.1 Identification

To leverage the panel nature of the data, the following main specification is used:

$$Ln(Slsamt_{it}) = \alpha + \beta_1 Columbine_{it} + \beta_2 After_{it} + \beta_3 (Columbine * After)_{it} + \delta_t + \theta_i + \epsilon_{it} \quad (2)$$

Where the sales amount of property i in time t is regressed on a difference-in-difference model. The CPI-chained price is denoted $Slsamt_{it}$ for house i in year t. The data set includes the exact date of sale, so $After_{it}$ is given a value of one for any sale after April 20, 1999.[10] An indicator variable, $Columbine_{it}$, takes the value of one for a house that was

[10] $After_t$ is not collinear with year fixed effects because there are homes that were sold in 1999 both before and after the Columbine Shooting.

in the Columbine area at the time of the sale. The coefficient of interest, β_3, measures the relative change of housing prices in the CCA after the shooting. A year fixed effect,δ_t, allows for non-linear price trends in the housing market. The repeat sales nature of the data set allows me to include property fixed effects, θ_i, and examine change in value within property. Because of concerns about serial correlation, all results are clustered by parcel of land with robust standard errors (Bertrand et al. 2004). It is important to note that in 2001 several neighborhoods were redistricted and switched from Columbine High School to Dakota Ridge High School, so even with parcel fixed effects a Columbine indicator variable must be included if years after 2000 are included.[11]

An alternative specification that I use extensively in my results is below:

$$Ln(Slsamt_{it}) = \alpha + \beta_1 Columbine_{it} + \beta_2 After_{it} + \sum_{y=1999}^{2013} \beta_y (Columbine * y)_{it} + \delta_t + \theta_i + \epsilon_{it} \quad (3)$$

Where each year after the shooting has its own interaction term with the Columbine variable. The variable $Columbine * 1999$ is set to one only for sales that took place after April 20th for houses that were in the CCA at that time.

The most salient advantage of this identification strategy is the inclusion of the property fixed effects. Most research done on housing prices incorporates a hedonic model, where the effect of different characteristics of a property on price are quantified using a rich data set that includes aspects of a house such as number of bedrooms, square footage, size of the garage, and others. The Assessor's data set does not include much information about the individual properties and this could create a large omitted variable bias of unknown direction. By examining the effect of the Columbine shooting within any given property, instead of across properties, any differences that are time invariant between houses will be captured by the house fixed effect. While some homes will undoubtedly undergo renovation and others will fall into disrepair, there is no reason to believe that the prevalence of either would be different in the CCA compared to the rest of Jefferson County.

The effect of the Columbine Shooting is identified byβ_3 in Equation 2 and $\beta_{1999} - \beta_{2013}$ in Equation 3, which isolates intra-property changes in price. By identifying the difference in the trends between houses within the CCA and the rest of Jefferson County, the coefficient quantifies the effect of the shooting and of social stigma as compared to a hypothetical counterfactual; what would have happened to housing prices in the CCA had the shooting not occurred. For the interpretation of the coefficient on the 1999 or 2000 interaction term to be spurious, a negative shock would have had to occur in the CCA at almost the same time as the Columbine Shooting without spilling over into other catchment areas.

[11] Although some houses move out of the CCA, there are not enough sales in a particular year to reliably estimate an effect using only these observations.

5 Results

All specifications include the middle 98 percent of all sales prices, resulting in a minimum sales price of $29,000 and a maximum sales price of $4,082,000. Including all properties does not change the statistical significance or magnitude. This is done to eliminate any possible coding errors, as there are several properties whose sales price is listed as either less than $10,000 or above $1 billion. Table 3 displays preliminary results. Column 1 is a standard OLS regression that omits the property fixed effects from Equation 2. This result shows a statistically significant negative effect caused by the Columbine Shooting across homes. The coefficient indicates that houses that sold in the CCA after the shooting sold for 10.9 percent less than they would have otherwise. Column 2 displays results from Equation 2, which includes the property fixed effect. The coefficient on the interaction variable halves in size. This is most likely because the profile of homes sold in Jefferson County changed over time. That is, after the Columbine Massacre it is possible that those with less expensive homes decided to sell more frequently. Column 3 restricts sales years to 1994 through 2000 to isolate the immediate after-effects of the shooting. The coefficient on the interaction term corresponds to a 11.8 percent relative drop in housing prices.

Table 4 examines the effect of the shooting by year using Equation 3. Figure 6 displays the same information graphically with a 95 percent confidence interval. For homes that sold in 1999 in the Columbine area after April 20, the coefficient indicates a 9.9 percent decrease. I interpret this number with caution because the date of sale on file is the closing date, which on average is two months after the offer from the buyer has been accepted by the seller. This would bias the results toward zero, as homes that sold in May and early June had an agreed upon price before the shooting. The first full year of sales after the shooting, 2000, shows a 10.1 percent decrease in housing price, is highly statistically significant, and is consistent with Column 3 in Table 3.

As more years pass, the effect shows an attenuating trend, decreasing to only 3.5 percent by 2007. The downward trend also gives circumstantial evidence that the true effect in 1999 was greater than 10.1 percent and was possibly as large as 11 percent. Interestingly, statistical significance is lost during the height of the Sub-prime Mortgage Crises and Great Recession as the coefficient on the interaction term nears zero. In 2012 and in 2013, the last two years data are available, the magnitude on the coefficient increases and statistical significance returns. The number of houses sold decreased sharply from 2007-2010 as property lost a large percentage of its value, so the weight prospective home buyers place on stigma may be pro-cyclical with the economy. During the height of The Great Recession, home buyers would have had less money to spend on housing, so houses in the Columbine area seemed

more like a bargain. With the return of consumer confidence, it appears that consumers again placed a value on the stigma of living in the CCA.

It is important to note that without information on the demographics of neighborhoods within the CCA the results in later years should be interpreted less confidently. If different demographic groups began to migrate into the area because of decreased housing prices, then the effect is no longer purely social stigma (Clapp et al. 2008). By comparison, in the year 2000 locals would not yet be responding to a change in the demographics of the area.

5.1 Robustness Checks

Table 5 begins a series of robustness checks. In Column 1 I drop any houses that switched from part of the CCA to the Dakota Ridge Catchment Area. The coefficients stay negative and highly significant. Next I alter the time window used to show that previous results are not caused by a statistical irregularity. In Column 2 the time span is changed from 1990-2013 to 1994-2013. The coefficients stay negative, although do not maintain significance past the immediate aftermath of the shooting. In Column 3 the time window is 1980-2013. The results stay statistically significant and the magnitudes moderately increase.

Columns 4 and 5 limit the group of properties being used as the counterfactual. Most of Jefferson County is part of suburban Denver. The western and southern portion of the county enter the foothills of the Rocky Mountains, resulting in a much lower population density. Although still near Denver geographically, the towns of Evergreen, Conifer, and Pine are closer to mountain towns than metropolitan suburbs.[12] While most of Jefferson County is similar to the CCA, these properties may not be optimal controls. By eliminating the neighborhoods most unlike the treatment area, the counterfactual will provide a better comparison. In Column 4 houses in zip codes that are entirely in the foothills are eliminated from the sample. In Column 5 additional zip codes that are mostly in the foothills are also eliminated. While these areas are large, they are sparsely populated and do not have many property sales. Compared to Table 4, only seven thousand thousand homes are omitted in Column 4 of Table 5. In both cases the results maintain statistical significance and a similar magnitude.

