An Econometric Analysis of the Efficacy of Parking Garage Security in Downtown Eugene, Oregon

Matthew W. Curtis
&
Ari I. Siegel

Presented to the Department of Economics, University of Oregon, in partial fulfillment of requirements for honors in Economics

Under the supervision of
Professor Glen R. Waddell

June 2010

An Econometric Analysis of the Efficacy of

Parking Garage Security in Downtown Eugene, Oregon

Abstract

The Parking Services program for the City of Eugene currently hires DePaul security guards to patrol downtown Eugene parking facilities in order to record incidents and deter criminal activity. This paper conducts analysis to determine the existence of a deterrent effect from increased security presence, in addition to assessing the efficacy and efficiency of Parking Services' security guard allocation. Empirically we find a significant deterrent effect does exist, but this effect is not uniform. We find differences in the deterrent effect across categories of offenses as well as across different parking structures. Using these findings, we suggest various ways in which Parking Services can maximize the efficiency of its downtown security presence.

Approved: _____ 8 June 2010

Professor Glen R. Waddell Date

Report

1 Overview

The Parking Services program for the City of Eugene is interested in assessing the efficacy and efficiency of security guard allocation in the downtown parking facilities of Eugene, Oregon. In particular, Parking Services (PS) seeks to increase efficiency and decrease costs by determining the extent to which the level of security guards should fluctuate throughout the year. PS also wishes to assess the efficacy of a recent increase in security guard presence downtown. This increase in security presence is financially unsustainable. Thus, PS seeks to find ways to cut unnecessary expenditures from their security budget. Parking Services' ultimate goal is to ensure the peace of mind and safety of their customers while maintaining a sustainable budget.

As part of this exercise, we will utilize downtown parking garage incident logs and crime statistics for the city of Eugene. We will analyze the changes in the level of parking garage incidents against several variables in hopes of isolating the determinants of such offenses and recommending the appropriate actions to reduce parking garage incidents in the future.

Siegel and Curtis are undergraduate students in the Department of Economics of the University of Oregon. Siegel is a junior at Oregon, majoring in Economics and Business Administration. Curtis is a senior at the University and is graduating with a Bachelor of Science in Economics and Political Science.

The report is comprised of five sections. In Section 2, we provide some motivation and context for the problem and detail the project objectives. In Section 3, we describe the data to be used in our analysis. In Section 4, we discuss the empirical methodology we adopt and conduct analysis based on the available data. We draw concluding remarks in Section 5.

2 Project Description

The City of Eugene's Parking Services program manages downtown parking and off-street parking facilities, among other parking areas. PS hires DePaul security guards to patrol the downtown area, primarily parking garages, to function as a deterrent to property and other crimes and to act as the eyes and ears of the Eugene Police Department (EPD) in the garages. In 2009, the allocation of PS funds toward security guards increased from $160,000 to $500,000. This increase is not intended to be permanent, and a significant portion of this project will be directed toward determining the effectiveness of the increase in security guard presence in relation to downtown parking garage crime. We will look to find ways in which the allocation of

security guards can be streamlined in order to increase the efficiency of security guard allocation.

The literature has established that there are many different determinants of crime. In criminology, rational choice theory assumes that individuals decide whether or not to commit unlawful acts based on the perceived benefits versus the perceived costs of that act (Clarke and Cornish, 1986). Perceived costs include, but are not limited to, the severity of punishment if caught and the likelihood of arrest itself. In the context of this project, Eugene Parking Services is not able to influence the severity of punishment. However, PS does have an implicit influence on the likelihood of arrest through varying the level of security guard presence in parking structures. Although past studies were inconclusive (e.g., Cameron 1988), Levitt (1997) suggests that increased police presence does reduce criminal activity. This suggests that deterrence through increased patrol presence may be an effective form of crime prevention.

In addition to the aforementioned factors, there are also socioeconomic determinants of criminal activity. Specifically for property crime, Mathur (1976) shows these other determinants include economic inequality, race, education, and unemployment. Herbert and Hyde (1985) demonstrate that the level of social cohesion and self-policing in a community are additional deterrents to crime.

3 Data and Descriptive Analysis

Our empirical analysis uses data from several sources, covering the period July 2003 through December 2009. The data includes monthly unemployment rates for the local area, as well as the incident logs and employment statistics of parking garage security guards. Incident logs record exact times of events as discovered by guards, as well as the location and categorical description of each incident.[1] Security employment statistics are weekly and include wages paid and number of hours worked by DePaul security guards as a whole. The unemployment data used in our analysis is the monthly unemployment rate for the Eugene-Springfield metropolitan area as recorded by the Oregon Employment Department.

