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The Effects of Sex Offenders on Housing Sales Prices

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Abstract

I measure the impact of sex offenders on housing sales prices by combining data from the North Carolina Sex Offender Registry with data on housing sales from December 2004 through December 2008 in Mecklenburg County, NC. Using time-series and cross-sectional analysis, I estimate that the arrival of a sex offender into a neighborhood decreases housing sales prices within 0.1 of the miles of a sex offender by approximately 6%, while all other nearby housing sales prices are unaffected. I then apply this finding to examine sex offender residency restrictions passed in North Carolina in 2006. I find that houses located within neighborhoods where a sex offender can no longer reside experience an increase in sales prices of roughly 2% as a result of this law. This is consistent with related research and theoretical models of housing prices.

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I. Introduction

Throughout the past two decades, a number of laws have been passed which are designed to increase public awareness of sex offenders. Recently, several states have also placed further limitations on sex offenders by establishing residency restrictions, or zones where sex offenders are not allowed to reside. North Carolina is an ideal state to study the impact of these laws, as there are robust data sets available to the public that document sex offenders. In North Carolina, all sex offenders either convicted or released from prison on or after January 1, 1996 are registered in the North Carolina Sex Offender Registry that is freely available online. Anyone who accesses this database can view the names and residential addresses of all registered sex offenders in North Carolina, as well as pictures and identifying information such as height, weight, scars and tattoos.

One interesting economic consequence of the public availability of sex offenders' locations is the influence on nearby housing prices. Leigh Linden and Jonah Rockoff, two economists at Columbia University, have studied the effects of sex offenders on nearby property values in Mecklenburg County, North Carolina. This is the most populated county in North Carolina, and includes one of the largest cities in the United States, Charlotte.[1] Linden and Rockoff (2008) conclude that when a sex offender moves into a neighborhood, the prices of nearby homes drop significantly. Analyzing data on property sales from 1994 through 2004, they concluded that the average sale price of a house located within

[1] In 2011, the estimated population of Charlotte was 751,087, making it the 17th largest city in the United States (http://quickfacts.census.gov/qfd/states/37/3712000.html).

0.1 miles of a sex offender drops by about 4 percent, or roughly $5,500. Altogether, they estimate that property sales decreased by roughly $60 million in Mecklenburg County alone.[2]

My research is divided into two parts. In the first half, I extend the research conducted by Linden and Rockoff (2008). I use data on sex offenders and single family home property sales in Mecklenburg County, North Carolina to examine the effects of proximity to sex offenders on housing sale prices in the two years following their data using difference-in-difference and standard regression models. This new data yields similar results to those that Linden and Rockoff (2008) found, confirming that close proximity to sex offenders has a negative impact on housing sales prices. Using models similar to those employed by Linden and Rockoff (2008), my research indicates that houses within 0.1 miles of a sex offender's residence decrease in value by approximately 6%, while housing sales within 0.1 to 0.3 miles of a sex offender's residence are not impacted by the arrival of a sex offender. The second part of my research adapts these models to analyze potential changes in housing sales prices caused by a North Carolina General Statute that imposes residency restrictions on sex offenders. Specifically, starting December 1, 2006, sex offenders are prohibited from living within 1,000 feet of a school or child care center. My research demonstrates that housing prices located within 1,000 feet of a school increase by

[2] Over the 10 year span that they studied, there were 373 sex offenders who moved into homes in Mecklenburg County. The $60 million estimate was determined by multiplying the number of houses within 0.1 miles of these sex offenders by the average loss in property sale value due to the arrival of a sex offender.

approximately 2% due to the enforcement of residency restrictions on sex offenders.

Both parts of my research help to explain the relationship between housing sales and perceived crime risk within a neighborhood. Public perception of sex offenders is that they are more likely to commit another crime, especially another sexual offense. Studies have shown this to be true, and it is estimated that sex offenders are 4 times more likely to be arrested for another sex crime when compared to non-sex offender (Langan et al. 2003). This increase in sex crime risk and the decrease in housing prices associated with a sex offender moving into a neighborhood as demonstrated by my research helps to explain the relationship between an increase in crime risk and the decrease in housing sales prices. This hedonic pricing model of property sales can provide valuable information on the relationship between proximity to sex offenders and property values. This information on the relationship between the amount of money that homeowners are willing to pay (or give up) to decrease the risk of crime can be used to further enhance public policy relating to sex offenders as well as programs or services to reduce the risk of crime.

II. Background

A. Institutional Setting

Sex offender registration laws have been in effect for almost two decades. In 1994, the Jacob Wetterling Act required states to register sex offenders. Jacob Wetterling was a young boy who was kidnapped while riding his bicycle home from a store with some friends. Neither Jacob nor the kidnapper was ever found.

This law was the start of a wave of legislation aimed to protect the public from sex offenders. In 1996, this law was expanded to include public notification of the residential address of sex offenders. While the exact requirements of this law vary from state to state, most states provide information about sex offenders' names, residential locations and pictures to the public.

In 2005, the National Sex Offender Public Registry was established. This is a website that contains links to sex offender registries from all states. The following year, the registry was renamed the Dru Sjodin National Sex Offender Public Registry. Dru Sjodin was a college student at the University of North Dakota when she was murdered by a registered sex offender. This registry provides users with the ability to search for sex offenders by name, zip code, or by inputting an address and viewing all sex offenders that live within a certain radius.

