The Effect of Neighborhood Watch Programs on Neighborhood Crime in Medford Oregon

Economics 419: Honors Thesis - Draft

May 25th, 2014

Abstract: Over the past decade Medford Oregon has expanded their Neighborhood Watch program and increased the number of neighborhood watch groups they have in each section of the city. Using robust panel regression analysis we studied what effect this program had on crime rates of the treated areas. Our data included total number of crimes across 7 years from 2007 to 2013 and across the 7 areas, or beats, each of which had a varying number of active neighborhood watches over our sample period. Our goal was to use the number of neighborhood watch groups per beat and several other proxy variables to try and estimate how much, if at all, this program is affecting crime rate in Medford. We found that one additional neighborhood watch decreases the crime rate per beat by about 3% and one additional neighborhood watch per square kilometer decreases the crime rate by about 18%.

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1. Executive summary

Over the past decade Medford Oregon has expanded their Neighborhood Watch program and increased the number of neighborhood watch groups they have in each section of the city. Medford is broken up into 7 distinct geographic areas referred to as beats. They vary in area from 1.49 square kilometers to 18.08 square kilometers. Each beat has a different number of neighborhood watch groups and the number of overall number of neighborhood watch groups increased from 2007 to 2013. In 2007 the number of neighborhood watches per beat ranged from 2 to 21 and by 2013 it was 2 to 27 per beat.

Using robust panel regression analysis we studied the effect this program had on crime rates of the treated areas. Our data included reported crimes across 7 years from 2007 to 2013 and across the 7 beats. We used local schools as proxies for income and population. Our goal was to use the number of neighborhood watches per beat and our proxy variables to try and estimate how much, if at all, this program is affecting the total crime in this city.

We ran multiple regressions to see how one additional neighborhood watch group would affect overall crime and also how one additional neighborhood watch per square kilometer would affect crime. We ran the regression for neighborhood watch groups per square kilometer in order to account for the differences in beat size. This variable was obtained by dividing total number of neighborhood watches in a beat by the area of that beat. We found that one additional neighborhood watch decreases

crime per beat by about 3% and one additional neighborhood watch per square kilometer decreases crime by about 18%.

We also ran regressions for specific crimes we felt may be affected, crimes such as burglary, vandalism, and breaking and entering. We also ran a regression for crimes we thought would not be effected such as fraud, violent crimes, and sex crimes. When we ran the regressions for crimes we felt may be effect we got large negative results than for our base regressions. Not only did these regressions give us large negative values but it also decreased our p-values to 0, indicating that the results were even more significant. For crimes that we felt we would not be effected by the neighborhood watch program we obtained high p-values suggesting that they were in fact not being effected by the program.

2. Introduction

Neighborhood Watch is a crime prevention program that stresses education and common sense (Stegenga 2000). Launched by the National Sheriffs' Association in 1972, Neighborhood Watch teaches citizens how to help themselves by identifying and reporting suspicious activity in their neighborhoods. In addition, it provides citizens with the opportunity to make their neighborhoods safer and improve the quality of life. According to the National Crime Prevention Council's research (2008), "40 percent of Americans live in areas covered by Neighborhood Watch groups" (p.1).

This research paper is an attempt to evaluate the effectiveness of neighborhood watch programs in Medford, Oregon. Medford city is located in Jackson County, Oregon, which is 277 miles south of Portland, Oregon. The total area of Medford is 25.7 square miles. According to 2000 Federal Census, the population of Medford is 75,180 (2011), and the projected population for 2020 is 100,981. The demographics of Medford are mostly white, about 86.0% and Hispanic origin is 13.8%. There were 30,079 households in 2010 and the vacancy rate was 7.2% (U.S. Department of Housing and Urban Development). Medford has a variety of neighborhoods, and each neighborhood has its own distinct issues and assets. Recognizing the need to keep Medford's neighborhoods healthy and safe, Medford Police Department decided to start the Neighborhood Watch Program. According to Medford Police Department, Neighborhood Watch is not just the formation of a neighborhood patrol group. The program is a cooperative effort among citizens and the Medford Police Department. It is important to note that program is not intended for civilians to stop criminal or suspicious activity. In the last few years, there has been a significant increase in the number of

groups taking part in the program and organizing neighborhood watch groups in Medford. It appears to be the result of placing a new increased priority on forming organizing and coordination Neighborhood Watch groups. With the new leadership and increasing participation rates in mind, we have been tasked with trying to evaluate the effectiveness of the neighborhood watch groups in reducing the city's crime rates.

In this research, we are going to test whether the increase in the number of neighborhood watch groups in Medford has had an effect on crime in the city. Geographically, the neighborhood watch groups are divided into 7 areas or "beats". Every beat has a varying number of neighborhood watch groups in its area. The mission of the programs in Medford is to enhance neighborhood security, heighten the community's power of observation, and to encourage mutual assistance and concerns among neighbors.