Table 6 presents a second series of robustness checks. In Column 1 all homes with only one or two sales between 1980 and 2013 are dropped. Properties with only one sale will be fully captured by the property fixed effect. Although the one-sale homes will not affect the coefficients, they will deflate the standard errors. Restricting the data to homes with at least three sales sharply reduces the number of observations in the sample to 31,632, but the standard errors are now only reflecting homes that have three or four sales between 1980

[12] As their names suggest.

and 2013. Column 2 repeats the exercise, but only homes with four sales, the most allowed by the data set, are included. In both cases the magnitude and statistical significance stay largely unchanged in the year 2000. Columns 3 and 4 repeat Columns 1 and 2 but include number of sales from years 1990-2013 instead of 1980-2013. Once again the results are largely unchanged. The large number of observations in the complete sample also deflate the standard errors, and Column 5 addresses this issue by using a random 25 percent subsample from all properties. This increases the magnitudes of the coefficients, but results remain highly statistically significant.

One possible concern is that those that were directly impacted by the Columbine Massacre, especially those that lost a family member, had a tangible association with the event and were willing to sell their home at a lower price. For those households, the Columbine Massacre would carry more than just a social stigma. While this is not testable empirically, households with negative memories from the Columbine Shooting would have most likely sold their homes within several years of the event. The effect however persists throughout the 2000s, which is before a large demographic shift could have occurred but after any families directly affected by the tragedy would have left the area. Also, because of Jefferson County Schools open enrollment policy, all families would have the option of remaining in the same neighborhood but sending their children to a different school.

In summary, the results stated in Section 5 stay consistent after numerous robustness checks. Despite numerous alternative counterfactual groups, the coefficient of interest remains both statistically significant and the magnitude varies over a narrow range. Removing properties that are in neighborhoods most unlike the CCA and restricting the data set to properties that have the most sales confirms that stigma has an economic impact. Next, I give a detailed description of the synthetic control technique to further buttress the results.

5.2 Synthetic Controls

Following Abadie, Diamond, and Hainmueller (2010) I create a synthetic control group for the CCA. The synthetic control method treats all houses in the CCA as one neighborhood and then a weighted average of control neighborhoods that are most similar to the CCA are used as the comparison group. This technique is useful because the neighborhoods that most closely match the CCA with regards to housing trends and levels will be chosen as the counterfactual group. As seen in Table 2, properties in the CCA are newer and slightly more expensive than the rest of the county. By creating a synthetic control group, neighborhoods with properties of equal value to the CCA will be given a greater weight.

Using a synthetic control group does involve disregarding some of the observations used

in the previous section however. Another weakness of the synthetic control method is that the control group is compared to the treatment group based on both trends and levels. That is, a possible counterfactual will be discarded if the pre-trends between the counterfactual and treatment group are very similar but the levels are quite different. This contrasts with the difference-in-difference method where a control group is considered an accurate counterfactual if it exhibits equal trends with the treatment group prior to the event being studied.

That being said, there are advantages to matching a treatment with a control group on levels as well as trends. Consumers that are poorer or wealthier than the average home buyer in the CCA may place a different weight on stigma. For the wealthy, avoiding stigma may be more important than for the middle class. By matching the treatment group with control neighborhoods that have similarly priced houses, preference will be more closely aligned. Overall, the strength of finding a counterfactual that displays the same pre-trend in both levels and trends makes the synthetic control method a useful robustness check to confirm the previous results.

Formally,[13] the synthetic control method minimizes $(X_1 - X_0W)'V(X_1 - X_0W)$ subject to $w_j \geq 0$ and $w_1 + w_2 + ... + w_j = 1$ by choosing the optimal W. $W = (w_1, w_2, ..., w_J)'$ is a $(J \times 1)$ vector of non-negative weights where $j = 1, ..., J$ gives the number of possible control neighborhoods used in creating the synthetic counterfactual. These weights are chosen to create a control group that is as similar as possible to the CCA before the shooting. X_1 is a $(K \times 1)$ vector of pre-shooting variables for the treatment neighborhood; X_0 is the corresponding $(K \times J)$ matrix of variables for the control neighborhoods. For this paper the natural log of the sales amount from 1990 to 1998 is used as the pre-shooting variable. V is a diagonal matrix that gives weights for the variables used to establish the degree of similarity between the control neighborhoods and the CCA. Every year is given the same weight.

Figure 7 shows the results from the synthetic control test.[14] Before the 1999 the synthetic neighborhood accurately maps housing prices in the CCA. The positive spike in 1996 for the CCA is caused by the first sale of a number of expensive homes, but the overall upward trend from 1991 until the shooting is clear. Beginning in 1999 however, the synthetic control group and the Columbine Area deviate quickly. It is worth noting that Columbine house prices do not decrease, but instead stop increasing while the control group's prices increases rapidly. This was during the US housing boom, and it was unusual for average housing values to not increase during the early 2000s. This figure also shows a good pre-trends comparison, with

[13] The following is taken from Abadie and Gardeazabal (2003)

[14] The majority of neighborhoods are given some small weigh in this test, such as 0.007 or 0.008. Four neighborhoods are given weights 0.01 or higher. They are located in Ken Caryl, Evergreen, and Golden, Colorado. The most influential neighborhood is assigned a weight of 0.077.

a synthetic control that closely matches both the levels and trends of the Columbine area.

The gap between the synthetic control group and treatment group corresponds to a roughly 20 percent difference in housing prices in 2001, with the effect only dissipating slightly over time. This is nearly double the size of the effect found in the difference-in-difference regressions. This could be because the true effect is larger than the previous results indicate and the more accurate control group found by the synthetic control method displays the true impact.

Figure 8 shows the results for a synthetic control test but with a different control variable.[15] First, the log sales price is regressed on year fixed effects and property fixed effects. Then the residuals are saved and those residuals are used as the pre-treatment matching variable that creates the synthetic control group.[16] Because the residuals are within house differences, which has more variation than the average of thousands of homes sold, the residuals fluctuate more from year to year. For the same reason the synthetic control group does not match the the CCA as well as the previous example. Still, around the time of the shooting houses in the CCA see a marked and sustain decrease in prices relative to the synthetic control.

Figure 9 shows the results of a large-scale placebo test. Each gray line represents a neighborhood that matched its own synthetic control neighborhood at least as well as Columbine matched its synthetic control neighborhood in the pre-treatment period.[17] Each line is the difference between the "treated" neighborhood and the synthetic control neighborhood average sales price in thousands of dollars. It is clear that the majority of neighborhoods cluster around zero throughout the post-treatment period, although there is a slight downward trend in most of the neighborhoods that the CCA mirrors. Some neighborhoods do spike upwards because of new subdivisions with relatively expensive houses opening, causing the treatment neighborhood residuals to be larger than the synthetic control neighborhood. Of the neighborhoods where the synthetic control is larger than the treatment neighborhood, Columbine is the most negative. This provides additional evidence that the Columbine Shooting was responsible for a sharp decrease in housing in the Columbine area.

[15] In this synthetic control test most neighborhoods are given a small weight of 0.006-0.009, and nine neighborhoods are given a weight of 0.01 or higher. The highest weight assigned to a neighborhood is 0.024.

[16] Any property that only has one sale will have a residual of zero and will not contribute to the results.

[17] This was calculated by summing the squared residuals for each year between the actual neighborhood and the synthetic neighborhood. In the appendix I also do a placebo test for neighborhoods that match at least 50 percent worse than the CCA, and neighborhoods that match at least 100 percent worse.