North Carolina has one of the most informative sex offender registries of any state. It provides a range of identifying characteristics of sex offenders including pictures, names, height, weight, eye color and any other identifying scars or marks. Also, the registry has detailed information of the date and description of all crimes committed, as well as release dates and dates when sex offenders have moved into their current address.

While registries have become one of the most prominent ways of tracking and identifying sex offenders, there have been a number of other ways that states have tried to prevent sex offenders from committing future crimes and to protect neighborhoods, especially areas where children are present. As of 2006, more

than 20 states have passed some form of residency restriction on sex offenders. Typically, these laws prohibit sex offenders from living close to schools, parks, day care centers, and other areas where children congregate. Depending on the state, sex offenders cannot live within anywhere from 500 to 2,500 feet of one of these facilities.

Starting on December 1, 2006, North Carolina enacted its own residency restriction law for sex offenders. This law prevents a sex offender from living within 1,000 feet of a school or child care center, and if caught, the offender may be charged with a felony. There are two noticeable exceptions to this law. First, the law grandfathers sex offenders living within close proximity to a school or child care center before December 1, 2006 and allows them to continue to reside at their current address. However, if they decide to move after December 1, they will be subject to the residency restriction laws. Furthermore, this statute does not prevent sex offenders from living near child care centers located within 1,000 feet of an institute of higher education, as long as the sex offender is a student or is currently employed at the institute.

These laws are highly controversial, as many advocates argue that they have unintended consequences, such as severely limiting where a sex offender can reside. Typically, sex offenders who have just been released from prison are faced with the difficult task of finding affordable housing and advocates have argues that residency restrictions further reduce the availability of affordable housing. Consequently, advocates argue sex offenders either lie about their addresses or in extreme cases become homeless.

B. Related Literature

A number of economic papers have focused on the relationship between crime risk and property values (Hellman and Naroff 1979; Lynch and Rasmussen 2001). Recently, economists have examined the relationship between the arrival of a perceived high risk individual to a neighborhood (e.g. a sex offender) and the effect on housing prices. While sex offenders are significantly more likely to commit another sex crime (Langan et al. 2003), there has been no conclusive evidence that sex offenders only target individuals near where they reside. In fact, Agan (2011) finds that there is no ability to infer where sex crimes will be committed based on sex offenders' residential location. Together, this implies that there is no real risk of being located in close proximity to a sex offender, and that any decrease in property sales prices is caused by the perceived risk of living near a sex offender.

In 2003, Larsen et al. looked at the relationship between property values and nearby sex offenders by examining cross-sectional variation in data from Montgomery County, Ohio. Linden and Rockoff (2008) improve upon this model by using cross-sectional and inter-temporal data from Mecklenburg County to analyze the impact of the arrival of a sex offender on housing prices. While Larsen et al. (2003) estimated that houses sell for 17 percent less within 0.1 miles of a sex offender, Linden and Rockoff (2008) estimated that the true change is closer to 4%. They also examined their data using the framework of Larson et al. (2003), and observed that the 4% change increased to just under 20%, which they

attribute to Larson et al. (2003) not taking into account that sex offenders systematically move into cheaper houses than the average individual.

Economists have also examined the effects of residency restrictions on sex offenders. Adkins et al. (2000) , Durling (2006) , Levenson and Hern (2007), and Kang (2012) have all looked at the consequences of residency restrictions, and have found no significant decrease in recidivism caused by these laws. Residency restrictions can also cause a severe decrease in available housing for sex offenders. In cities such as San Francisco, residency restrictions eliminate virtually all available housing for sex offenders (Lagos 2010). Furthermore, studies on residency restrictions indicate that sex offenders encounter increasing financial strain and have to live further away from public transportation access points as well as work areas (Levenson 2008). The lack of effectiveness associated with residency restrictions combined with the numerous unintended consequences have caused these laws to be extremely controversial.

III. Methodology

A. Data

My empirical analysis relied on two sources of data. Data from June 2012 on sex offenders was obtained through the North Carolina Department of Justice. This data includes the current address of all sex offenders as well as the date that they registered at their address.[3] By law, sex offenders are required to register within three business days of release from a penal institution, and if a sex offender

[3] This data contains information on 18,872 sex offenders who have registered starting in December 1996. It is important to note that the data provides information on the current address of sex offenders, so my analysis does not consider sex offenders who frequently move residences.

moves, the sex offender must provide written notification of the new address within three business days. Because these laws are so strict, I can accurately judge when a sex offender moves into a neighborhood.

The other source of information is Mecklenburg County data on housing prices from December 2004 through December 2008. This information contains the address, date and sale price of all single-family houses in Mecklenburg County, as well as numerous identifying characteristics of each house, such as the number of heated square feet, bedrooms and bathrooms and an overview of the external condition of each house. Mecklenburg County also provided data on the locations of all charter, private and public schools. I normalize the sales prices to December 2006 dollars by using the Home Pricing Index for Charlotte, NC.

By combining these data sets, I am able to construct a data set that has the characteristics of every single family house that was sold, the distance between sex offenders and the houses that were sold and the dates of both the sex offenders' arrivals and the housing sales. For the second part of my analysis, I add data on distances between housing sales and schools and child care centers to the dataset.