3. Literature Review

Research has been conducted over the past 30 year trying to analyze the effectiveness of Neighborhood Watch programs. The majority of the studies have originated from research in United States and the UK. Many of the studies have been conducted by police departments or included data from police departments.

The results of previous studies are mixed, some show a significant reduction in crime rates associated with Neighborhood Watch, while others show that neighborhood watch programs could be associated with a minor increase in crime. Perhaps, this is because increasing crime motivates the formation of Neighborhood Watch groups.

Latessa and Travis (1987) analyzed the effect of a watch program in Cincinnati, Ohio. Evaluating a community of 17,000 residents, the authors were able to identify a significant reduction in burglary rates compared to the year before the watch program was introduced in the area. Burglary rates in the experimental area decreased by 11%, while burglary in Cincinnati as a whole decreased by 2%.

Henig (1984) conducted research in one police district in Washington, D.C, to determine how actively blocks were participating and the effectiveness of the program in reducing crime. A sample of 25 watches were selected. Contrary to the findings by Latessa and Travis (1987) there was no clear evidence that crime had dropped more rapidly in participating blocks than in those that were not participating in the neighborhood watch program.

A possible explanation for the different results in these studies could be that neighborhood watch programs have a larger effect on certain types of crime, such as burglary, than the overall crime rate of a given area.

A 2008 U.S Justice Department meta-analysis "Does Neighborhood Watch Reduce Crime?" by Holloway, Bennett, and Farrington (2008) which reviewed results from previous research projects conducted from 1977 to 1994 in North America and the UK. The analysis included results from eighteen different studies. The purpose of this meta-analysis was to calculate a mean effect of the efficiency of neighborhood watch programs. The majority of the evaluated studies for the analysis, fifteen studies, relied on police data. The remaining three studies used survey data. However, only eight of the studies were specifically measuring the effect of neighborhood watch programs on average crime rate, while the remaining ten studies were estimating the effect of

neighborhood watch programs in addition to other programs with similar purposes. While there were significant differences in effect size among the included studies, only three of the studies showed a positive relationship between neighborhood watch programs and crime. The mean effect size of this analysis showed that crime decreased by 16 percent in the experimental area compared to the control area. This means that across all studies combined, neighborhood watch was associated with a reduction in crime.

4. Hypothesis development

We expect that the neighborhood watch program in Medford to decrease neighborhood's crime rate. As the number of neighborhood watch groups increases in a given beat, we expect the crime rate in that beat to decrease.

There are several factors contributing to this hypothesis. The main method by which the program is supposed to reduce crime is by having residents of an area look for and report suspicious activity to the police. This could have a direct effect on crime rate. As an increased number of potential crimes are reported, the chance of preventing those crimes increases. Additionally, as suggested in previous research, a possible indirect effect of neighborhood watch programs is that knowledge of the program being active in an area could deter potential offenders from committing a crime (Bennett 1990). Finally, participants in the program in Medford are trained to provide the police with significant and accurate information when reporting suspicious activity or potential crimes. Given this training, the neighborhood watch groups can act as a useful extension to the police force and thereby increase the efficiency of the police.

Though we expect to see an overall negative effect on crime rate, we expect that the main effect will be on crimes such as breaking and entering, vandalism, trespassing, and home burglary. We have the required data to test alternative hypotheses such as the effect on a small category of crimes.

We do not expect to see any effect on crimes such as fraud or financial crimes, violent crimes, and little or no effect on drug related crimes. We can use this expectation to test and see if the negative effect we may be seeing is really due to neighborhood watches.

Other factors we expect to have an effect on the overall crime rate of a beat is population, average income, and area. We expect that the greater the area or population of which a single neighborhood watch group is appointed, the less effective the group will be in reducing the overall crime rate of that area. Due to this concern we will run analysis for not only the effect of number of neighborhood watch on crime but also the effect on neighborhood watch per square kilometer.