6 Discussion

In this paper, I use the unique aftermath of the Columbine Massacre to ascertain whether social stigma exists and quantify the magnitude. I find that the Columbine Shooting resulted in a 10.1 percent decrease in housing prices. This corresponds to a $19 million dollar loss to property sellers in the year 2000 alone. By leveraging panel data that eliminates many of the omitted variables that present problems in traditional hedonic housing models the effect of stigma from the Columbine shooting is effectively isolated. The results are robust to an array of robustness checks and alternate specifications, all of which show a consistent negative effect in the CCA. Using a synthetic control group confirms that after the 1999 Columbine shooting housing prices in the area stagnated while the rest of Jefferson County saw a steep rise in prices.

To claim that the 10.1 percent decrease in housing prices is solely a result of stigma, there must be no concurrent mechanisms such as changes to school quality or risk. First, Columbine High School saw no physical changes in the aftermath of the shooting save the continued closure of the library, which was walled over and eventually turned into an atrium. Second, the school quality remained the same. Third, unlike environmental contamination or a "murder house", almost all home buyers would know that their house was part of the CCA and their children would be attending Columbine High School. Fourth, outside of the school itself there was no tangible effect of the shooting, meaning that the neighborhood did not change in any identifiable way.

Although no data exists as to whether residents thought that there was now a higher risk of a copy-cat or repeat shooting, personal evidence gathered by myself points to the opposite. Unlike the Beltway Sniper (Gershenson and Tekin 2015), locals say that once Columbine went through a school shooting, the odds that a second one happened at the same school was even less. From an official standpoint, all Jeffco High Schools enacted new security measures. Columbine was not singled out for more or less stringent rules or security budget. Overall, most of the community sees the Columbine Shooting as a one time event perpetrated by two deranged individuals.

This paper uses a revealed preference approach to quantify the effect of stigma. As an avenue of further research, examining the effects of a "murder house" or other socially stigmatized properties could be done. Also, little work has been done on stigma utilizing stated preference approach. It would be interesting to see how survey respondents said a stigmatized property would affect their valuation of an asset. Finally, most of the stigma literature has focused on housing stock, but it is possible that other assets such as cars, vacation destinations, or even universities could be affected by stigma. The effect of stigma

on other consumer choices should also be investigated using a revealed or stated preferences approach.

For policy makers, stigma needs to be taken into account when attempting to rehabilitate an area that has experienced a negative shock if homeowners are to be fully compensated for the loss of value of their property. In places across the country from Love Canal to New Orleans to Aurora, Colorado, negative events have made the towns bywords for disaster. The results in this paper show that after a negative shock, even if all physical damage is rectified and risk perception has not changed, social stigma will still result in a loss of property value.