It is important to note that this data only reflects houses that are sold in Mecklenburg County, and therefore may not accurately represent the value of houses more broadly. Changes in composition of either buyers or sellers caused by the arrival of sex offenders to a neighborhood or the passing of the residency

restriction law in 2006 may cause my estimates to be either positively or negatively biased.[4]

B. Sample Summary

For the first part of my research, I look at all housing sales that occurred between December 2004 and December 2006 that have a recorded sales price. After eliminating all housing sales prices below $40,000 and above $1.165 million (the 1st and 99th percentile of housing sales prices), I am left with 20,588 housing sales. 752 of these sales occurred within 0.3 miles of a sex offender, while 182 occurred within 0.1 miles of a sex offender. Table 1 provides a summary of the main characteristics of housing sales by location. It is clear from this information that sex offenders move to cheaper, smaller houses relative to all housing sales in Mecklenburg County. This further reinforces the need to use specific control groups in order to accurately measure the effects of sex offenders on housing prices.

The second half of my research relies on housing sales from December 2004 to December 2008. Again, I include all housing sales except for those in the 1st and 99th percentile, which leaves 43,039 total sales. I also discard all housing sales that occur near schools and child care centers that have a sex offender living within 1,942 feet. If a school or child care center already has a sex offender living within 1,000 feet, this law will have no effect on property values because the risk

[4] It is possible that the arrival of a sex offender will cause people who are very averse to crime risk to immediately try to sell their houses. In order to expedite the sale, they may list their houses below the market value in order to attract a buyer as quickly as possible, which would negatively impact the accuracy of my estimates.

of having a sex offender live in that neighborhood will not be eliminated. Furthermore, since the treatment group does not have any neighborhoods with sex offenders, I need to construct a control group that is of a similar nature. Finally, if a sex offender lives just outside of the 1,414[5] foot outer-radius of the control group, the sex offender can still affect housing prices, so I eliminate schools and child care centers where a sex offender lives within 528[6] feet of the control group. Out of 43,019 sales, 4,360 sales occurred within 1,000 feet of a school or child care center and 3,923 sales occurred between 1,000 feet and 1,414 feet that fit the previous specification. Major characteristics of the housing sales can be seen on table 4. Unlike where sex offenders locate, houses that are close to schools tend to have similar characteristics, on average, when compared to all houses sold in Mecklenburg County. Even though these houses are very similar, we still want to limit our control group to those houses just outside the treatment group in order to eliminate other potential biases.

C. Empirical Model

There are a large number of factors that go into choosing where to buy a house. Individuals must not only consider the characteristics of the house, such as the overall quality, size and numbers of bedrooms and bathrooms, but they must also consider the neighborhood. Moving close to a school can potentially benefit an individual or family with young children, while moving into an area with high taxes can be a detriment to home owners. Because of the multitude of highly

[5] This radius was chosen so that the treatment and control groups have the same number of square feet.
[6] The first part of my research indicates that sex offenders influence housing prices within 0.1 miles (528 feet) of his or her residence.

varying neighborhood in Mecklenburg County, North Carolina, it is essential that I do not solely rely on cross-sectional data in order to analyze the effects of sex offenders on housing prices. As seen on table 1, sex offenders move to smaller and cheaper houses. Therefore, it is essential that I look at very specific housing sales in both treatment and control groups to accurately examine both the influence of sex offenders on housing prices and the impact of residency restrictions on sex offenders.

I limit my analysis to a treatment group of housing sales within 0.1 miles of a sex offender and the control group to housing sales between 0.1 to 0.3 miles of a sex offender. This ensures that I have an adequate amount of housing sales to analyze while simultaneously only examining houses that are in close proximity to one another.[7] When examining the residency restrictions placed on sex offenders, I look at houses within 1,000 feet of a sex offender compared to those between 1,000 feet and 1,414 feet of a sex offender. While the 1,414 foot radius seems significantly smaller than the 1,000 foot radius, the number of square feet in both the control group and treatment group are the same. This provides a suitable number of housing sales in both the treatment and control group while still keeping the analysis free of bias, as houses in the treatment group are located in close proximity to houses in the control group.

Before I examine the effects of sex offenders on nearby housing prices or the change in housing prices caused by residency restrictions, I have to verify that

[7] By having houses that are relatively close to one another, I can eliminate many sources of bias, as the close proximity guarantees that the control and treatment groups will be relatively homogenous.

the treatment and control groups that I have described are similar to each other so that the identification assumption holds in order for the difference-in-difference estimates to be accurate. The identification assumption for the first part of my research is that if a sex offender did not move into a neighborhood, there would be no change in the difference in housing prices between the treatment and control groups. I construct the following linear regression model to look at the differences in major characteristics of housing sales in the treatment and control groups. This model is:

(1) $$\log(P_i) = \alpha_i + \pi_1 D_i^{1/10} + \varepsilon_i$$

I measure the log of the normalized sales price as a function of the distance from the sex offender (or where the sex offender will live) to the housing sale, a random error term, and a year specific term. $D_i^{1/10}$ is a dummy variable that equals 1 if the housing sale occurs within one-tenth of a mile of where a sex offender is located or will locate and 0 otherwise. I also estimate all other major characteristics of housing sales using a similar equation, but instead of using the log of price as the dependent variable, I use other characteristics of housing sales. These regressions provide information about the differences in key housing characteristics in the treatment and control groups that I examine.