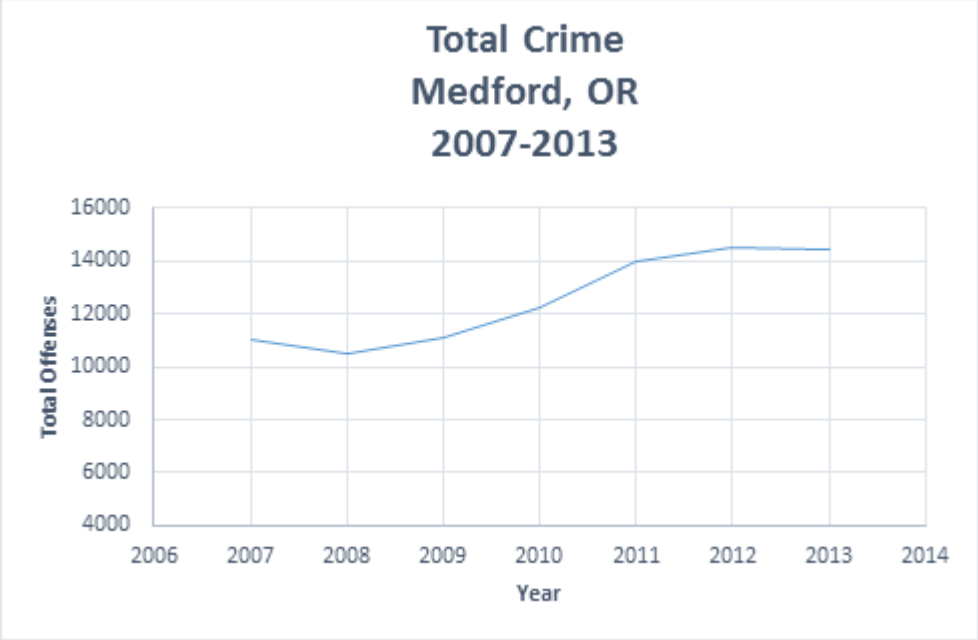
5. Data Description

The city of Medford is divided into seven beats with different areas. Each of these beats have a different number of neighborhood watch groups, of which were founded at different times. From the Medford Police Department, we obtained crime data including total offenses in each beat from the year 2007 through 2013. This data was further divided into two subgroups based on our hypothesis that neighborhood watch groups will have a greater effect on certain crimes. Our first custom group of crimes include crimes that are likely to be affected by additional neighborhood watch

groups. We define these crimes as Type 1 crime. This group includes a series of robbery, burglary, pickpocket offenses, purse snatching, shoplifting, a series of theft, vandalism, crime damage, and trespassing. Alternatively, Type 2 crime is a custom group of crimes unlikely to be affected by neighborhood watch groups. This group includes murder, negligent manslaughter, aggravated assault, restraining order violations, different kinds of fraud and financial crimes, and sex crimes. These crimes are less likely to be influenced by additional neighborhood watch groups in each beat.

The data from the Medford Police Department shows an overall increase in the crime rate in Medford between the years 2007 through 2013 as depicted in the graph below.

Graph 1: Total crime in Medford (2007-2013)



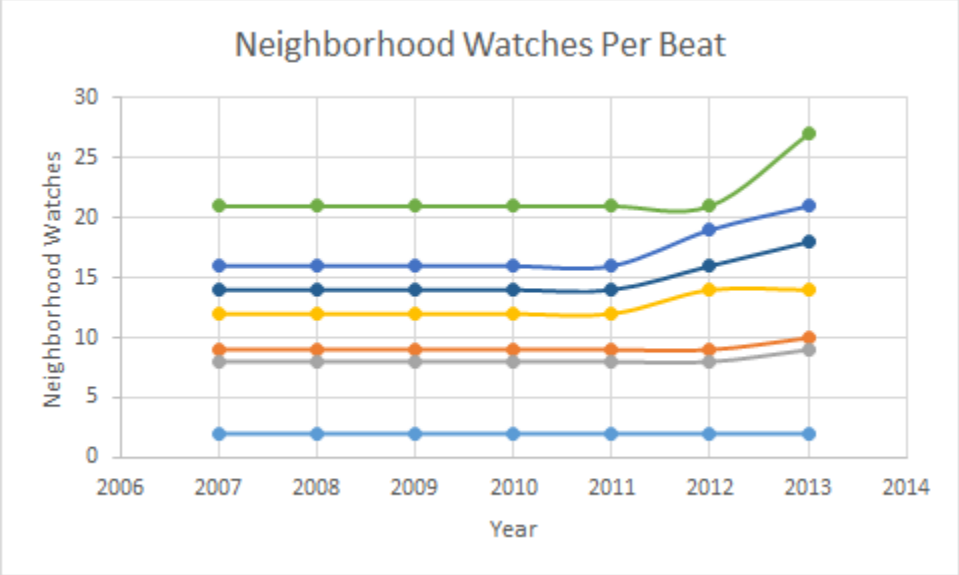
The Medford Police Department also provided us with a map (attached in appendix) showing how the beats are distributed across Medford along with the number of neighborhood watch groups in each beat between the years 2007 through 2013.

Looking at each specific beat, the number of neighborhood watch groups in a single beat shows little variation between the years 2007-2013. Most beats did not experience any significant change in the number of groups prior to 2012. However, the number of neighborhood watch groups varies across beats from a minimum of 2 (Beat 7) to a maximum of 27 (Beat 2). Overall, the number of neighborhood watch groups in Medford has increased since 2007. Table 1 shows a summary of the distribution of neighborhood watch groups per beat.