Initial inspection of the security guard incident log data from 2003-9 shows that the most commonly cited incident is loitering (48%) followed by skateboarding (16.4%) and vehicle-related incidents (6.8%). Other offenses listed include drugs, graffiti, vandalism, stolen vehicles, alcohol and facilities-related incidents. Incidents without a specific classification comprise 13.6% of the recorded incidents.[2]

From 2008 to 2009, PS increased security expenditures from $160,000 to $500,000. We find that ten of the eleven incident log categories saw a decrease in occurrence over this time period. This initial trend suggests the security increase has decreased total crime occurrences, and the forthcoming analysis of this study will attempt to confirm or deny this hypothesis.

---

[1] Incident log records from July 2003 through March 2007 are monthly. After March 2007, records are at the incident level. Incident log data was not available for five months of 2007: April, May, June, September & November. Records from all other months during the 2003-9 timeframe were available and were used in this study.

[2] It should be noted that stolen vehicles, theft and facilities-related incidents were not recorded as distinct categories before July 2007, and were therefore not included in this distribution calculation. Of the post-July 2007 data, theft, stolen vehicles and facilities incidents comprise 7.0%, 0.6% and 3.3% of total incidents, respectively.

Before July 2007, all incident log data lists incidents from six locations: Broadway, Hult Center, Library, Overpark, Parcade and Pearl. Data after this time period and through 2009, however, lists incidents from approximately 50 different locations in the downtown area. Despite this large number of locations, over 97 percent of all incidents recorded since July 2007 are from the six facilities previously listed. Because of the statistical dominance of these six sites, and the fact that no data exists on the other locations before July 2007, all analysis conducted in this study will use data exclusively from the six garages of Broadway, Hult Center, Library, Overpark, Parcade and Pearl.[3] The average number of monthly incidents is broken down by garage in Table 1.

4 Methodology

The econometric analysis we perform examines the effectiveness and efficiency of parking garage security guard allocation. We analyze the changes in the level of parking garage incidents against different variables in hopes of isolating the determinants of such activity and considering the various marginal adjustments that could be made to reduce parking-garage incidents in the future. Specifically, regression analysis is used to estimate the effect of the recent increase in security guard expenditure on preventing crime. Dependent variables in this model include counts of individual incidents, by type, as well as the aggregate incident levels within downtown

[3] The term “garage” is used loosely throughout this report. Some parking facilities are indeed garages, while others are actually surface lots. We have generally used “garage” for ease of language. See Figure 1.

parking structures. Independent variables, in addition to the general economic indicators previously mentioned, include two measures of time (linear and quadratic) and location specified by garage. The results of these regressions will also help to quantify the marginal cost of decreases in security expenditures and to determine appropriate changes in security guard allocation.

Our analysis will be based off several different regressions which are generally categorized by the amount of specificity used in each regression's variables. Our analysis trends from the general to the specific. The first regression we analyze deals with monthly incident levels in the aggregate. The second analyzes differences in incident occurrence at each of six major garages, and the third determines the differences in occurrence between specific incident types. Our fourth and final regression analyzes the occurrence of specific incident types for each location separately in order to determine the existence of trends in the data and to draw conclusions based on our findings.

4.1 Analyzing monthly aggregates, per garage

Our first regression analyzes the effects of several variables on the total number of incidents per month per garage. Regression 1 is as follows:

$$Y_{ig} = \beta_0 + \beta_1 t_i + \beta_2 t^2_i + \beta_3 u_i + \beta_4 FTE_i + \varepsilon_{ig} \qquad [1]$$

Given that [1] is run on observations across multiple garages in a given month, standard errors are corrected for clustering on garage.[4] In this regression, the dependent variable Y_{ig} is total incidents in month i in garage g. The t_i and t^2_i variables are trend

[4] The significance of our variable of interest is not changed with the level at which we choose to cluster.

markers to account for exogenous changes in incident levels over time, namely linear and quadratic changes, respectively. Including these terms will keep any existing linear or quadratic trends in the data from being attributed to other variables – those that may move systematically over time, in particular. The variable u_i is the Eugene-Springfield unemployment rate for the current month.

Although controlling for seasonal effects was considered in the models, their inclusion led to much less overall statistical significance than the trend variables used in this analysis. The data suggests incident occurrence does not vary significantly throughout the year. On the other hand, inclusion of trend variables fits the data much better.[5]

A key variable of interest in our analysis is FTE_i, which is defined as the average number of full-time security guards employed each day by Parking Services for the current month. The variable gets its value by transforming the total sum of hours worked by all downtown Eugene security guards in a given month to obtain the approximate number of full-time shifts worked each day for that month. We've termed the resulting value the Full-Time Equivalent, or FTE. An increase of 1 in the value of a month's FTE approximates adding one full-time security guard to the PS payroll in each day of that month.[6]

---

[5] See Table 2.

[6] The FTE is calculated by dividing the total security hours for a given month by 30 to obtain the approximate number of security hours per day, then dividing the resulting number by 8, obtaining the approximate number of full-time shifts worked per day. (This calculation assumes the DePaul security guards work 8-hour shifts.)