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Tables and Figures

Figure 1: Map of Jefferson County

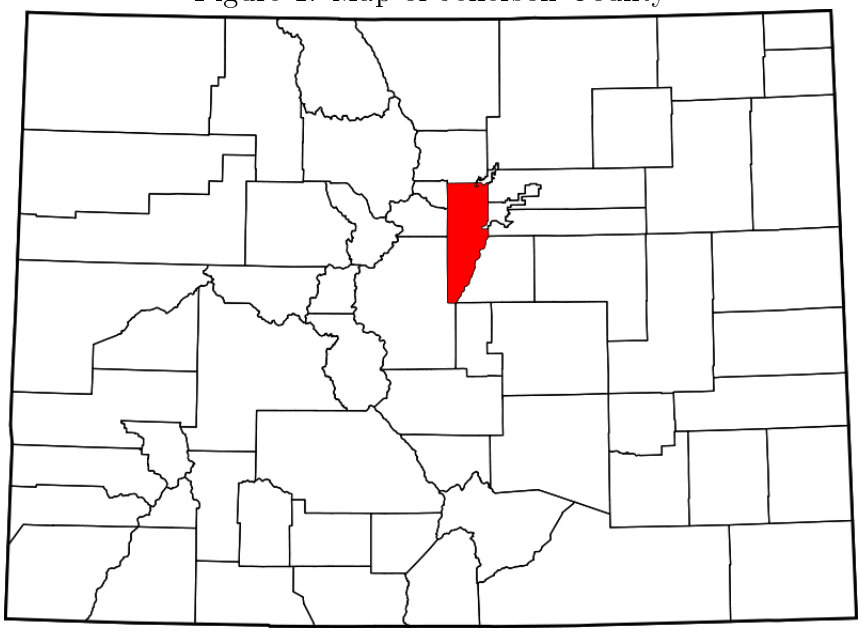


Figure 2: Jeffco High Schools

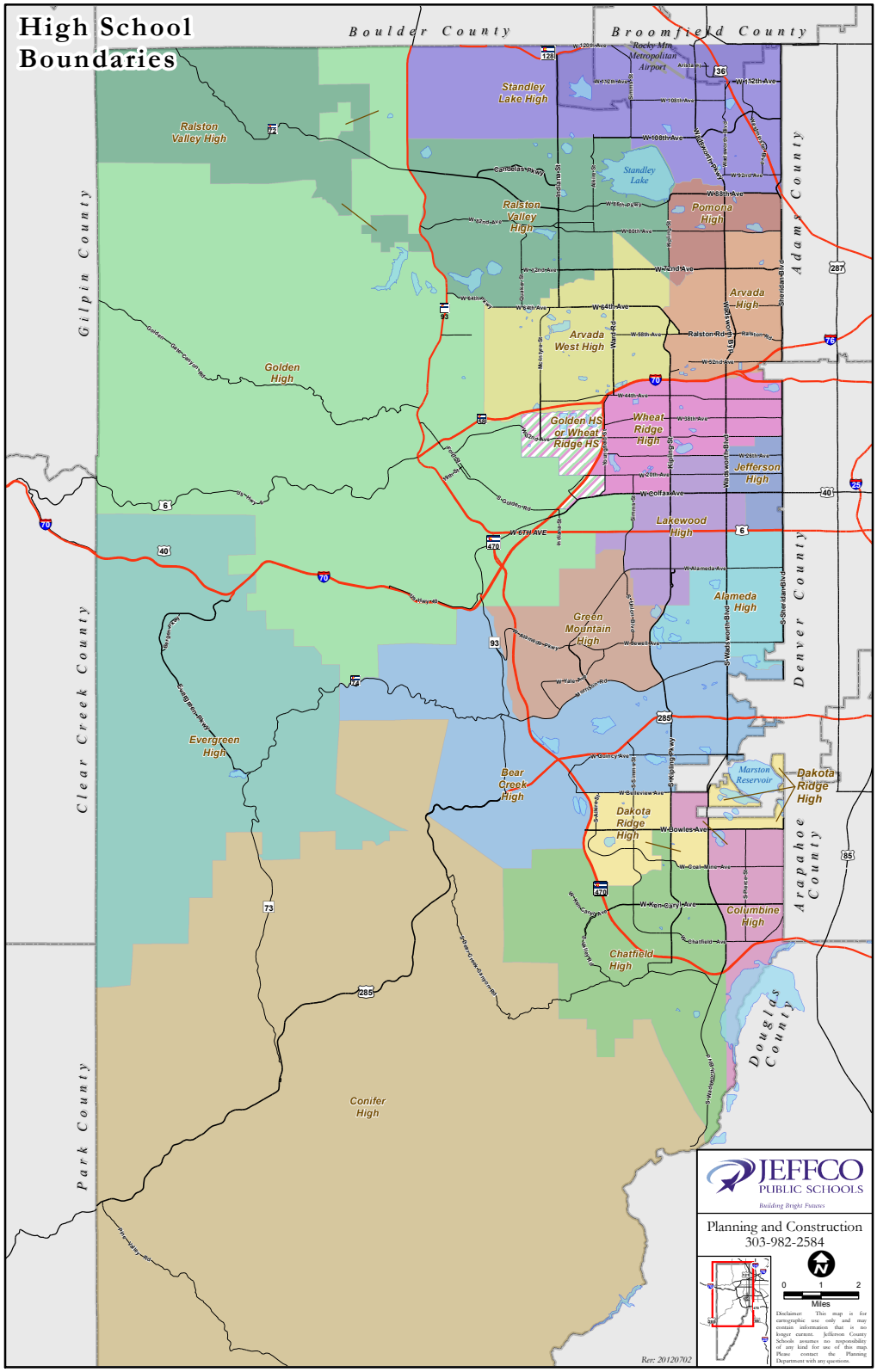


Figure 3: The Columbine Catchment Area