Table 1. Number of neighborhood watch groups per beat (2007-2013)

	Mean	***St.Dev***	***Min***	***Max***
Neighborhood Watch Groups	*12.245*	*6.163*	*2*	*27*

Graph 2: Number of neighborhood watches per beat (2007-2012)



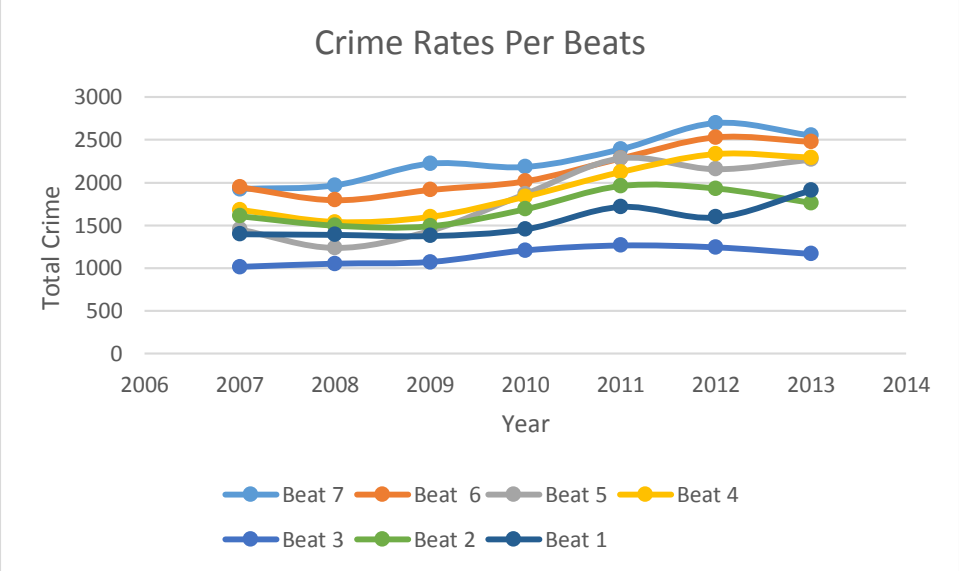
The data from the Medford Police Department included a total of 116 different types of offenses. However, as mentioned above we hypothesize that many of these offenses, such as fraud, will not be affected by neighborhood watch groups. Table 2

shows a summary of our crime data from the Medford Police Department and our two custom groups.

Table 2. Offenses per beat (2007-2013)

	Mean	**St.Dev**	**Min**	**Max**
Total Crime	1791.653	435.691	1013	2697
Type 1 Crime	882.5	205.5	499	1303
Type 2 Crime	1033.5	212.5	436	1673

Graph 2: Total crime rate per beat (2007-2013)



To control for the effect population might have on the crime rate we use elementary school enrollment as a proxy for population in each beat. By using our map of the beats provided by the police department and a map of the school districts in Medford, we were able to match each school district with the corresponding beat(s). A

number of school districts stretched across multiple beats. In those circumstances we were forced to estimate the number of students from each beat enrolled at a specific school. This was done by dividing the total number of students at a school by the number of beats in the given school district. The student enrollment data was obtained from Oregon Department of Education website. We relied on this proxy for population changes because population and enrollment changes should be highly correlated. Enrollment also does not require mapping the police beats on to census tract information.

Along with the data for student enrollment, the Oregon Department of Education also collects data on the percentage of students receiving reduced or free lunch in elementary school. We used this data as a proxy for average income in each beat, and recorded it in the same way as student enrollment.

To obtain an approximation of the area of each beat, we used google maps software and our provided map. With this software, we were able to obtain a close estimate of the area of each beat measured in square kilometers. This was done so that we can create a variable for neighborhood watch groups per square kilometer, and thus control for the differences in the area of the beats.

Table 3: Medford's Beat Area (in square kilometers)

	Mean	***St.Dev***	***Min***	***Max***
Area of Beats	*8.644*	*5.083*	*1.49*	*18.08*

For the purposes of our regression we were manipulated the data in a few ways below is a table of the data and the ways we interacted it.

Table 4: Variable description

Variable	Description
$crime_{it}$	total # of crimes in beat i at time t
$crime\_type1_{it}$	total # of Type 1 crimes in beat i at time t
$crime\_type2_{it}$	total # of Type 2 crimes in beat i at time t
$nwgroups_{it}$	number of neighborhood watch groups in beat i at time t
$enrollment_{it}$	students enrolled in elementary school in beat i at tim year t (used as for population in beat i at time t)
$p\_freelunch_{it}$	percent of students in elementary school receiving free or reduced lunch in beat i at time t (used as a proxy for average income in beat i at time t)
$beatarea_{i}$	approximate area of beat i in km2
$nwgroups/km^2_{it}$	(# of neighborhood watch groups in beat i at time t) / (approximate area of beat i)
crimearea	total number of crime in beat i at time t divided by area of beat i

6. Methodology

In order to determine the effect of neighborhood watch groups on crime in Medford's police beats, we ran several regressions with our collected panel data. Our main regression is a semi-logarithmic model which allows us to interpret the coefficients as a percent change in crime. This model specifies the log of crimes as our dependent variable. Neighborhood watch groups, school-enrollment, and free/reduced lunch are independent variables. Additionally, dummy variables for year and beats are included giving us a total of 49 observations. The reason for including school-enrollment and percentage of students receiving free and reduced lunch in this model is to control for the effects population and income might have on the log of crimes.