When estimated with the available data, this regression yields a coefficient estimate of the FTE variable equal to -2.59.[7] This can be interpreted as suggesting that the overall number of incidents recorded for a given month will decrease on average by about 2.6 for each of the six major parking facilities if one additional eight-hour security shift is worked each day of that month. In making payroll decisions in the future, this estimated trade-off can be utilized by Parking Services to approximate a type of cost-benefit analysis to determine the likely effects of adding or dropping a certain number of security guards in a month.[8] Whether these incidents represent 2.6 fewer skateboarders or 2.6 fewer stolen vehicles at a certain garage remains to be seen, and determining this will be the focus of later analysis in this study.

Intuitively, there are two mechanisms through which increases in patrol hours could influence the number of recorded incidents. First, for the same number of actual incidents, increasing the number of FTE hours patrolled should lead to more recorded incidents, as there is a higher likelihood that any single incident is witnessed and/or recorded than before due to the greater patrol presence. Second, a greater patrol presence could have a real deterrent effect, leading to real reductions in the number of incidents and thereby decreasing the number of recorded incidents.

In our analysis, the estimated coefficient on the patrol hours variable is negative, suggesting that in the case of security guard presence in downtown Eugene parking facilities, the deterrent effect is the stronger of the two potential mechanisms. This is

---

[7] See Table 3.

[8] Same results in other words: when estimated using total sum security hours, the same regression suggests that each additional 100 hours of parking security on the PS payroll for a month will see an average decrease in recorded incidents of approximately 1 in each garage for that month.

consistent with the actual number of incidents occurring in downtown parking facilities decreasing as security patrol hours are increased. However, the increased likelihood of incidents being recorded must still be considered when interpreting the influence of additional security presence. For example, while our analysis suggests an effect of -2.6 on total monthly incidents for each FTE added to the payroll, the actual effect of hiring additional security guards is likely to be greater than this. This is because additional security guards record incidents previously unseen, partially offsetting the deterrent effect. Thus, the coefficient of -2.6 on the FTE variable can be seen as a lower limit on the true deterrent effect of having an additional guard patrolling each day for a month. If there is no increase in recorded incidents due to more security guards circulating about town, then one would interpret -2.6 as the true deterrent effect.

The trend variables, controlling for linear and exponential changes in incident levels over time, act as a substitute for any number of variables exogenous to our model, including local population and crime levels. Therefore, the coefficients placed on the trends estimate the degree to which incidents per month have increased or decreased over time, specifically for the period 2003 to 2009. From this regression, it appears that over time, aggregate incident levels are trending slightly downwards.[9]

4.2 Regressions by Garage

While an aggregate regression may be helpful in understanding the sum effects of additional security hours on the average amount of incidents in a month, a regression

[9] It should be noted that although both linear and exponential (quadratic) trends were found to be statistically significant in the data, the linear component of the trend is a larger contributor to explaining the trending within the data. See Table 3.

on the average amount of offenses at specific garages in a month may illustrate possible reallocations of security hours that increase overall security efficiency compared with previous allocations. Similar to the previous analysis, these regressions take the form:

$$Y_i = \beta_0 + \beta_1 t_i + \beta_2 t^2_i + \beta_3 u_i + \beta_4 FTE_i + \varepsilon_i, \text{ if garage} = X \qquad [2]$$

Estimating such a regression for each parking facility enables us to compare the estimated coefficients for each variable across different locations. Our analysis in this case will focus on the geographic variability in the relative effectiveness of the FTE variable.

In sum, it appears the effectiveness of FTE does vary across garages. Our analysis suggests the deterrent effect outweighs the effect of increased observation in all locations analyzed except the Library.[10] Further, the positive coefficient on the FTE variable for the Library is not statistically significant, which suggests that increased security presence does not have a real effect on the number of incidents recorded at the Library. This is unsurprising considering that the Library facility includes a large surface lot in addition to a smaller parking garage across the street. The area around the surface lot is a popular spot for teenagers and other pedestrians to socialize, and there is much foot traffic. In light of this, it is likely that the large presence of people in this area acts as a deterrent to crime already, and that additional security guards patrolling the Library surface lot area have little to no effect on deterring incidents from happening there.

[10] See Table 4.

With this in mind, if one were to decide to reduce overall security hours, it appears one could minimize the marginal cost in terms of increased incidents by reducing hours spent patrolling the Library. Alternatively, without reducing security expenditures at all, there could be a significant benefit to moving patrol hours from the Library area to garages that see a greater deterrent effect from increased security hours. As the Overpark garage has an estimated FTE coefficient of -8.34, significantly greater than any other garage, having security officers spend more time at that facility as opposed to other areas may be a cheap way to reduce overall incident occurrence.[11]

It is important to note that while these coefficients may suggest efficient ways to reduce total incidents, they do not suggest what types of offenses will be reduced. It is possible that a reduction in incidents at Broadway largely leads to Loitering reductions, while a reduction at another garage would lead to reductions in more serious offenses. If one values reducing certain offenses more than others, it is important to consider what types of incidents are being reduced when reallocating patrol hours. This is the focus of the proceeding analysis.