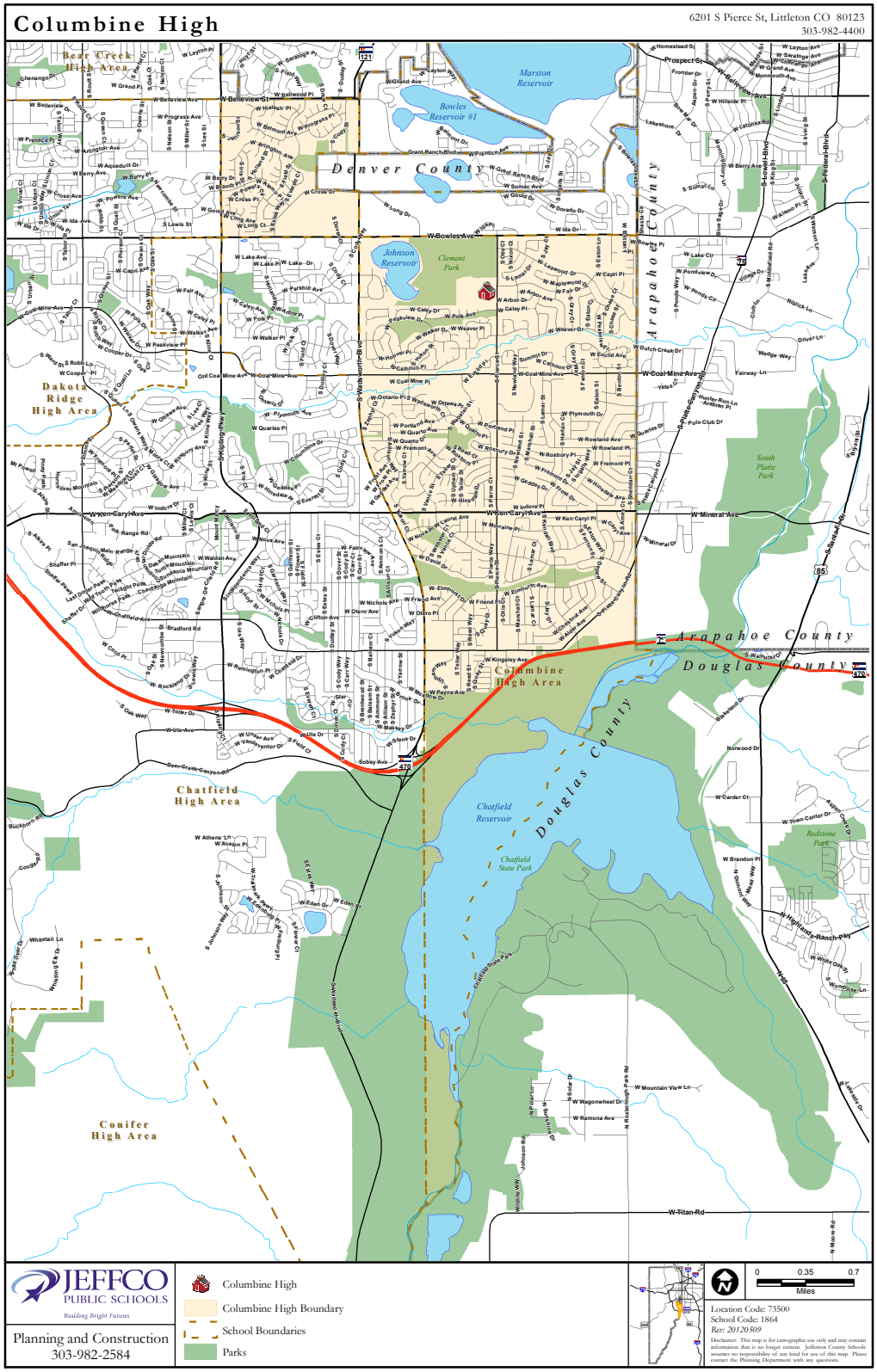


Figure 4: Sales by Year: Jefferson County

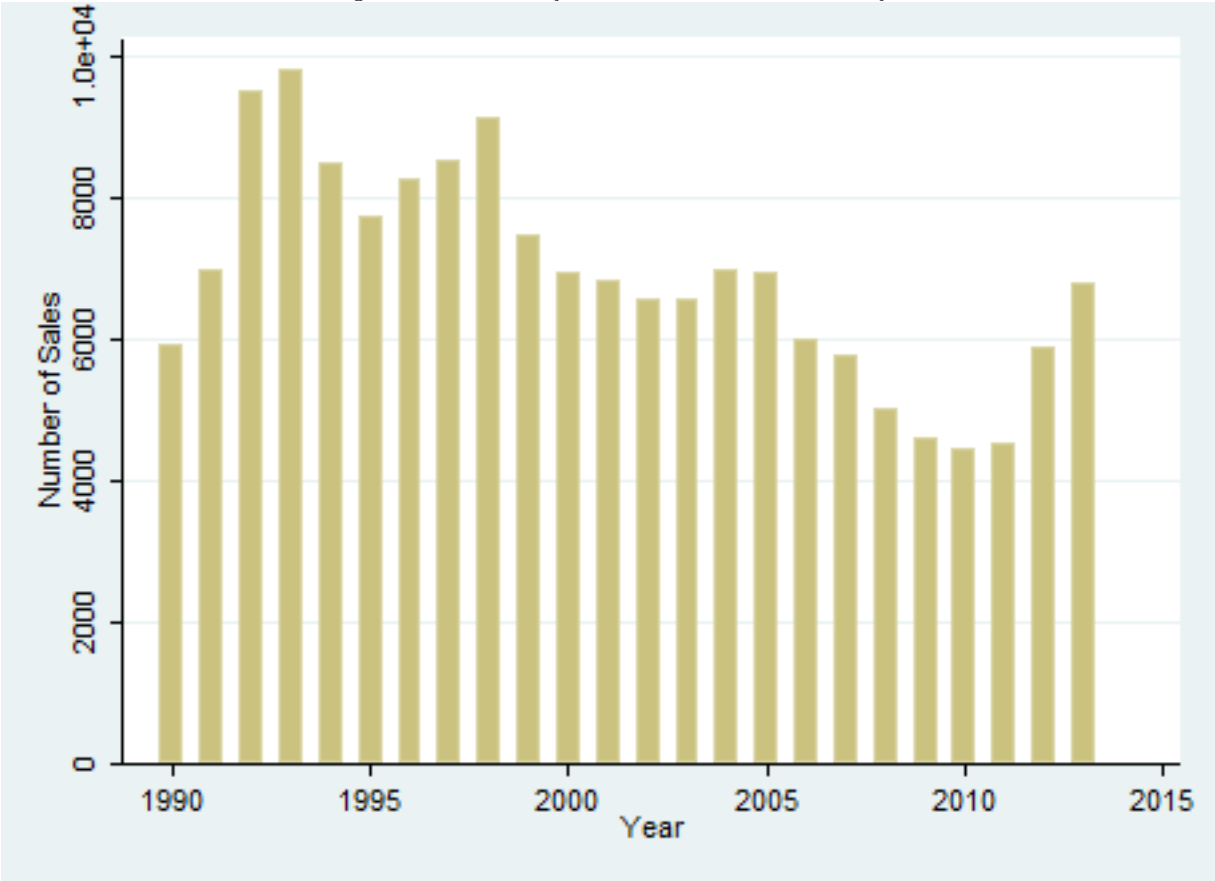


Figure 5: Sales by Year: CCA

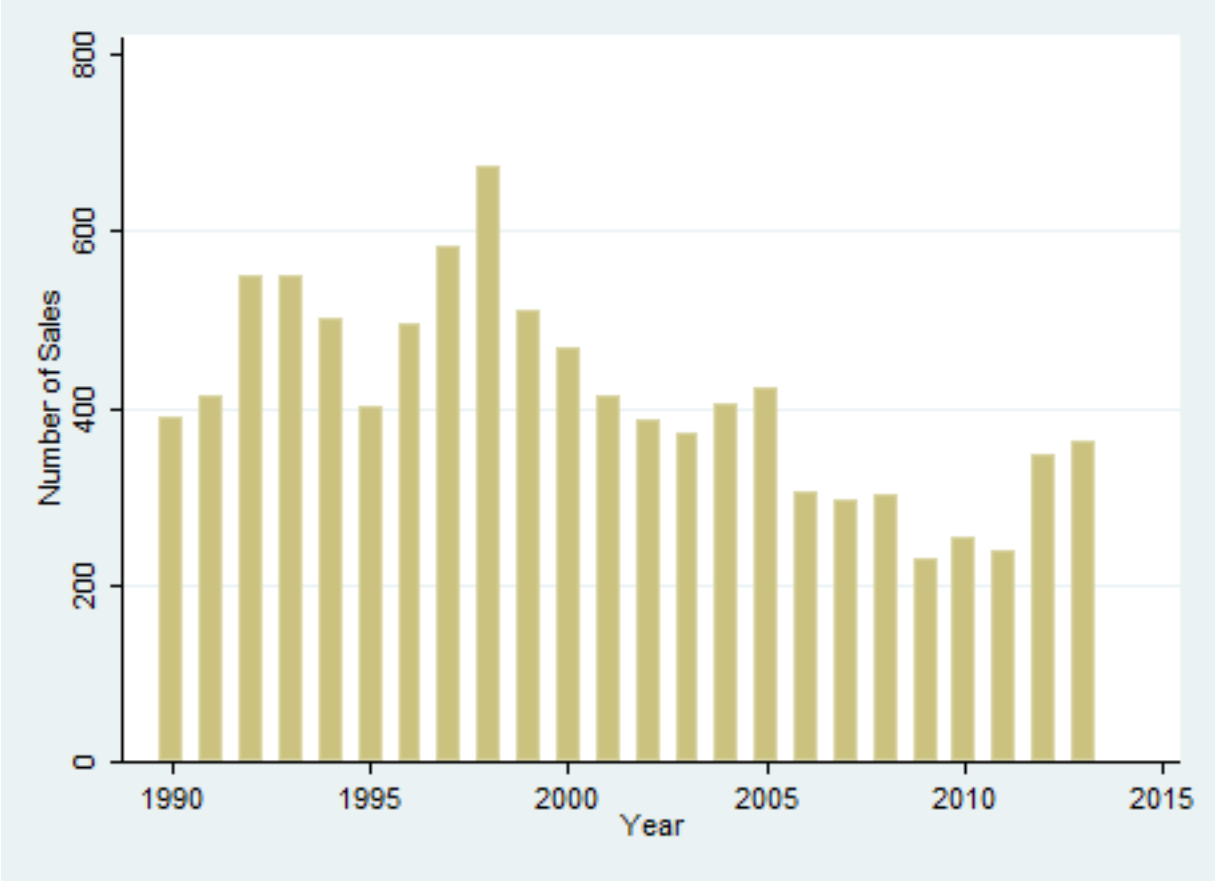
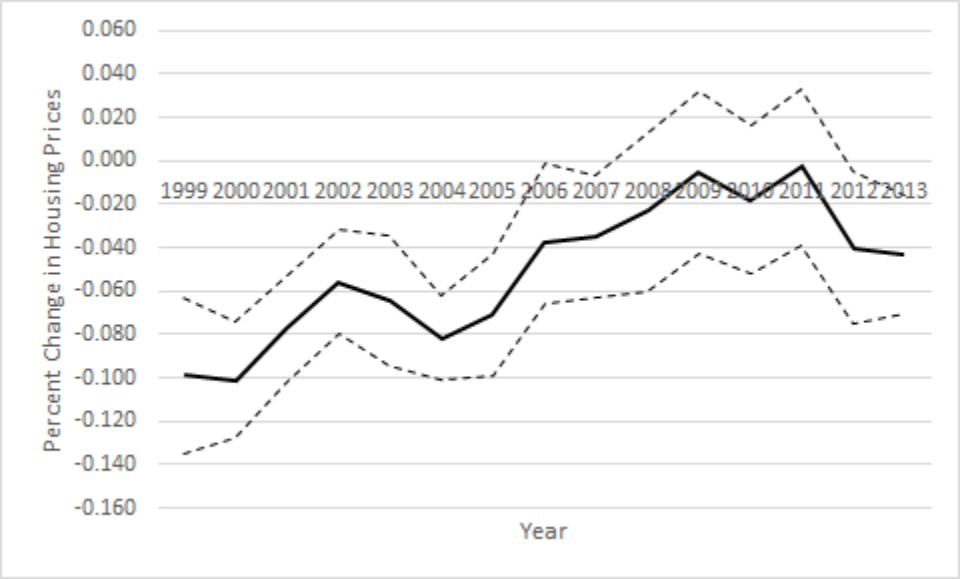
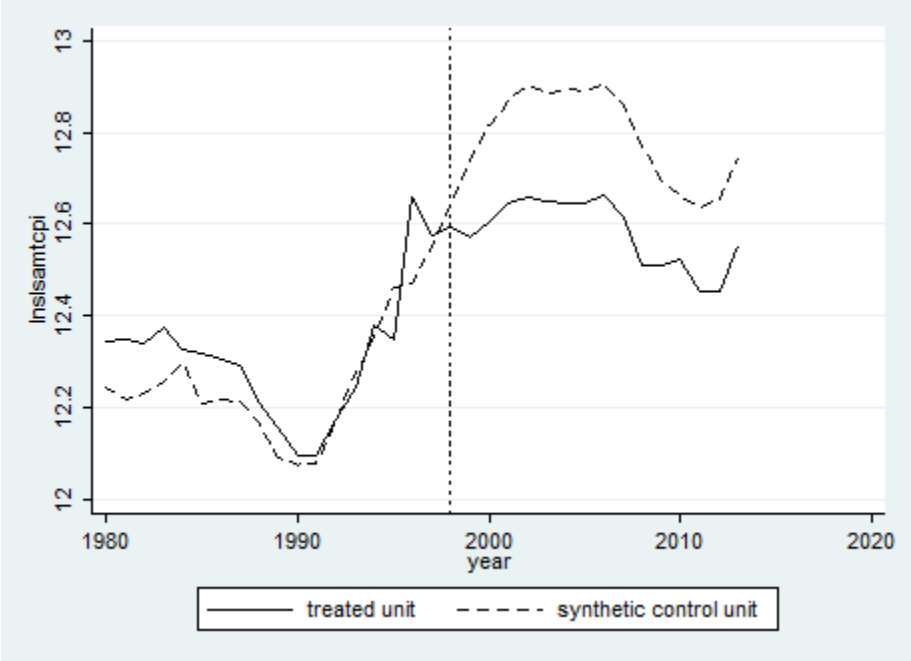