Model 1 Specification:

$$log\_crime_{it} = \beta 1 + \beta 2 nwgroups_{it} + \beta 3 log\_enrollment_{it} + \beta 4 freelunch_{it} + \beta 5\text{-}B11 year_{it} + \beta 12\text{-}17 beat_{it} + u_{it}$$

Using log crime allows us to interpret the coefficient on neighborhood watch groups as a percent change in crime due to a one unit increase in neighborhood watch groups. The year effects control for all other factors that change over time in the same way for each beat, and the beat effects control for all other factors that vary across beats but are fixed over time. Together, the beat, year and time-varying effects of enrollment and free lunch tend to account for factors affecting crime other than neighborhood watch groups that differ across neighborhoods.

Due to concerns about bias results following from a greater increase in the formation of neighborhood watch groups in wealthier, low-crime areas, we decided to run a second regression where we excluded the variable for percentage of students receiving free or reduced lunch. The reason for running this regression is that if this possibility is behind the effect we estimate, then including free lunch, a proxy for income should diminish the effect we find.

Model 2 Specification:

$$log\_crime_{it} = \beta 1 + \beta 2 nwgroups_{it} + \beta 3 log\_enrollment_{it} + \beta 4\text{-}B10 year_{it} + \beta 11\text{-}16 beat_{it} + u_{it}$$

Note that none of the models above controls for area of a beat in comparison to the number of neighborhood watch groups present. Including area is not possible because beat area does not change, so it is perfectly collinear with the fixed beat effects.

To determine if the difference in area among the seven beats has an effect on our results, we modified our independent variables slightly. Instead of using number of neighborhood watch groups as the independent variable of interest in the model we specified a ratio of neighborhood watch groups per km^2.

Model 3 Specification:

$$log\_crime_{it} = \beta 1 + \beta 2 nwgroups/km^2_{it} + \beta 3 log\_enrollment_{it} + \beta 4 freelunch_{it} + \beta 5\text{-}B11year_{it} + \beta 12\text{-}17beat_{it} + u_{it}$$

As we did in our first model with number of neighborhood watch groups as the independent variable of interest, we ran an additional regression of this model where we excluded the variable for free and reduced lunch.

Model 4 Specification:

$$log\_crime_{it} = \beta 1 + \beta 2 nwgroups/km^2_{it} + \beta 3 log\_enrollment_{it} + \beta 4\text{-}B10year_{it} + \beta 11\text{-}16beat_{it} + u_{it}$$

To test our hypothesis that neighborhood watch groups have a greater effect on certain types of crime we used a subgroup of crimes which only included crimes we believe to be affected by neighborhood watch groups. This subgroup consists of 23 different crimes, including offenses of theft, robbery, burglary, and vandalism. The model below uses the same specification as our previous models with the exception that the log of total crime is replaced by the log of the new subgroup of crimes as the dependent variable.

Model 5 Specification:

$$log\_crime\_type1_{it} = \beta 1 + \beta 2nwgroups_{it} + \beta 3log\_enrollment_{it} + \beta 4freelunch_{it} + \beta 5\text{-}B11year_{it} + \beta 12\text{-}17beat_{it} + u_{it}$$

As with our earlier models, this model was tested with number of neighborhood watch groups as the independent variable of interest, and also a ratio of neighborhood watch groups per km^2.

Model 6 Specification:

$$log\_crime\_type1_{it} = \beta 1 + \beta 2nwgroups/km^2_{it} + \beta 3log\_enrollment_{it} + \beta 4freelunch_{it} + \beta 5\text{-}B11year_{it} + \beta 12\text{-}17beat_{it} + u_{it}$$

Similarly, we also ran these regressions with type 2 crimes as the dependent variable. These are crimes we hypothesized would not be affected by neighborhood watch groups.

Model 7 Specification:

$$log\_crime\_type2_{it} = \beta 1 + \beta 2nwgroups_{it} + \beta 3log\_enrollment_{it} + \beta 4freelunch_{it} + \beta 5\text{-}B11year_{it} + \beta 12\text{-}17beat_{it} + u_{it}$$

Model 8 Specification:

$$log\_crime\_type2_{it} = \beta 1 + \beta 2nwgroups/km^2_{it} + \beta 3log\_enrollment_{it} + \beta 4freelunch_{it} + \beta 5\text{-}B11year_{it} + \beta 12\text{-}17beat_{it} + u_{it}$$

To test if the effects we estimated in our models experienced diminishing returns we also estimated models with squared terms of the variables for number of

neighborhood watch groups and neighborhood watch groups per km^2. Finally, models with lag effects were estimated to account for any delayed effects on crime.

7. Results

Model 1 & Model 2 Results:

Model 1 produced a significant coefficient on neighborhood watch groups equal to *-.03285,* suggesting that one additional neighborhood watch group decreases total crime by about 3%. When excluding the variable for percentage of students receiving free or reduced lunch the coefficient for neighborhood watch group did not change by a significant amount.