4.3 Regressions by Incident Type

The next regression we analyze deals with specific classifications of recorded offenses. The regressions still take the form:

$$Y_{ig} = \beta_0 + \beta_1 t_i + \beta_2 t^2_i + \beta_3 u_i + \beta_4 FTE_i + \varepsilon_{ig,} \text{ if type} = X \qquad [3]$$

However, each type of incident now has its own regression, where only observations of a given type are regressed. The regressions therefore should describe the marginal

[11] The next closest FTE coefficient is -2.82 at the Broadway lot. See Table 4.

effect of changes in the listed variables on the average monthly number of each specific type of recorded incident. While an aggregate regression of all incidents estimates the sign and strength of the relationship between variables and total incident occurrence, it is quite possible that the effects of the variables will differ, depending on the type of incident in question. Changes over time, the unemployment rate and average full-time shifts per month (FTE) all have the potential to affect the different incident types to varying degrees. All else held constant, if the probability of being caught increases equally across incident types, the offenses that are punished more harshly should decrease to a greater extent than the others. This is because the perceived net costs increase more for offenses with more significant consequences than those of their less egregious counterparts.

As our earlier analysis suggests, increasing the number of full-time security shifts in a month tends to decrease the number of recorded incidents overall. This means that at the aggregate level, the deterrent effect of added hours outweighs the effect of guards on duty catching and reporting more incidents. The extent of this relationship varies when incidents are broken down by type. As expected, it appears some incident types are much more elastic than others in terms of sensitivity to increased security hours, but our analysis suggests this is not necessarily related to the degree of punishment of the different offenses.

The deterrent effect appears to outweigh the increased observation effect most significantly for Loitering-related incidents, with an estimated coefficient of -0.89 for the FTE variable. On the other hand, Drugs and Vandalism both estimate positive FTE

coefficients of 0.06 and 0.14, respectively, implying that the increased observation effect is dominant for those incident types.[12] However, in this case as in the others, since the observation effect masks the true deterrent effect, it is unknown the extent to which increased patrol presence actually reduces incident occurrence.

All else equal, a reduction in security expenditures will likely lead to increased incident occurrence. However, each incident type will not decrease to the same degree. Because Loitering and Theft both show the greatest response to increased security hours (as estimated by their respective FTE coefficients of -0.89 and -0.53), this suggests that these two offenses will increase relatively more than other incident types if parking security expenditures are decreased.[13] This is important to note, because these estimates will enable Parking Services to assess the likely marginal cost of additional incident occurrence against the marginal benefit of lowered monetary expense when considering budget reductions. These coefficients may be considered when thinking about what types of offenses will increase the most when hours are reduced.

4.4 Regressions by Incident and Garage

The number of patrol hours has varying effects across the six specified garages as well as across incident type. Combined, it is possible to look at the effectiveness of increased security hours on specific offenses in each garage. Performing analysis by individual garage and incident type allows the data to reveal whether there are any differences in the relationship between FTE and the number of incidents that are

[12] The estimated FTE effect on Drugs is not statistically significant. See Table 5.
[13] The “Other” category has an estimated FTE coefficient of -0.66. See Table 5.

particular to either incidents or garages. Differences are seen both in the types of incidents that each garage is susceptible to, as well as differences in the responsiveness to increased security hours in each parking facility.

Using this information, Parking Services may be able to decide to how to target reductions in specific offenses by increasing the patrol hours at certain garages. This could be done by removing hours from locations with a smaller marginal benefit to FTE, and thus make patrol hours more effective overall without an increase in security expenditure. While there are many relationships between incident type and location, the following paragraphs highlight a few key examples.[14]

In considering Theft, for example, our analysis suggests that the only locations to see a statistically significant response to increased patrol hours are Broadway and Overpark. Likewise, the Overpark and Parcade garages appear to be the only facilities at which security hours have a significant effect on Alcohol offenses. On the other hand, Drugs and Stolen Vehicles do not see a significant response to changes in patrol presence at any of the six locations analyzed. Also, from the regression results it can be seen that some facilities to not have any recorded incidents of certain types over the 2003-09 time span.[15] This is especially true of the Library, which has not had any Bicycle, Facilities, Graffiti, or Stolen Vehicle-related incidents observed.[16] This is a

[14] Dividing the data into 66 models (11 incident types for each of the 6 garages) creates an issue of cell size. This means that there are not enough observations to be able to make accurate or economically sound analysis for those observations. A large number of estimated coefficients in these regressions are not significantly different from zero. See table 6.
[15] See table 6 for all FTE estimates of this regression.
[16] This may be anticipated, given that surface lots are much less likely to fall victim to Bicycle incidents than garages. For example, the enjoyment a cyclist gets from speeding down parking garage ramps makes them a much more appealing target than the flat and boring surface of outdoor lots.