After I examine the differences between the treatment and control groups, I compare housing sales located within 0.1 miles of where a sex offender will locate to all other housing sales within the same year using the same regression model as before:

(2) $$\log(P_i) = \alpha_i + \pi_1 D_i^{1/10} + \varepsilon_i$$

Then, I re-estimate the previous model with all housing sales characteristics as well as neighborhood-year fixed effects added:

(3) $$\log(P_i) = \alpha_{ij} + \beta \cdot X_i + \pi_1 D_i^{1/10} + \varepsilon_i$$

X_i is a vector of housing characteristics and β_i is a vector of coefficients.[8] The neighborhood-year fixed effects term, α_{ij}, controls for both changes in houses prices caused by different neighborhoods, but also time trends across time in these neighborhoods. Using these two equations, I can compare the coefficients on the $D_i^{1/10}$ term to see how well the observable characteristics of housing sales can predict the sales price.

Once I examine how well the observable characteristics of housing prices determine the sales price of a house, I estimate two difference-in-difference models. In the first model, I look at the treatment and control groups. The regression model is as follows:

(4) $$\log(P_i) = \alpha_{ij} + \beta \cdot X_i + \pi_1 D_i^{1/10} + \pi_2 D_i^{1/10} Post_i + \varepsilon_i$$

Where $Post_i$ is a dummy variable that indicates whether a housing sale occurred before or after a sex offender arrived. In this model, π_2 is the difference-in-

[8] The housing characteristics that I use in my regression models are: number of bedrooms, number of full bathrooms, number of half bathrooms, age of the house, an indicator variable for whether or not the house was built in the year it was sold, number of heated square feet and the overall quality of the exterior of the house.

difference estimate of the change in housing prices caused by the arrival of a sex offender.

Finally, I estimate the arrival of a sex offender by looking at all housing sales in Mecklenburg County and adding additional terms to the previous regression model. $D_i^{1/3}$ is an indicator value that is 1 if a housing sale occurred between 0.1 and 0.33 miles of a sex offender and 0 otherwise.

(5) $$\log(P_i) = \alpha_{i,j} + \beta \cdot X_i + \pi_1 D_i^{1/10} + \pi_2 D_i^{1/10} Post_i + \pi_3 D_i^{1/3} + \pi_4 D_i^{1/3} Post_i + \varepsilon_i$$

In this regression model I am interested in the difference-in-difference value, π_2.

I use the same estimation models to look at the impact of the residency restrictions laws, with two major changes. $Post_i$ now is a dummy variable set to 1 if the housing sale occurred after December 1, 2006 and 0 otherwise, and the two dummy variables $D_i^{1/3}$ and $D_i^{1/10}$ are replaced by $D_{1000,i}$ and $D_{1414,i}$, respectively. These variables are indicator variable that specify whether a property sale occurred within 1000 feet of a school or between 1000 feet and 1414 feet of a school. Finally, the identification assumption for the second half on my research is that if this statute did not come into effect in December 2006, then the difference in housing prices between the treatment and control groups before and after December 2006 would be the same.

IV. Results

One of the main assumptions of the empirical model is that houses that sell in the treatment and control groups have similar characteristics. While table 1 shows that the mean value of these housing characteristics is similar across both

groups, I also estimate the differences in housing characteristics by using variations of equation 1. I substitute the dependent variable with each of the major characteristics of houses, and the results are shown on table 2. Very few of my estimates of π_1 are statistically different from 0 at the 95% confidence interval, and of the variables that do change between the treatment and control groups, they do not change significantly. In the case of the log of the year that the house was built, while the coefficient is statistically different from 0, I estimate that its value is 0.004, or that houses within 0.1 to 0.3 miles of a sex offender are just 0.4% older than houses located within 0.1 miles of a sex offender. Also, while the difference in the number of bedrooms and half bathrooms is statistically different from 0, the number of bathrooms falls by 0.18 for houses located within 0.1 miles of a sex offender while the number of half bathrooms rises by 0.12. Both of these changes are extremely small, and therefore these results show that the control and treatment groups have no major differences.

The other major assumption of the empirical model is that these housing characteristics can accurately control for differences in housing prices. Estimating equation 2, the value of π_1 is -0.402, which can be seen on the first column of table 3. This can be interpreted as houses located within 0.1 miles of a sex offender before the offender arrive sells for roughly 40% less than those located further away from where a sex offender will reside. In other words, houses located near a sex offender are already significantly cheaper than the average house sold in Mecklenburg County before a sex offender arrives. However, when I estimate equation 3, which is the same as equation 2 except for the addition of

housing characteristics as well as neighborhood-year fixed effects, the value of π_1 changes to 0.0245, which is not statistically different from 0 at the 95% confidence level. This data is located on the second column of table 3. This implies that once we control for observable characteristics of housing sales, there is no difference in price. This implies that the characteristics of housing sales that are included in these regression models accurately control for observable features.