Table 5: Model 1 and 2 results

Independent Variable	Model 1 Coef.	Model 2 Coef.
nwgroups	-.0328544** (.013915)	-.0318628** (.0131248)
log_enrollment	.3674736 (.3286835)	.3676918 (.3236256)
p_freelunch	.0810751 (.1881241)	-
R^2	0.8380	0.8377
Observations	49	49

*** p < .05, * p < .10*

Model 3 & Model 4 Results:

Model 3 produced a greater negative number on the coefficient of interest than Model 1 and Model 2. The coefficient on neighborhood watch groups per km^2 suggests that one additional neighborhood watch group per km^2 decreases crime by about 18.8%.

Once again, excluding the variable for percentage of students receiving free or reduced lunch did not have a significant effect on the coefficient of interest.

Table 6: Model 3 and 4 results

Independent Variable	**Model 3 Coef.**	**Model 4 Coef.**
nwgroups/km$^2_{it}$	-.1884978** (.0979106)	-.1945028** (.1038726)
log_enrollment	.3136855 (.4335312)	.3110152 (.4295861)
p_freelunch	-.0989801 (.1756459)	-
R2	0.8150	0.8144
Observations	49	49

*** p < .05, * p < .10*

Model 5 & Model 6 Results:

When only including crimes we hypothesized are affected by neighborhood watch groups, the coefficients for neighborhood watch groups and for the ratio of neighborhood watch groups per km^2 showed greater effects compared to our models including total crime. The p-values also decreased significantly.

Table 7: Model 5 and 6 results

Independent Variable	**Model 5 Coef.**	**Model 6 Coef.**
nwgroups	-.0599532*** (.0163045)	-
nwgroups/km$^2_{it}$	-	-.4191802*** (.0942644)
log_enrollment	.5488207 (.3941291)	.4634363 (.5871107)
p_freelunch	.2384008 (.2794918)	-.0677287 (.3373422)
R2	0.7461	0..7015
Observations	49	49

**** p<.01 , ** p < .05, * p < .10*

Model 7 & Model 8 Results:

These models, including type 2 crimes, or crimes we hypothesized would not be affected by additional neighborhood watch groups, estimated no significant coefficients for neighborhood watch groups or neighborhood watch groups per square kilometer.

Table 8: Model 7 and 8 results

Independent Variable	Model 7 Coef.	Model 8 Coef.
nwgroups	-.0262462 (.0188897)	-
nwgroups/km$^2_{it}$	-	-.0599532 (.0163045)
log_enrollment	.3480016 (.3544088)	.5488207 (.3941291)
p_freelunch	.1760079 (.2006231)	.2384008 (.2794918)
R2	.8528	.7461
Observations	49	49

**** p<.01 , ** p < .05, * p < .10*

Our models with squared terms were not able to estimate the linear and squared terms precisely due to collinearity. The squared terms did however suggest that there are diminishing returns to the effects we estimate, but the terms were not independently significant. This is most likely the result of limited observations.

Additionally, our models with lagged terms were not able to estimate any significant coefficients suggesting that the effects of the neighborhood watch are felt within the first year.

8. Conclusion

In our base regression (Model 1) with log of crime as the dependent variable and number of neighborhood watch groups as our independent variable of interest we obtained a coefficient of about -0.03. As this is in terms of the log of crime, the coefficient suggests that for every one additional neighborhood watch group there is a

3% decrease in crime rate. This suggest that the neighborhood watch program does have a negative effect on crime.

Our second model was run to make sure that the result we were getting were not too highly correlated with the wealth of the areas. We wanted to take out the factor of free and reduced lunch (which we used as a proxy for the wealth of each beat) to see if it had an effect on the coefficient for neighborhood watch. We ended up with a coefficient of -0.03186, which is a difference of less than one tenth of one percent, compared to our original regression. This is a very small change suggesting that the results we obtained did not come from the wealth of the beats.

For our third model we wanted to test if the difference in area among the seven beats has an effect on our results, we used a ratio of neighborhood watch groups per km^2 as a new independent variable. This third model is identical to Model 1, with the exception that the variable for neighborhood watch groups per km^2 replaced the variable for number of neighborhood watch groups. For number of neighborhood watch groups per km^2 we got a coefficient of -.189. This suggests that one additional neighborhood watch group per km^2 decreases crime by about 18.9%. The negative effect of this variable on log of crime is significantly greater than the variable in Model 1. Thus, one additional neighborhood watch group per km^2 has bigger influence on decreasing crime rate than one additional neighborhood watch group per beat. Therefore, the difference in area among the seven beats does have an effect on our results, and the negative effect on crime for an additional neighborhood watch group is greater per square kilometer than per beat. It might because of the fact that some beats are bigger than

other beats, and some beats might have greater density in population, which influences their crime rate.

Our fourth model is identical to Model 3, with the exception that we left the percentage of free/reduced lunch out of the regression. Again, this was done to make sure that the result we were getting were not too highly correlated with the high-income areas. We got a coefficient on log of crime equal to -.195, which is similar to the coefficient in Model 3 suggesting that our results are not only coming from neighborhood watch groups being formed in wealthy areas.