reflection of the small incident totals for the Library area in general, likely reasons for which have been previously discussed.[17]

While these regressions combining garage and incident type suggest various actions that may be taken in order to efficiently reduce the occurrence of specific offenses, it is important to note the tradeoffs that exist in reallocating security hours by location. It must be acknowledged that reallocating patrol man-hours from one location to another will likely lead to an increase in incidents at the former, even while benefitting the well-being of the latter. For example, while the reallocation of patrol hours from the Pearl garage to Broadway will likely reduce the number of thefts overall per month, the decreased patrol presence at Pearl will likely lead to increases in Loitering there, partially offsetting the social gains of reducing Theft. Indeed, it is even possible that certain reallocation combinations will lead to an increase in incident levels overall. A decision to reallocate security patrol hours must consider all the marginal benefits and costs of the change, not just the potential benefits from a reduction in the specific incident type in question.

In sum, our analysis suggests that the marginal benefit to increased patrol hours is largest at the Overpark garage, while it is not statistically significant at the Library. This suggests that focusing relatively more attention to Overpark is desirable to have the strongest deterrent effect possible with existing resources. The analysis also suggests various ways to reduce specific incident types, such as Theft or Loitering, by reallocating security man-hours from one garage to another.

---

[17] See statement in Section 4.2 regarding Library deterrence.

4.5 Further considerations

While data and time constraints at the time of analysis keep us from considering some further questions, other areas of interest were simply beyond the scope of this study and may be well-suited for future analysis. Possible areas to consider in the future include day-of-week and time-of-day differences in incident levels, which may also play a role in determining the effectiveness of increases in security presence. The utilization of garage-revenue data would also be a useful factor to consider in the future, as this would stand as a proxy to the amount of traffic that passes through garages. For example, the number of customers in a given garage may be an additional deterrent to certain offenses or an invitation to others, depending on the incident type. Thus, the level of vehicle presence may be an important factor in determining the effectiveness of changes in FTE, especially across different offenses.

5 Concluding Remarks

Throughout this analysis, the assumption was made that for each additional full-time equivalent, the amount of extra time spent at each garage was distributed evenly. In other words, if a guard were to work 12 extra hours in a month, each of the six garages would receive two additional hours of patrolling. There are two implications of this assumption. First, if patrol hours are not in fact evenly distributed across all garages, coefficients on FTE for regressions that are separated by garage will be not reflect the true return. For example, if in fact when security hours increase the Library receives a disproportionally small share of those hours (less than a sixth of the total

increase), its coefficient in the regressions by garage will suggest a marginal benefit that is smaller than the benefit in reality. The possibility and significance of this issue will have to be considered by Eugene Parking Services when making policy decisions based on the regression results discussed in this report.

A second implication of this assumption is that FTE coefficients across garages suggest the marginal benefit at a particular garage, only when FTE increases across all garages. In other words, if one additional guard is hired for a month, each garage receives one sixth of that officer's time. This means that if a guard were hired with instructions to patrol one specific garage, the likely marginal benefit would be approximately six times greater than the results of this report suggest. This effect is actually likely to be greater than this, considering the fact there are several more parking facilities patrolled in the downtown area than the six analyzed in this study.[18]

This analysis assesses the effectiveness and efficiency of parking garage security guard allocation in downtown Eugene, Oregon. We have analyzed the changes in the level of parking garage incidents against several variables in hopes of isolating the determinants of such activity and recommending the appropriate actions to reduce parking garage offenses in the future. In so doing, we have made specific policy recommendations that we believe will be beneficial to the City of Eugene's Parking Services program and their customers. The results of our regressions have shaped our conclusions in the following ways:

- Security guard presence has both a deterrent effect and an increased observation effect which influence the number of incidents recorded in parking facilities. Our

[18] See Figure 1.

analysis has led us to conclude that the deterrent effect is the greater of the two, and that increased security guard presence does in fact have an overall negative impact on the number of offenses committed in parking facilities.

- There are likely ways in which security patrol hours can be reallocated across garages in order to reduce specific offenses without increasing security expenditures. For example, the Library area sees very few incidents, and the deterrent effect of increased security hours is virtually non-existent there. Perhaps having security patrols place more emphasis on the Overpark garage could be a more efficient allocation of resources.
- While we have provided the context in which Eugene Parking Services can look at the marginal costs and benefits of increasing and decreasing security expenditures, at an aggregate level PS will need to assess whether the financial savings of reducing security hours are worth the cost of the additional incident levels that our analysis suggests will be placed upon the city of Eugene and its residents.