Once we have verified these two assumptions, I estimate equation 4. The two key coefficients in this equation are π_1 and π_2. I estimate that the value of π_2 is -0.062, which is significantly different from 0 at the 95% confidence interval, and π_1 is 0.024, which is not statistically different than 0 at the 95% confidence interval. These figures can be seen in the third column of table 3. The value of π_1 implies that there is no difference in the value of a house between 0.1 and 0.3 miles and a house within 0.1 miles of a sex offender once all observable characteristics are controlled for. Furthermore, the value of π_2, which is the difference-in-difference estimator, implies that there is a significant non-zero decrease in housing prices when a sex offender arrives in a neighborhood. While the 6.2% decrease is statistically different from 0, it is not statistically different from the estimated 4% decrease in housing prices within 0.1 miles of a sex offender that Linden and Rockoff (2008) estimated.

I then expand my model to include all housing price sales and again estimate the difference-in-difference regression model specified in equation 5. The results can be seen in column 4 of table 3. The only coefficient that is statistically different from 0 is the difference-in-difference estimator (π_1). Similar

to the last model, this estimate is not statistically different than the estimate from the previous model or from the estimate that Linden and Rockoff (2008) found. Furthermore, the estimate of π_4 indicates that the arrival of a sex offender has no effect on houses that are between 0.1 and 0.3 miles of a sex offender. This implies that the arrival of a sex offender only affects houses in the immediate vicinity (within 528 feet) of where the sex offender is residing.[9] In other words, the decrease in housing sales prices cause by a sex offender is extremely localized.

Now that I have shown there is a significant decrease in housing sales prices caused by sex offenders, I can examine the impact of the residency restriction statute passed in 2006. I again rely on the key assumptions that houses located within 1,000 feet of a school are similar to those located between 1,000 and 1,414 feet of a school and that these observable housing characteristics can accurately control for the varying prices of housing sales.

While table 4 shows the mean values of all key characteristics, I also estimate them using the same linear regression that I used for the first part of my research on table 5. The results indicate that the control and treatment groups are similar, however there are differences between the control and treatment groups. The treatment group tends to have smaller, cheaper houses with slightly fewer heated square feet, number of bedrooms and bathrooms. However, upon further examination, these differences are very small. The difference between treatment

[9] My research as well as other related work on this topic indicates that sex offenders cause housing sales prices within 0.1 miles (528 feet) decrease significantly while those between 0.1 and 0.3 miles of where a sex offender resides do not decrease. However, this does not apply that a house located 527 feet from a sex offender will experience a drop in price by roughly 6% while a house located 529 feet from a sex offender will not see a drop in price.

and control group of 112 square feet is very small, especially since Linden and Rockoff (2008) note in their paper that the average walk-in closet is about 80 feet. While houses in the control group and treatment group vary in terms of number of bedrooms and bathrooms, these again are very small. Furthermore, since the treatment and control groups are located in extremely close proximity, it is very unlikely that an event could occur that would change housing prices in just the treatment or control groups. For this reason, as well as the next regression that I construct, it seems that the identification assumption will hold.

My estimate of π_1 in equation 2 is -0.133 (shown in the first column on table 6), which is statistically different from 0. I then estimate equation 3, which takes into account differential prices in houses caused by the neighborhood that the house sells in as well as the key characteristics of a house. The results, shown in column 2 of table 6, indicate that π_1 is only 0.007, or that houses located close to schools sell for only 0.7% more than other houses sold in Mecklenburg County. This number is not statistically different from 0 at the 95% confidence interval. This shows that the added variables as well as neighborhood-year effects explain all of the difference between prices of housing sales located close to schools and other housing sales in Mecklenburg County.

Now that I have verified the key assumptions that the regression models rely on, I estimate the impact of the legislation through equation 4 , which is shown in column 3 of table 6.The difference-in-difference estimator (π_1) is positive, which implies that eliminating the possibility of a sex offender moving

into a neighborhood increases housing sales prices by approximately 1.4%. This number is not statistically different from 0 at any reasonable confidence level.

The use of neighborhood-year fixed effects in this model helps to eliminate changes in neighborhoods across time to give us a more accurate estimate. However, one concern is that the fixed-effects terms are absorbing the effect of the statute in this model. For that reason, I re-estimate the difference-in-difference estimator using the same equation with just neighborhood fixed effects (and still including housing characteristics). The result can be seen in column 4 of table 6. Now, the difference-in-difference estimator is 0.021, which is statistically different from 0 at the 95% confidence level. This model shows that there is a causal relationship between the passing of the residency restriction laws and the increase in housing prices. It must be noted that this regression model no longer accounts for changes in neighborhoods over time. However, as we are only observing housing prices within a 4 year window, these changes will have a minimal effect on difference-in-difference estimate obtained from the regression model.

V. Discussion and Conclusion

According to the results of related research and hedonic pricing models, the perceived threat of crimes brought on by the arrival of a sex offender to a neighborhood should decrease housing values while the elimination of the possibility of an increase in crime risk caused by residency restriction laws should increase housing values. By examining residential locations of sex offenders in Mecklenburg County, NC and using both cross-sectional and time-series data, I

am able to accurately examine the effects of perceived crime risk on housing sales prices. My analysis relies on the assumption that differences in housing prices rely on observable characteristics of houses, which is demonstrated by my regression models. My findings support both of the conclusions suggested by theoretical models. When a sex offender moves into a neighborhood, housing sales prices within a localized area (up to 0.1 miles) decrease by approximately 6%, while all housing sales prices further away from the sex offender's residence are unaffected. I then use this finding to evaluate residency restrictions implemented in North Carolina in December, 2006. I find that these restrictions increase housing prices by approximately 2% in areas where a sex offender can no longer live (and where there were no sex offenders previously residing). This shows that the elimination of perceived crime risk posed by a sex offender positively influences housing prices, while the perceived increase of crime risk caused by a sex offender negatively influences housing prices.