Figure 6: Percent Difference in Housing Prices by Year



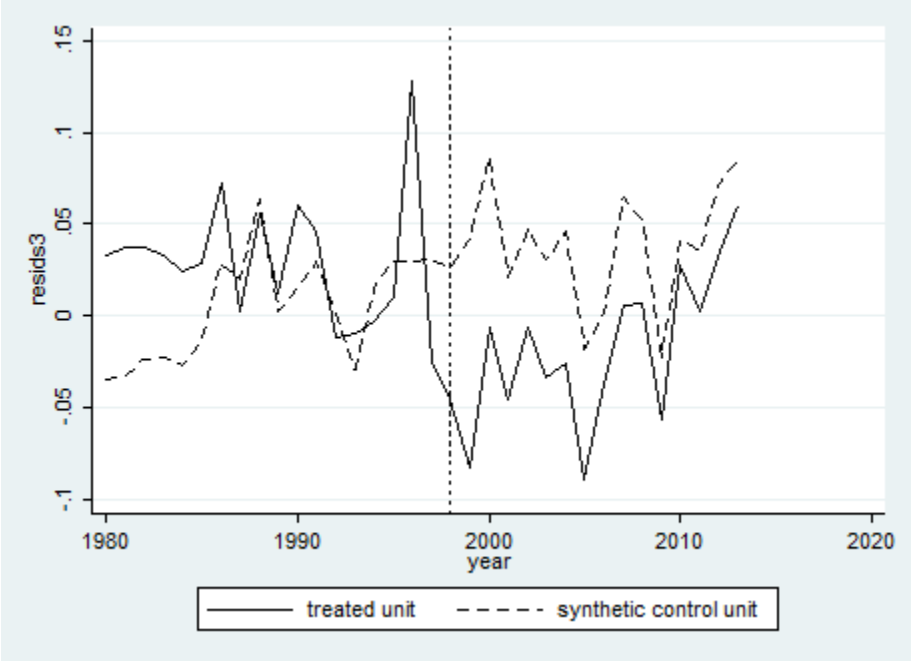
The above figure shows the results of difference-in-difference results for each year. The figure corresponds with Table 3.

Figure 7: Synthetic Control Graph



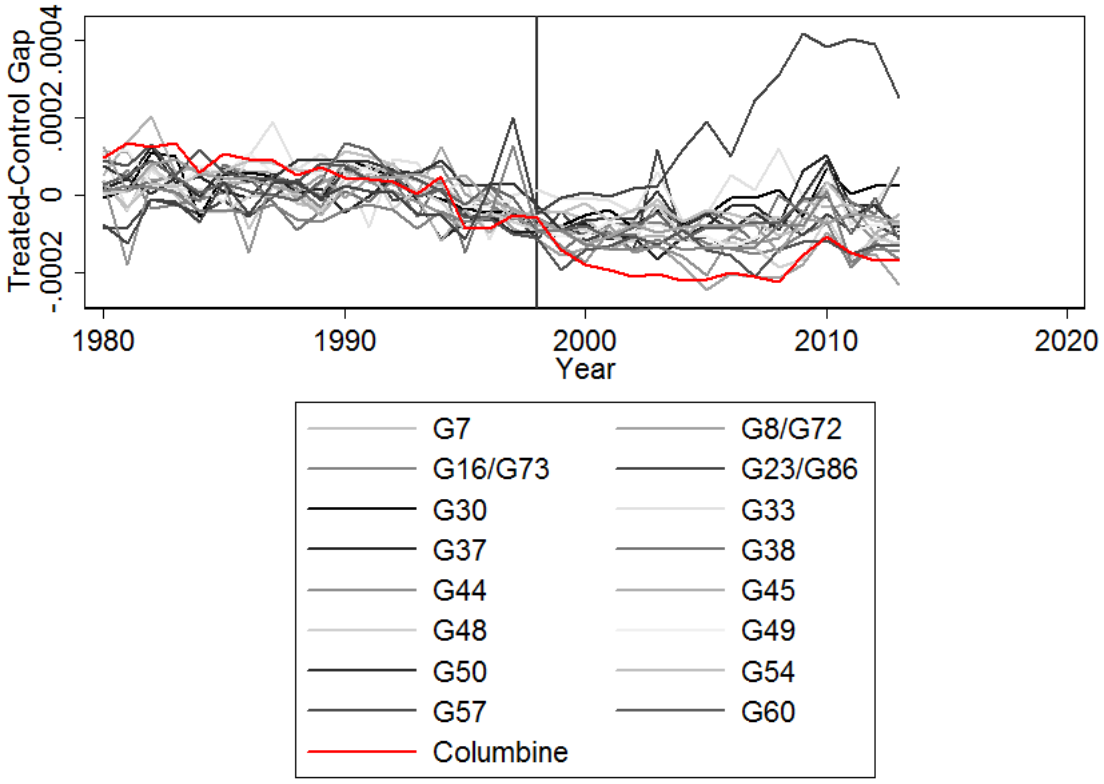
The above shows the results of a synthetic control approach, where the treated unit is the CCA. As is clear in the figure, prices in both the CCA and synthetic control area mirror each other in both trends and levels until the 1999, the year of the Columbine Shooting. The positive spike in 1996 for the CCA is caused by the first sale of a number of expensive homes, but the overall upward trend from 1991 until the shooting is clear.

Figure 8: Synthetic Control Graph Composition of Sales



The above figure shows a synthetic control treatment where the dependent variable is now the residual from each sale. Once again, the treatment and control groups mirror each other until the Columbine shooting.