Thus, neither Model 2 nor Model 4 (regressions excluding free/reduced lunch) indicates that our proxy for income has a significant effect on our results. The differences between the coefficient for number of neighborhood watch groups in model 1 and model 2 is only 0.099%, and the difference between neighborhood watch groups per km^2 in model 3 and model 4 is .06%. These small differences suggests that the results we obtained are not influenced by a selection bias where more neighborhood watch groups are being formed in high-income beats with low crime.

Our fifth model estimates the effects of additional neighborhood watch groups on types of crimes we hypothesized would most likely be affected. Our model specification is identical to Model 1 with the exception that instead of total crime as our dependent variable we use Type 1 crime. Running this regression we got a coefficient of about -.06. This suggests that the neighborhood watch program decreased crime by about 6% for the crimes that we hypothesized would be affected by the program. This coefficient is almost double the coefficient obtained for the first model. Our p-value also went down

to 0.00 for these crimes suggesting that the coefficient in this model is even more significant.

Our sixth model replaced neighborhood watch groups with neighborhood watch groups per square kilometer and then ran the same regression as in model 5. For this model we obtained a coefficient of about -.42. This implied that each additional neighborhood watch group per square kilometer decrease crime by 42%. This was more than double the 18.9% decrease that was obtained in model three. Once again the p-value decreased compared to the original model.

Model 7 and Model 8 were estimated as a type of placebo test where we ran the regression for crimes that we hypothesized would not be affected by the neighborhood watch groups. The purpose of running these regressions was to make sure that the negative results on crime were coming from additional neighborhood watch groups. It was a concern that these results could have been due to some omitted variable bias. We had high R^2 values, which could have implied that the regressions were missing some key variables and therefore getting a result that may not have been due to additional neighborhood watch groups. However, the results for both neighborhood watch groups and neighborhood watch groups per square kilometer were insignificant (p-values > 0.10) when using Type 2 crime as our dependent variable. In other words, neighborhood watch groups does not have a significant effect on these crimes, implying that the estimated effects on total crime and Type 1 crime are not the result of some omitted variable factor.

Our regressions with squared terms suggests that there are some diminishing returns to the effects we estimate, but we cannot conclude the degree of this effect due

to the fact that the squared terms and the linear terms in this model are too collinear to estimate them both precisely. Considering the results from previous research, it is likely that the decreases in crime we estimated in our models also experience some lagged effects, we were however not able to estimate any significant lagged effects in any our models.

The results from the majority of the studies included in the meta analysis "Does Neighborhood Watch Reduce Crime?" by Holloway, Bennet and Farrington (2008) suggests that neighborhood watch groups were associated with a reduction in crime. Our results align with those results in that we have found a significant reduction in crime due to additional neighborhood watch groups in the areas of Medford included in our research. However, our models cannot provide answers to why neighborhood watch groups in Medford are associated with this reduction in crime. It might be because of the features of the neighborhood watch groups we discussed in our hypothesis development, but further research is needed to determine the factors contributing to the reduction in crime provided by the neighborhood watch groups.