My findings bring up several interesting related questions. While there is an overall increase in housing prices caused by residency restrictions within neighborhoods where a sex offender can no longer establish residency, there may be varying effects depending on proximity to the boundary of this neighborhood. Given a larger data set to work with, one could examine the increase in housing prices as a function of distance from the boundary of the zone where sex offenders can not live.

References

Adkins, G., Hu, D., & Stageberg, P. (2000). The Iowa Sex Offender Registry and Recidivism. Des Moines, Iowa: Department of Human Rights.

Agan, A. (2011). Sex Offender Registries: Fear without Function? *Journal of Law and Economics*,54(1), 207-39.

Barnes, J., Dukes, T., Tewksbury, R., & De Troye, T. (2009). Analyzing the Impact of a Statewide Residence Restriction Law on South Carolina Sex Offenders. *Criminal Justice Policy Review*, 20(21), 166-98.

Chajewski, M., & Mercado, C. (2009). An Evaluation of Sex Offender Residency Restriction Functioning in Town, County, and City-wide Jurisdictions. *Criminal JusticePolicy Review*, 20(1), 44-61.

Durling, C. (2006). Never Going Home: Does It Make Us Safer? Does It Make Sense? Sex Offenders, Residency Restrictions, and Reforming Risk Management Law. *Journal of Criminal Law and Criminology*. 97(1), 317-63.

Figlio, D. & Lucas, M. (2004). What's in a Grade? School Report Cards and the Housing Market. *American Economic Review* 94(3), 591-604.

Gibbons, S. (2004). The Costs of Urban Property Crime. *The Economic Journal,* 114(499), 441-63.

Hellman, D. & Naroff, J. (1979). The Impact of Crime on Urban Residential Property Values. *Urban Studies*, 16, 105-12.

Lagos, M. (2010, December 27). Sex Offender Residency Ban on Lawmaker's Agenda. *San Francisco Chronicle.*

Langan, P., Schmitt, E., & Durose , M. (2003). Recidivism of Sex Offenders Released from Prison in 1994. Bureau of Justice Statistics Report No. NCJ 198281. Washington, D.C.: U.S. Department of Justice.

Larsen, J., Lowery, K., & Coleman, J. (2003). The Effect of Proximity to a Registered Sex Offender's Residence on Single-Family House Selling Price. *The Appraisal Journal,* 71(3), 253–65.

Levenson, J., & Hern, L. (2007). Sex Offender Residence Restrictions: Unintended Consequences and Community Reentry. *Justice Research and Policy*. 9, 59-74.

Levenson, J. (2008). Collateral Consequences of Sex Offender Residence Restrictions. *Criminal Justice Studies: A Critical Journal of Crime, Law and Society.* 21(2), 153-66.

Lynch, A. & Rasmussen, D. (2001). Measuring the Impact of Crime on House Prices. *Applied Economics*, 33, 1981-89.

Linden, L. & Rockoff, J. (2008). There goes the Neighborhood? Estimates of the Impact of Crime Risk on Property Values from Megan's Laws. *American Economic Review*, 98:3, 1103-27.

Thaler, R. (1978). A Note on the Value of Crime Control: Evidence from the Property Market. *Journal of Urban Economics,* 5(1), 137-145.

Vasquez, B., Maddan, S., & Walker, J. (2008). The Influence of Sex Offender Registration and Notification Laws in the United States. *Crime & Delinquency*, 54(2),175-192.

Table 1: Key Characteristics of Single Family Houses Sold in Mecklenburg County, 2004-2006

	All Sales	Between 0.3 Miles and 0.1 Miles	Within 0.1 Miles
	Mean (Std Err)	Mean (Std Err)	Mean (Std Err)
Sale Price	2.223	1.435	1.354
($100,000s)	(0.011)	(0.031)	(0.036)
Heated Sq. Ft.	2.225	1.664	1.67
(1,000s)	(0.007)	(0.027)	(0.034)
Bedrooms	3.332	3.088	2.978
	(0.006)	(0.027)	(0.045)
Full Bathrooms	2.11	1.843	1.845
	(0.004)	(0.021)	(0.027)
Half Bathrooms	0.608	0.409	0.448
	(0.004)	(0.021)	(0.038)
Sample Size	20530	567	181

Table 2: Regression Analysis of Key Characteristics of Single Family Houses within 0.3 Miles of a Sex Offender, Sold in Mecklenburg County, 2004-2006

	Log Price	Log Year Built	Heated Sq. Feet (1000s)	Bedrooms	Number of Full Bathrooms	Number of Half Bathrooms
Differences in Sales Within	0.02	0.004	-0.025	-0.183	0.009	0.122
0.1 Miles of Offender	(0.047)	(0.001)*	(0.075)	(0.080)*	(0.059)	(0.061)*
Constant	11.736	7.592	1.611	3.082	1.84	0.38
	(0.023)*	(0.0006)*	(0.037)*	(0.039)*	(0.029)*	(0.030)*
Sample Size	364	364	364	364	364	364
R2	0.0008	0.04	0.006	0.016	0.001	0.018