Figure 1

Map of Downtown Eugene Parking Facilities

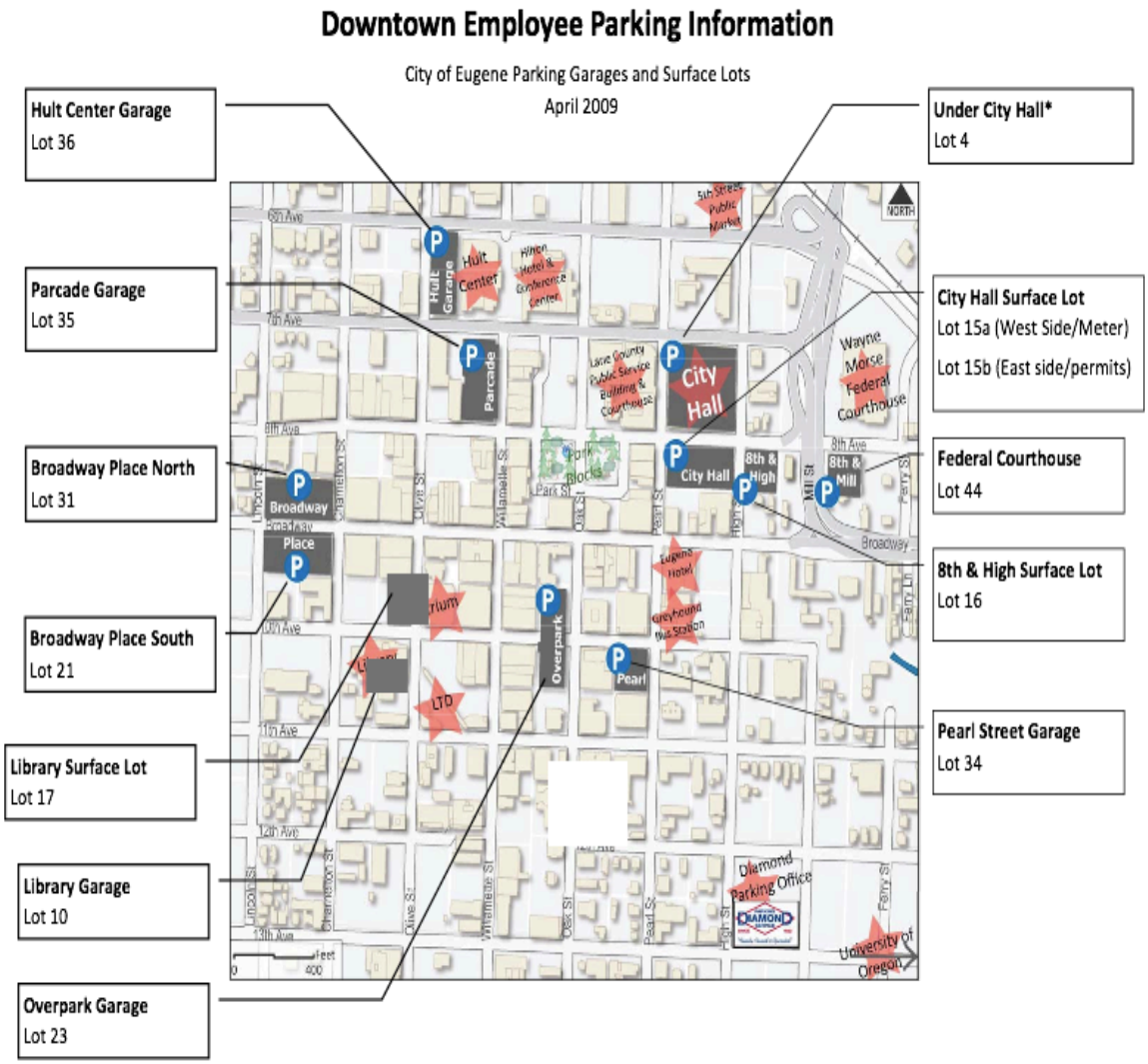

Table 1

Summary of Incidents, by Garage

Garage	Mean Incidents Per Month
-	-
Broadway	18.32
Hult Center	7.9
Library	1.4
Overpark	29.2
Parcade	17.9
Pearl	17.9
-	-
Average Incidents	13.41

Table 1 shows the average number of total monthly incidents at each garage. As can be seen from the table, the Overpark and Broadway locations see the largest number of incidents, while the Library averages a mere 1.4 incidents per month.

Table 2

Incident Fluctuations by Month

Variables	Number of incidents by month
_Imonth_2	**-1.910****
	(0.593)
_Imonth_3	**-4.132****
	(1.482)
_Imonth_4	**-6.624****
	(1.692)
_Imonth_5	**-4.022****
	(1.374)
_Imonth_6	**-1.749**
	(1.113)
_Imonth_7	**-4.235***
	(1.959)
_Imonth_8	**-2.516**
	(1.313)
_Imonth_9	**-3.087***
	(1.415)
_Imonth_10	**-1.456**
	(1.762)
_Imonth_11	**-4.978***
	(1.960)
_Imonth_12	**-1.287**
	(0.968)
Urate	**0.166**
	(0.504)
FTE	**0.900**
	(0.491)
Constant	**10.57****
	(3.406)
Observations	438
R-squared	0.035
*** p<0.01	
** p<0.05	
* p<0.1	

In this regression, the dependent variable is the total number of incidents for the current month, per garage. General variation between months can be seen. Relative to other regressions in this analysis, much less variation in incidents is explained, with an R-Squared of 0.035.