9. References

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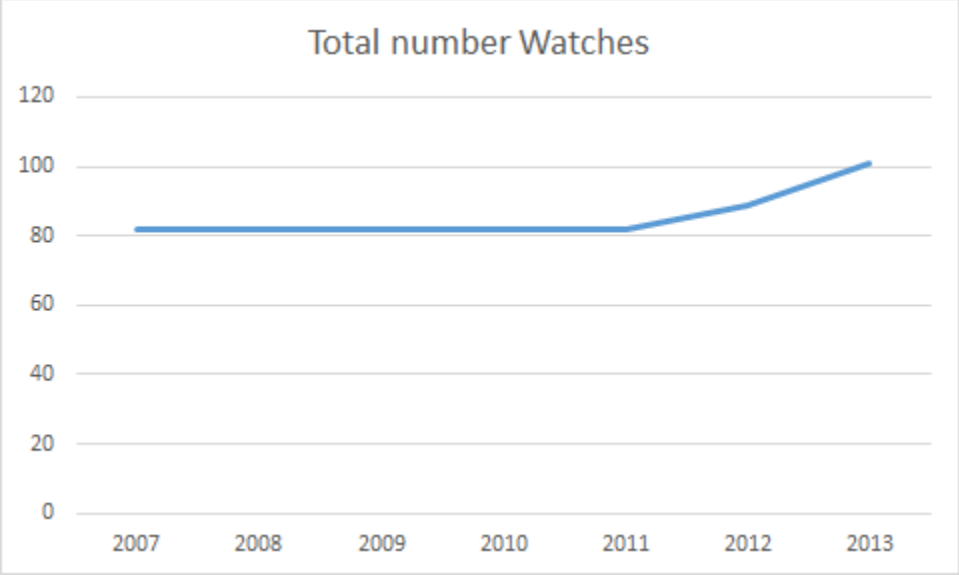
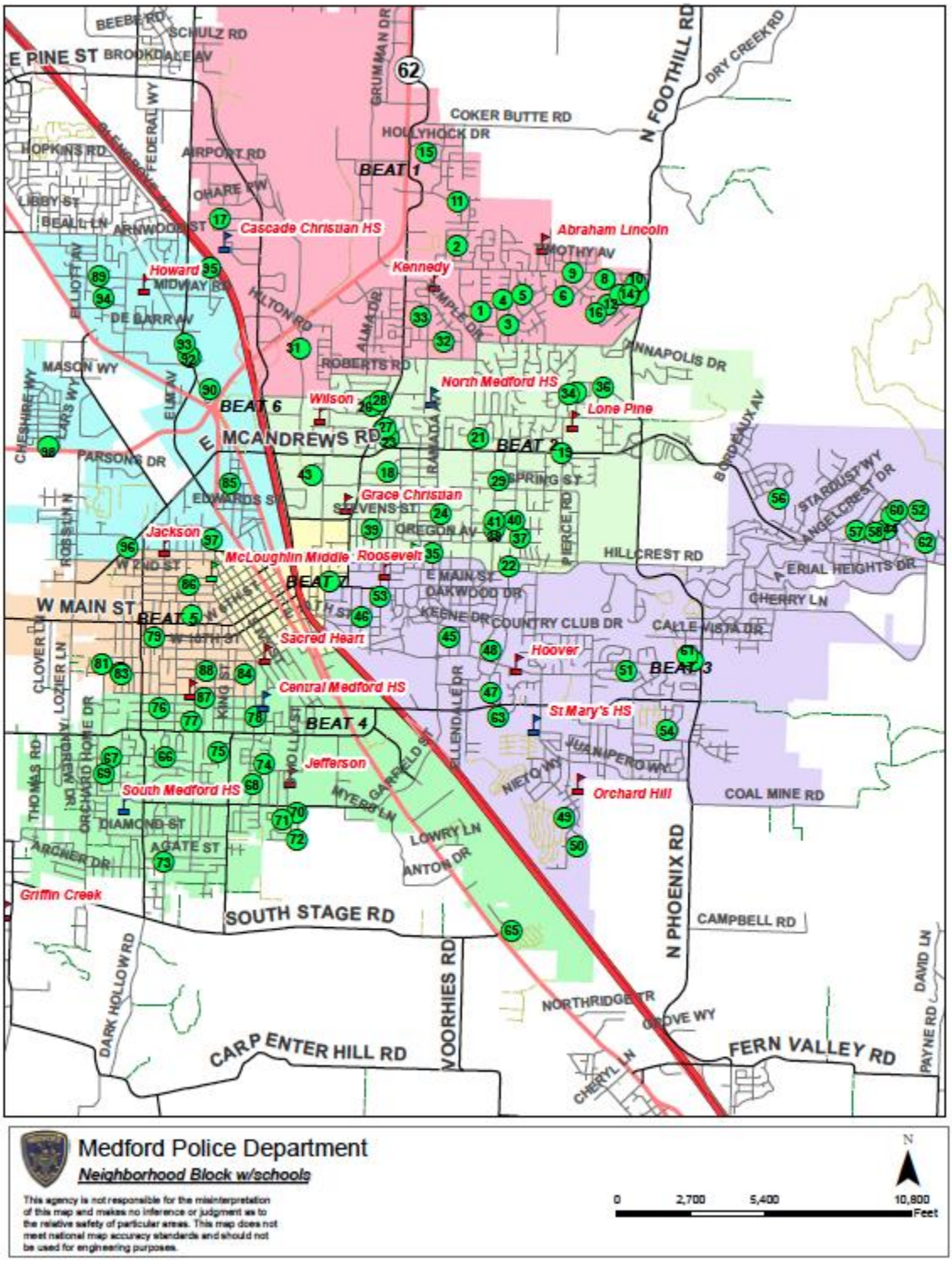
10. Appendix

Total Number of Neighborhood watches in Medford:

Year	Total number of Neighborhood watches.
2007	82
2008	82
2009	82
2010	82
2011	82
2012	89
2013	101



Beat Map of Medford:



Beat Areas in Medford:

Beat Number	**Area (km^2)**
1	11.49
2	8.95
3	18.08
4	9.53
5	3.48
6	7.49
7	1.49

Models with squared terms:

Independent Variable	**Model with** (nwgroups)$^2_{it}$	**Model with** (*nwgroups*/km^2)$^2_{it}$
nwgroups	.0319091 (.0596247)	-
nwgroups/km$^2_{it}$	-	.-.297398 (.7487723)
(nwgroups)$^2_{it}$	-.001504 (.001198)	
(*nwgroups*/km^2)$^2_{it}$	-	.0215178 (.1456795)
log_enrollment	.3997176 (.38263)	.3105844 (.4331235)
p_freelunch	.0733392 (.1243428)	-.0776894 (.1746116)
R2	.8473	.8154
Observations	49	49