Note: Only single family homes sold before the arrival of a sex offender.
*** significant at 95% level.**

Table 3: The Effect of a Sex Offender's Close Proximity to a Housing Sale

	Log (Sale Price)		Log (Sale Price)	
	Pre-Arrival Within 0.1 Miles		Pre & Post-Arrival	
	All Sales	All Sales	Sales Within 0.3 Miles	All Sales
Within .1 Miles of Offender	-0.402	0.0245	0.024	-0.011
	(0.060)*	(0.025)	(0.021)	(0.020)
Within .1 Miles Post-Arrival			-0.062	-0.068
			(0.028)*	(0.033)*
Within 1/3 Miles of Offender				-0.019
				(0.016)
Within 1/3 Miles Post-Arrival				-0.006
				(0.021)
Housing Char.		X	X	X
Year FE	X			
Neighborhood- Year FE		X	X	X
Sample Size	20437	20437	748	20530
R2	0.003	0.9	0.9	0.87

***significant at 95% level.**

Table 4: Key Characteristics of Single Family Houses Sold in Mecklenburg County, 2004-2008

	All Sales	Between 1000 feet and 1414 feet	Within 1000 feet
	Mean (Std Err)	Mean (Std Err)	Mean (Std Err)
Sale Price	2.125	2.133	1.94
($100,000s)	(0.007)	(0.032)	(0.039)
Heated Sq. Ft.	2.17	1.993	1.901
(1,000s)	(0.005)	(0.014)	(0.021)
Bedrooms	3.291	3.199	3.109
	(0.004)	(0.014)	(0.013)
Full Bathrooms	2.081	1.955	1.903
	(0.003)	(0.011)	(0.010)
Half Bathrooms	0.594	0.526	0.489
	(0.002)	(0.008)	(0.008)
Sample Size	43039	3923	4360

Table 5: Regression Analysis of Key Characteristics of Single Family Houses within 1414 feet of a School or Child Care Center, Sold in Mecklenburg County, December 1, 2004 through December 1, 2006

	Log Price	Log Year Built	Heated Sq. Feet (1000s)	Bedrooms	Number of Full Bathrooms	Number of Half Bathrooms
Within 1000 ft. of School	-0.07	-0.0001	-0.112	-0.06	-0.045	-0.02
or Child Care Center	(0.018)*	(0.0004)*	(0.025)*	(0.026)*	(0.020)*	(0.016)
Constant	12.059	7.591	2.014	3.213	1.972	0.521
	(0.013)*	(0.0003)*	(0.018)*	(0.019)*	(0.015)*	(0.012)*
Sample Size	4305	4305	4305	4305	4305	4305
R2	0.007	0.0004	0.006	0.003	0.002	0.018

Note: Only single family homes sold before the residency restriction statute comes into effect.
*** significant at 95% level.**

Table 6: The Effect of Residency Restriction on Housing Sales Prices

	Log (Sale Price)		Log (Sale Price)	
	Pre-Residency Restrictions		Pre & Post-Residency Restrictions	
	All Sales	All Sales	Sales Within 1414 feet	Sales Within 1414 feet
Within 1000 ft. of School or Child Care Center	-0.133 (0.012)*	0.007 (0.005)	-0.004 (0.008)	-0.008 (0.007)
Within 1000 ft. Post-Residency Restrictions			0.014 (0.011)	0.021 (0.010)*
Housing Char.		X	X	X
Year FE	X			
Neighborhood- Year FE		X	X	
Neighborhood FE				X
Sample Size	21727	21727	8283	8283
R2	0.006	0.87	0.90	0.87

Note: Only housing sales in close proximity to schools that do not have a sex offender residing close to the school (within 1942 feet).
***significant at 95% level.**

Summary of Capstone Project

Throughout the past two decades, there have been a number of laws designed to increase public awareness of sex offenders. In North Carolina, all sex offenders either convicted or released from prison on or after January 1, 1996 have to register to a sex offender database that is freely available online. Anyone who accesses the North Carolina Sex Offender Registry website has access to the names and locations of all registered sex offenders, as well as pictures and identifying information such as height, weight, scars and tattoos.

One interesting economic consequence of the public availability of sex offenders' locations is the influence on nearby housing prices. Leigh Linden and Jonah Rockoff, two economists at Columbia University, have studied the effects of sex offenders on nearby property values in Mecklenburg County, North Carolina. This is the most populated county in North Carolina, and includes one of the largest cities in the United States, Charlotte. Through their research, they have concluded that when a sex offender moves into a neighborhood, the prices of nearby homes drop significantly. Analyzing data on property sales from 1994 through 2004, they concluded that the average sale price of a house located within 0.1 miles of a sex offender drops by about 4 percent, or roughly $5,500. Altogether, they estimate that property sales decreased by roughly $60 million in Mecklenburg County alone. They then go on to estimate the cost to victims of sexual offenses by combining the estimated loss of property sales with data on crimes committed by sexual offenders.