Table 3

Estimating Effects on Monthly Incident Totals,

per Garage

VARIABLES	Number of Incidents	P>|t|
Trend	**-0.221***	**0.053**
	(0.0907)	
Trend2	**0.00991****	**0.032**
	(0.00337)	
Urate	**-0.913**	**0.144**
	(0.567)	
FTE	**-2.589***	**0.097**
	(1.229)	
Constant	**22.67*****	**0.03**
	(4.313)	
Observations	438	
Number of garagenum	6	
R-squared	0.386	
*** p<0.01		
** p<0.05		
* p<.1		

The dependent variable is total monthly incidents, per garage. A slight downward trend in the incident level over time can be seen. The variable of interest, FTE, measures the approximate number of full-time security guards hired by PS in a month, and it is estimated that for each additional guard hired, incidents per month will decrease by 2.6 at each garage on average.

Table 4

Comparing Effectiveness of FTE Across Garages

VARIABLES	Broadway	Hult Center	Library	Overpark	Parcade	Pearl
Trend	**-0.266**	**-0.349****	**0.116**	**-0.337**	**-0.466***	**-0.0224**
	(0.308)	(0.147)	(0.0858)	(0.467)	(0.241)	(0.117)
Trend2	**0.0135*****	**0.00893*****	**-0.00157**	**0.0210*****	**0.0144*****	**0.00309***
	(0.00449)	(0.00214)	(0.00125)	(0.00680)	(0.00351)	(0.00170)
Urate	**-0.694**	**-1.224*****	**0.309**	**-0.176**	**-3.527*****	**-0.152**
	(0.923)	(0.440)	(0.257)	(1.398)	(0.722)	(0.350)
FTE	**-2.824*****	**-1.761*****	**0.389***	**-8.341*****	**-1.503****	**-1.455*****
	(0.772)	(0.368)	(0.215)	(1.169)	(0.604)	(0.293)
Constant	**21.99****	**21.96*****	**-4.169**	**45.42*****	**41.42*****	**9.158****
	(9.215)	(4.397)	(2.563)	(13.95)	(7.213)	(3.498)
Observations	73	73	73	73	73	73
R-squared	0.675	0.545	0.170	0.662	0.671	0.461
*** p<0.01						
** p<0.05						
* p<.1						

The dependent variable is total incidents per month at each garage in question. The estimates suggest that the greatest deterrence to incident occurrence from increases in security hours is at the Overpark garage. Table 4 also suggests that the deterrent effect may be smallest at the Library, where the relationship between FTE and incidents is positive. This suggests the increased observation effect outweighs the deterrent effect at this location.

Table 5

Results by Incident Type

VARIABLES	Alcohol	Bicycle	Drugs	Facilities	Graffiti	Loitering
trend	**-0.0293****	**-0.0243***	**-0.0416****	**1.404*****	**0.0141**	**-0.00627**
	(0.0130)	(0.0121)	(0.0138)	(0.316)	(0.0123)	(0.0805)
trend2	**0.000604****	**0.000508****	**0.000859*****	**-0.0106*****	**8.93e-05**	**0.00247***
	(0.000198)	(0.000184)	(0.000195)	(0.00248)	(0.000187)	(0.00115)
urate	**-0.0887****	**-0.0747****	**-0.159****	**-0.446*****	**0.0323**	**-0.103**
	(0.0379)	(0.0333)	(0.0607)	(0.0889)	(0.0499)	(0.362)
fte	**-0.0331**	**-0.0967*****	**0.0621**	**-0.0151**	**-0.123***	**-0.889*****
	(0.0279)	(0.0182)	(0.0581)	(0.0688)	(0.0592)	(0.251)
Constant	**1.157*****	**1.373*****	**1.458*****	**-40.97*****	**0.169**	**6.892***
	(0.355)	(0.408)	(0.430)	(9.492)	(0.399)	(3.226)
Observations	438	438	438	168	438	438
R-squared	0.103	0.068	0.142	0.334	0.099	0.121
VARIABLES	**Other**	**Skateboard**	**Stolen Vehicle**	**Theft**	**Vandalism**	
trend	**-0.193*****	**0.0129**	**0.0259**	**-0.126**	**0.0872*****	**-**
	(0.0480)	(0.0470)	(0.0929)	(0.332)	(0.0150)	-
trend2	**0.00457*****	**0.000360**	**-0.000148**	**0.00118**	**-0.00139*****	**-**
	(0.000732)	(0.000642)	(0.000738)	(0.00295)	(0.000233)	-
urate	**-0.514****	**-0.0499**	**-0.0267**	**0.387****	**0.0389**	**-**
	(0.169)	(0.176)	(0.0213)	(0.145)	(0.0279)	-
fte	**-0.664*****	**-0.209***	**-0.0233**	**-0.527*****	**0.137*****	**-**
	(0.109)	(0.105)	(0.0141)	(0.159)	(0.0262)	-
Constant	**7.461*****	**2.323**	**-0.491**	**4.865**	**-0.990****	**-**
	(1.406)	(1.431)	(2.785)	(9.663)	(0.367)	-
Observations	438	438	168	168	438	-
R-squared	0.384	0.059	0.038	0.133	0.126	-