Figure 9: Synth Placebo



The above figure conducts a placebo test where each neighborhood is compared to its own synthetic control group. The lines above plot the difference between the treatment neighborhood and the synthetic control. It is clear that after 1999, the CCA displays the biggest drop in prices relative to the control.[18]

[18] If viewing the above in grayscale, Columbine is the most negative line from 2000-2005.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	P10	P90
Year of Sale	211205	1997	8.83	1985	2010
Square Ft.	211205	23318	106748	5583	30567
Year Built	211205	1975	16.38	1955	1995
Sale Amt.	211205	269264	223274	133365	417854
Columbine	211205	.064	.245	0	0
After	211205	.423	.494	0	1

Table 2: The CCA and Control Group Means

Variable	CCA	Control	t-test	p-value
Sale Amt.	278524	268630	-4.99	0.000
Year Built	1977	1974	-19.88	0.000
Square Ft.	10615	24188	14.32	0.000

Table 3: Difference in Difference Estimates

VARIABLES	(1) Ln Sales Price	(2) Ln Sales Price	(3) Ln Sales Price
Columbine	0.158***	0.282***	
	(0.0109)	(0.0767)	
After	0.0379***	0.106***	0.122***
	(0.0110)	(0.0179)	(0.0268)
Col*After	-0.109***	-0.0561***	-0.118***
	(0.0126)	(0.0117)	(0.0262)
Observations	83,476	83,476	56,536
R-squared	0.057	0.147	0.041
State FE	No	Yes	Yes
Year FE	Yes	Yes	Yes
Years	'94-'04	'94-'04	'94-'00
Properties	59,466	59,466	44,843

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Column 1 is an OLS regression. Column 2 includes house fixed effects. Column 3 only includes one year after the shooting.

Table 4: Results by Year

VARIABLES	(1) Ln Sales Price
Columbine	0.257***
	(0.0548)
After	0.104***
	(0.0121)
col_1999	-0.0992***
	(0.0182)
col_2000	-0.101***
	(0.0136)
col_2001	-0.0774***
	(0.0126)
col_2002	-0.0562***
	(0.0122)
col_2003	-0.0641***
	(0.0154)
col_2004	-0.0818***
	(0.00998)
col_2005	-0.0710***
	(0.0143)
col_2006	-0.0379***
	(0.0142)
col_2007	-0.0348**
	(0.0143)
col_2008	-0.0232
	(0.0186)
col_2009	-0.00541
	(0.0192)
col_2010	-0.0180
	(0.0176)
col_2011	-0.00286
	(0.0184)
col_2012	-0.0401**
	(0.0177)
col_2013	-0.0433***
	(0.0140)
Observations	165,750
Properties	91,090
R-squared	0.255
State FE	Yes
Year FE	Yes
Years	'90-'13

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Robustness Checks

VARIABLES	(1) Ln Sales Price	(2) Ln Sales Price	(3) Ln Sales Price	(4) Ln Sales Price	(5) Ln Sales Price
Columbine		0.237***	0.192***	0.256***	0.254***
		(0.0626)	(0.0620)	(0.0552)	(0.0552)
After	0.0877***	0.0935***	0.106***	0.111***	0.112***
	(0.0117)	(0.0167)	(0.0155)	(0.0126)	(0.0132)
col_1999	-0.0828***	-0.108***	-0.167***	-0.0883***	-0.0736***
	(0.0138)	(0.0415)	(0.0315)	(0.0184)	(0.0186)
col_2000	-0.0810***	-0.0542***	-0.127***	-0.0887***	-0.0748***
	(0.00978)	(0.0189)	(0.0205)	(0.0136)	(0.0137)
col_2001	-0.0765***	-0.0348	-0.107***	-0.0636***	-0.0507***
	(0.0126)	(0.0215)	(0.0172)	(0.0126)	(0.0127)
col_2002	-0.0578***	-0.0207	-0.0897***	-0.0430***	-0.0309**
	(0.0121)	(0.0209)	(0.0189)	(0.0121)	(0.0122)
col_2003	-0.0648***	-0.0264	-0.0961***	-0.0532***	-0.0433***
	(0.0154)	(0.0240)	(0.0240)	(0.0154)	(0.0155)
Observations	164,435	134,273	213,481	151,907	135,052
R-squared	0.260	0.123	0.150	0.247	0.239
Properties	90,484	79,980	105,090	83,933	74,609
State FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Years	'90-'13	'94-'13	'80-'13	'90'13	'90-'13

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Col 1 drops houses that switched out of the CCA
Col 2 changes time window to 1994-2013
Col 3 changes time window to 1980-2013
Col 4 eliminates zip codes entirely in the foothills
Col 5 eliminates zip codes entirely and mostly in foothills

Table 6: Robustness Checks Continued

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Ln Sales Price	Ln Sales Price	Ln Sales Price	Ln Sales Price	Ln Sales Price
Columbine	0.219***	0.281***	0.271***	0.368***	0.203
	(0.0583)	(0.0887)	(0.0577)	(0.0854)	(0.146)
After	0.0932***	0.106***	0.0939***	0.109***	0.0931**
	(0.0121)	(0.0195)	(0.0141)	(0.0265)	(0.0434)
col_1999	-0.0973***	-0.0583*	-0.0963***	-0.0690	-0.204***
	(0.0161)	(0.0303)	(0.0221)	(0.0514)	(0.0704)
col_2000	-0.119***	-0.0970***	-0.105***	-0.126***	-0.115***
	(0.0157)	(0.0243)	(0.0194)	(0.0396)	(0.0416)
col_2001	-0.0868***	-0.117***	-0.0815***	-0.149**	-0.0893***
	(0.0143)	(0.0310)	(0.0201)	(0.0646)	(0.0288)
col_2002	-0.0645***	-0.0483***	-0.0512***	-0.0425**	-0.0972***
	(0.0131)	(0.0182)	(0.0146)	(0.0193)	(0.0263)
col_2003	-0.0837***	-0.0462*	-0.0757***	-0.0356	-0.0681**
	(0.0160)	(0.0251)	(0.0198)	(0.0217)	(0.0282)
Observations	100,786	27,209	62,956	14,057	41,438
R-squared	0.258	0.290	0.256	0.264	0.269
Properties	31,632	6,862	19,971	3,541	35,555
State FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Years	'80-'13	'80-'13	'90-'13	'90-'13	'90-'13

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Col 1 limits sample to properties with 3-4 sales 1980-2013
Col 2 limits sample to properties with 4 sales 1980-2013
Col 3 limits sample to properties with 3-4 sales 1990-2013
Col 4 limits sample to properties with 4 sales 1990-2013
Col 5 takes random 25 percent sample

A The Columbine Massacre

After over a year of planning, on April 20th, 1999 Eric Harris and Dylan Klebold attacked Columbine High School with nearly 100 explosives and an array of handguns and shotguns. Their original plan was for two nine kilogram propane bombs to detonate inside the Columbine cafeteria and then shoot survivors outside of the building. Had the bombs detonated successfully, the death toll could have easily reached into the hundreds. The bombs however failed to explode, so Harris and Klebold reworked their plan and the massacre became known as a shooting, despite the shooter's intention to mimic the Oklahoma City Bombing.

After the planned detonation time passed, Klebold and Harris moved to a nearby stairwell and opened fire on students sitting outside and inside of the school near the cafeteria. The school's police officer was quickly notified and briefly exchanged fire with the perpetrators from his squad car but neither the officer nor the offenders were hit. Klebold and Harris then entered the school and walked down several hallways, shooting at students and throwing pipe bombs, most of which failed to detonate, before moving towards the library.

Over 50 students and staff had taken refuge in the library since the shooting had begun about ten minutes earlier. After asking for any jocks to come forward, Harris began shooting at random desks and then at responding police who were setting up a perimeter outside of the building. The shooters then began targeting various students throughout the library, singling out a black student and possibly athletes. After killing 10 students in the library and wounding an additional 12, Klebold and Harris exited the room and began to roam the rest of the school.