My research is divided into two parts. In the first half, I extend part of the research conducted by Leigh Linden and Jonah Rockoff. I use data on sex offenders and single family home property sales in Mecklenburg County, North Carolina to examine the effects of sex offenders on housing sale prices in the two years following their data. This new data yields similar results to those that Linden and Rockoff achieved, confirming that sex offenders still have a negative impact on housing sale prices. I then apply similar models to analyze possible changes on housing sale prices caused by a North Carolina General Statute that imposes residency restrictions on sex offenders. Specifically, starting December 1, 2006, sex offenders can no longer live within 1,000 feet of a school or child care center. My research examines whether or not the elimination of the possibility of having a sex offender move to a neighborhood influences the prices of housing sales.

In order to successfully analyze the effect of sex offenders on housing sale prices, I construct a treatment and control group of housing sales. Ideally, the houses in both the treatment and control groups will be very similar in characteristics. Before a sex offender arrives, the treatment and control groups should be composed of houses that are approximately the same value and size, and with other key characteristics such as number of bedrooms, bathrooms and overall quality of the house that are roughly the same. Furthermore, I have to ensure that the arrival of sex offenders does not impact the prices of housing sales in the control group. I then conduct a difference-in-difference estimation, where I compare the difference in housing sale prices between the treatment and control

group before the sex offender arrives in a neighborhood with the difference in housing prices after the sex offender arrives. This will give a rough estimate of the impact of a sex offender on housing prices.

The best treatment group to use for this is the housing sales that lie closest to where a sex offender will live. These sales will be impacted the most by the arrival of a sex offender. Unfortunately, finding a suitable control group is slightly harder. Looking at all property sales that do not occur close to where a sex offender will live, these sales will not be impacted by the arrival of a sex offender. However, these houses are systematically different from those houses located near a sex offender. I show that, on average, sex offenders locate to smaller, cheaper houses, so I cannot use all other housing sales as a suitable control group. Instead, I examine housing sales that lie just slightly further away from a sex offender than the treatment group. More specifically, my treatment group will be housing sales that occur within 0.1 miles of a sex offender and my control group will be houses that lie between 0.1 and 0.3 miles away from a sex offender. Since these houses are located in such close proximity to each other, and oftentimes in the same neighborhoods, they have very similar characteristics and are therefore suitable treatment and control groups.

Now that I have suitable treatment and control groups, I go about estimating the change in housing prices due to the arrival of sex offenders. In order to offset the slight differences in the control and treatment groups, I constructed a linear regression model. This model provides the same difference-in-difference estimate as before; however, it adjusts the estimate of the change in

housing sale prices caused by sex offenders in order to account for the slight variations in housing characteristics between groups. Also, I correct for possible changes in housing sale prices due to different neighborhoods. Since houses with similar characteristics in different neighborhoods often do not sell at the same price, I make sure to account for this variation.

After accounting for these differences in housing characteristics, I found that houses selling within 0.1 miles of a sex offender sell for about 6% less than those within 0.1 and 0.3 miles of a sex offender. I then go on to construct another regression model in order to further justify these findings. Instead of looking at only housing sales within 0.1 miles and 0.1 to 0.3 miles of a sex offender, I look at all housing sales and take into account the distance from a house to a sex offender. This regression model gives an estimated decline of housing sales within 0.1 miles of a sex offender of 6.8%. The closeness of these two estimates to each other further strengthens my estimates, and leads me to conclude that sex offenders have a profound negative impact on property sales.

Now that I have shown that sex offenders negatively impact property sales that take place in their immediate vicinity, I use the same framework to analyze the impact of a North Carolina General Statute on housing prices. This statute, which took effect on December 1, 2006, prohibited registered sex offenders from living within 1,000 feet of a school or child care center. However, if a sex offender was previously living with 1,000 feet of a school or child care center, he or she could remain there.

My analysis focuses on schools in Mecklenburg County, NC. I construct treatment and control groups in the same way as Linden and Rockoff did in their research. The treatment group is housing sales within 1,000 feet of a school, and the control group is housing sales between 1,000 and 1,414 feet of a school. While the 1,414 foot radius seems significantly smaller than the 1,000 foot radius, the number of square feet in both the control group and treatment group are the same. After examining these two groups, they are remarkably similar. There is no major difference between price, size, or any other characteristics of these homes. Also, the homes within 1,000 feet of a school will be impacted by this law, while those outside will not. Again, I construct a linear regression model in order to account for the small amount of variation between the characteristics of the treatment and control groups as well as the different neighborhoods where these houses are located. After running this regression model, the result is that there is a 2% increase in housing prices within 1,000 feet of a school due to the enactment of this statute.

Together, these two parts of my research help understand both the change in housing sale prices caused by having a sex offender move into a neighborhood and the change in housing sale prices caused by the elimination of the possibility that a sex offender will move into a neighborhood. The first part of my research is essential to verify that sex offenders have a negative impact on housing prices within 0.1 miles of their residence. Once I establish this, I examine how a neighborhood reacts when the possibility of a sex offender arriving was eliminated through the North Carolina General Statute. I am able to prove that

there is a causal relationship between the passage of this statute and changes in housing sale prices within 1,000 feet of a school, which implies that this statute helps to offset the damages to housing sale prices caused by sex offenders. Even though related research has shown that this statute has had numerous negative consequences, such as failing to reduce recidivism among sex offenders, it does positively impact housing sales prices.