The dependent variable is the total monthly incident count for each incident type in question. Overall, Table 5 suggests that the incident type most deterred by security patrol presence is Loitering. Facilities, Drugs and Stolen Vehicles are not significantly responsive to changes in patrol hours.

Table 6

Results by Incident Type & Garage

VARIABLES	Hult	Broadway	Parcade	Pearl	Overpark	Library
Alcohol FTE	**-0.0238**	**0.0899**	**-0.104***	**0.00499**	**-0.206****	**0.0401**
	(0.0559)	(0.0916)	(0.0531)	(0.0264)	(0.0828)	(0.0242)
Bicycle FTE	**-0.106****	**-0.0602**	**0.00711**	**-0.103****	**-0.318*****	**0**
	(0.0398)	(0.0677)	(0.0523)	(0.0348)	(0.0695)	(0)
Drugs FTE	**0.0277**	**0.100**	**0.100**	**0.100**	**0.00306**	**0.0176**
	(0.0598)	(0.138)	(0.138)	(0.138)	(0.159)	(0.0279)
Facilities FTE	**-0.101**	**0.0343**	**0.00986**	**0.000643**	**-0.108**	**0**
	(0.122)	(0.173)	(0.116)	(0.0272)	(0.105)	(0)
Graffiti FTE	**-0.0470**	**-0.146**	**-0.202**	**-0.0318**	**-0.314***	**0**
	(0.0299)	(0.111)	(0.127)	(0.0288)	(0.163)	(0)
Loitering FTE	**-0.0920**	**-0.651**	**-0.0475**	**-0.728*****	**-4.076*****	**0.259**
	(0.194)	(0.605)	(0.379)	(0.179)	(0.871)	(0.225)
Other FTE	**-0.733*****	**-0.570***	**-0.794****	**-0.196*****	**-1.686*****	**-0.00764**
	(0.157)	(0.313)	(0.279)	(0.0520)	(0.160)	(0.0614)
Skateboard FTE	**-0.116**	**-0.0357**	**-0.0343**	**-0.215**	**-0.881*****	**0.0271**
	(0.177)	(0.101)	(0.146)	(0.189)	(0.221)	(0.0363)
Stolen Vehicle FTE	**-0.0788**	**-0.000451**	**-0.0547**	**0**	**-0.00555**	**0**
	(0.0577)	(0.0561)	(0.0413)	(0)	(0.0714)	(0)
Theft FTE	**-0.566**	**-1.636****	**-0.472**	**-0.0498**	**-0.513****	**0.0744**
	(0.382)	(0.587)	(0.352)	(0.0480)	(0.178)	(0.0635)
Vandalism FTE	**0.126***	**0.0471**	**0.350*****	**-0.000590**	**0.293****	**0.00510**
	(0.0604)	(0.0865)	(0.0728)	(0.0253)	(0.113)	(0.00589)
*** p<0.01						
** p<0.05						
* p<.1						

The dependent variable is the monthly total for each incident type at each of the six garages. Dividing the data by incident type per specific garage shows no significant relationship between changes in FTE and occurrence of that specific incident in the majority of cases. Continuing the theme of Table 1, the Overpark garage shows the most responsiveness to security increases among the specific incident types, while the Library does not see a significant difference in any of the 11 incident types with changes in FTE.

Works Cited

Cameron, Samuel. "The Economics of Crime Deterrence: A Survey of Theory and Evidence." *Kyklos* 41.2 (1988): 301-23.

Cornish, Derek B., and R. V. G. Clarke. "Introduction." Introduction. *The Reasoning Criminal*. New York: Springer-Verlag, 1986.

Herbert, David T., and Stephen W. Hyde. "Environmental Criminology: Testing Some Area Hypotheses." *Transactions of the Institute of British Geographers* 10.3 (1985): 259-74.

Levitt, Steven D. "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime." *The American Economic Review* 87.3 (1997): 270-90.

Mathur, Vijay K. "A Factor Analysis of Socio-Economic Determinants of Property Crimes in Cities." *The Annals of Regional Science* 10.2 (1976): 116-27.