At this point most of the building had been evacuated and remaining students and faculty had locked themselves in closets or classrooms. Klebold and Harris wandered the building for abut 30 minutes, trying to detonate their unexploded ordinance and firing randomly. They did notice students in several classrooms hiding underneath desks but never tried to gain entry. Finally they simultaneously committed suicide outside of the library, less than an hour after their rampage began. At the time standard police procedure was to set up a perimeter and wait for a SWAT team, which did not enter the building for several hours.

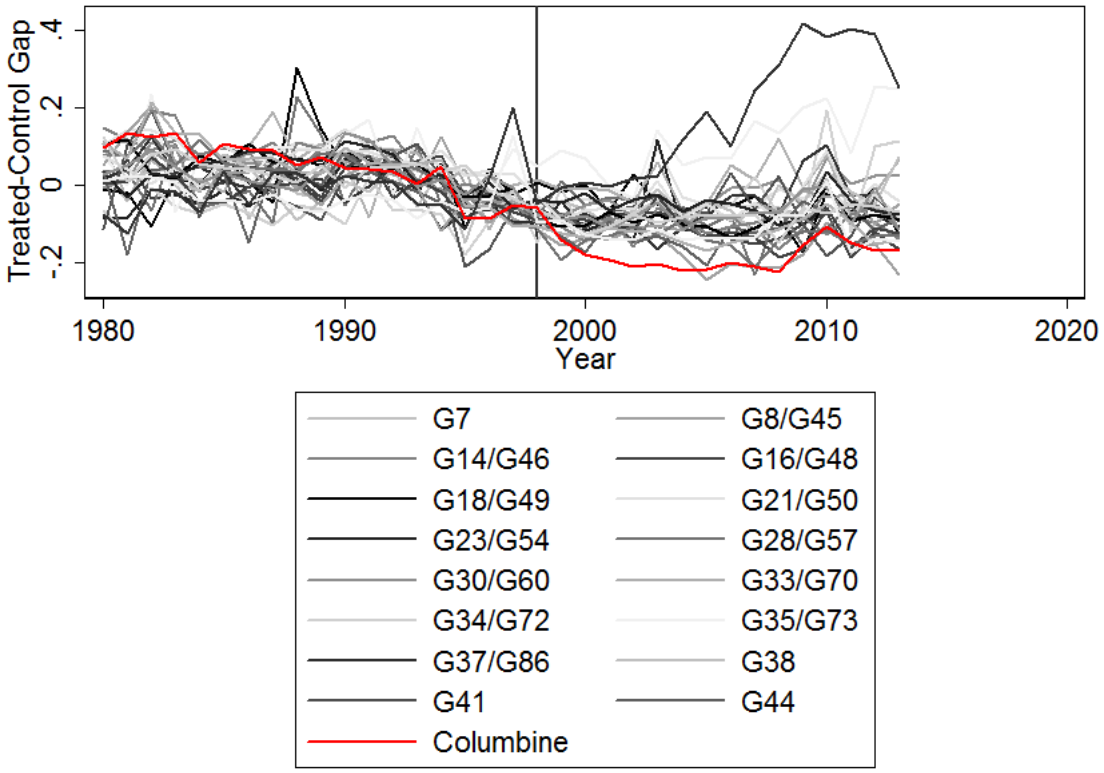
The total death count was 12 students, one teacher, and the two perpetrators. The tragedy became international news, and as the search for Harris' and Klebold's motives began, the massacre became a rallying point for those opposing anything from American gun laws to bullying in schools to violent video games. The 24-hour news channels fixated on Columbine for weeks. While at first various motives were considered, psychologists now believe that Harris was a deranged psychopath who was destined for violence, while Klebold

was a depressed and susceptible youth who was taken in by his partner's vision (Cullen 2009). Columbine High School's location in an upper middle class suburb in mid-America also contributed to its effect on the country. If it could happen in Columbine, could it not happen anywhere?

The public discourse that followed the massacre caused Columbine to enter the American consciousness for the long term, unlike other tragedies. Columbine has since been surpassed in fatalities by the shootings at Virginia Tech and Sandy Hook, but the name recognition is still present. Michael Moore first rose to national prominence with his documentary Bowling for Columbine. "Pulling a Columbine" has entered the American lexicon. Unlike other tragedies that stay in the public sphere briefly and are then forgotten or fade into the background, Columbine is still well known over fifteen years later.

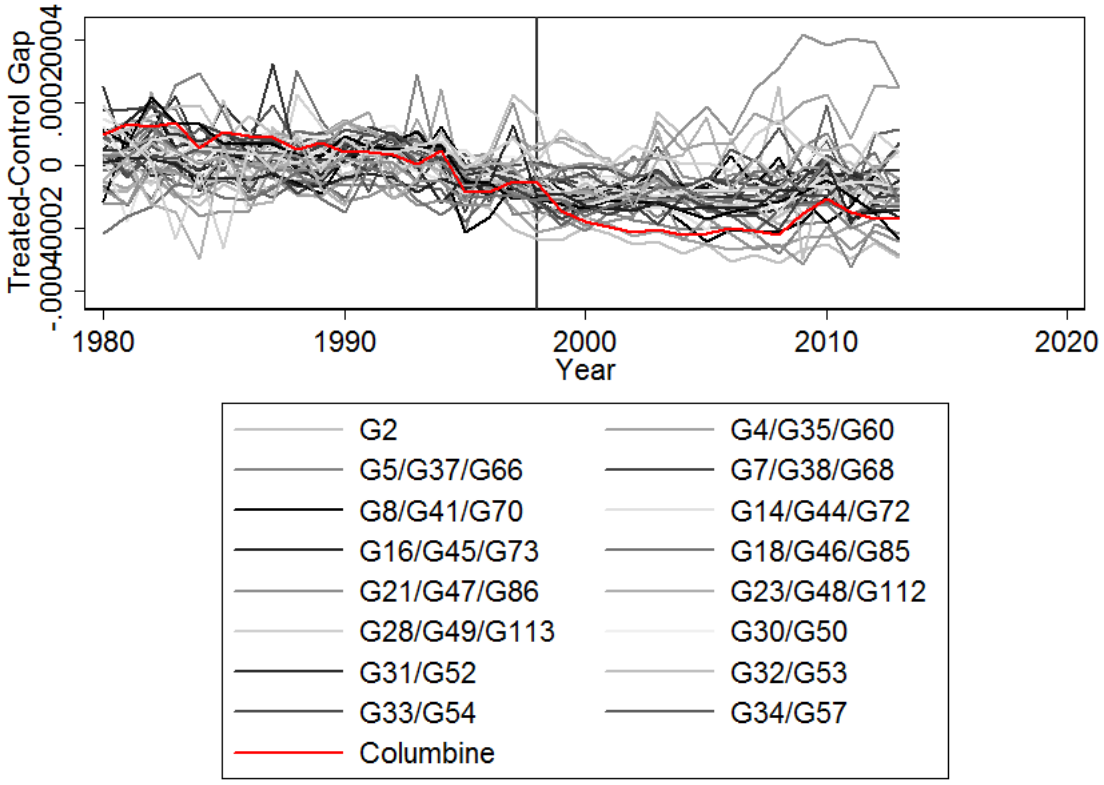
B Synthetic Control Alternative Specifications

Figure 10: Synthetic Control Placebo Test 2



The above placebo test compares the CCA to neighborhoods that match up to 50 percent worse to their respective synthetic control as the CCA matched to its synthetic control.

Figure 11: Placebo Test 3



The above placebo test compares the CCA to neighborhoods that match up to 100 percent worse to their respective synthetic control as the CCA matched to its synthetic control.