AN ECONOMIC ANALYSIS OF CAMPUS CRIME AND POLICING IN THE UNITED STATES: AN INSTRUMENTAL VARIABLES APPROACH

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Abstract

To date, the literature on campus crimes and its determinants has been largely descriptive and narrowly focused utilizing only regional cross-sectional data. By examining the factors that influence campus crimes utilizing a national panel collected from the FBI's Uniform Crime Report from 2000 to 2010, this paper helps to fill the under-researched aspect of how policing and campus setting influence campus crimes, both those of a violent and non-violent nature. Empirical evidence presented here suggests that there are significant differences in the effectiveness of policing by census region, by degree of urbanization, and by campus setting. Results suggest that the policing elasticities of crime are higher in the Northeast and Midwest than in the South and West. The nationwide campus policing elasticity suggests that a 10% increase in the campus police force would lead to a 10.5% to 17.6% decrease in campus crime.

Keywords: Campus crime, policing, instrumental variables estimation

Introduction

Mass media as well as campus officials have focused increasing attention on campus crime in recent years in light of the tragic shootings around the globe, particularly in the United States. The attention given to these high-profile incidents has helped create the impression that college campuses are potentially dangerous places. While the vast majority of campus crimes are neither deadly nor of a violent nature, campus crime is still important to study, since college enrollments have continued to increase due to the ever-increasing importance placed on obtaining a college degree. According to the National Center for Education Statistics (2012), enrollment at American collegiate institutions increased nine-fold from about 2.4 million in 1948 to about 21.6 million for the fall semester 2010 while the US population doubled from about 147 million in 1948 to about 309 million in 2010.

The enrollment growth rate of colleges and universities is outpacing the population growth rate of the nation, but fortunately the crime rates for both college campuses and for the nation as a whole have been decreasing in recent years. During the period from 2003 to 2010, the violent crime rate in the nation decreased by about 15% while the violent crime rate on college campuses decreased by 6%. The property crime rate for the nation and for college campuses decreased by 18% from 2003 to 2010 while the campus property crime rate decreased at about the same pace by 16.7%. Crime on campuses has implications for students' development—both socially and academically—as they are less likely to be actively engaged on campus in high crime environments.

Since the passage of the Clery Act of 1990, which requires colleges and universities to report the number of major crimes that occur on their campuses each year, campus safety has been a major public-policy issue. Discussions of policies to reduce campus crime have continued to gain media attention in recent years, highlighting the importance of a clear understanding of the determinants of campus crime. Student enrollment is an important determinant in the level of campus crime, and this relationship carries policy implications for when colleges and universities decide their admission selectivity procedures. The number of on-campus police officers impacts the crime level on all campuses across the nation, as the level of the police force is directly related to the deterrence of crime.

Community colleges have seen increasingly higher rates of enrollment over the past twenty years with many students deciding to take college courses part-time, during the evenings, close to their place of employment or home, and to gain necessary skills for career advancement. The structure of most junior colleges in the nation differs from that of four-year universities, as the residential model is no longer employed where students live in dorms and are an active part of the campus life and community at all hours of the day. We seek to explain how community colleges differ from four-year universities with regards to their crime levels.

This paper seeks to explore the effectiveness of policing in deterring crime as well as drawing comparisons between the effectiveness of deterring crime by campus setting, by degree of urbanization, and by Census region. By utilizing a national panel dataset from 2000 to 2010, we attempt to shed light on the major public policy issue of reducing campus crime. We utilize an instrumental variables approach to estimate the effect that policing has on deterring crime in order to eliminate the inherent simultaneity bias between policing and crime.

The paper begins with a review of the literature, discusses the data and the model, and continues to present and discuss the empirical results. We

conclude with a discussion of further extensions for future research as well as addressing the limitations of our analysis and policy conclusions.

Literature review

The antecedent literature relating to campus crimes is largely behavioral in nature, and the very few studies that have been conducted have been either merely descriptive or regionally based. Utilizing an econometric model, McPheters (1978) was the first to attempt to examine the relationship between campus crime and security activity as well as a number of other campus and off-campus variables. Crime data for the study were taken from the FBI's 1975 Uniform Crime Reports (UCR). McPheters found that campuses with higher levels of security expenditures tended to have higher rates of crime.

McPheters (1978) also discovered that the proportion of students living in dormitories and campuses that were located in close proximity to urban areas with high unemployment seemed to contribute to reported crime. Being located in an urban area alone was not significantly correlated with campus crime. His theory suggested that the insignificance of location as an indicator of campus crime could be partially explained by an exchange of risk factors. For instance, a small dormitory population would be seen as a low-risk factor since there is a tightly knit community; however, if this small dormitory population is in a large city, it has a high risk factor and it is theorized that the location effects would be neutralized. The McPheters study was severely limited by the small sample size and its generalizability is limited today as the college landscape is much larger and diverse than in the time of the study.

Fox and Hellman (1985), utilizing the 1980 FBI Uniform Crime Report, conducted a study of the factors that influence campus crime rates. Their study used data from 222 campuses and was published several years prior to the explosion of media attention to campus crime following the case of Jeanne Ann Clery. The authors found that colleges and universities have less crime than their surrounding communities, and that location had no influence on the ratio of campus to community crimes. They also discovered positive and significant correlations between campus crime and tuition cost, the percent of male students, population density, and campus police staffing levels.

Volkwein, Szelest, and Lizotte (1995) draw upon merged national databases containing federal crime statistics, community demographic data, and campus characteristics in order to examine the relationship of campus crime to campus and student characteristics. Their study found that there are major differences in crime rates between two-year colleges and four-year universities due to the residential nature of four-year universities that

changes the campus landscape. Another finding was that campus mission, wealth, and student characteristics (such as the percentage of African American students and the per student revenues) are the best predictors of campus crime. The authors also find no compelling evidence of crime spillovers from the community to campus environments. Lastly, they find a significant positive relationship between campus property crime and campus police staffing.

Fisher (1995) provides a discussion of the legal, legislative, and administrative responses to victimization and fear on campuses. The passage of the Crime Awareness and Campus Security Act of 1990 mandated postsecondary schools to publicly report certain crime statistics and security policies—and has led to the media's attention towards crime data of universities nationwide. She posited that the schools that were in compliance with the Campus Security Act would offer at least one crime awareness or prevention program in an effort to both reduce crime rates and make the campus safer by informing students. The author notes that many campuses had already installed blue-light emergency telephones or alarms in an attempt to complement the effects of the university police.

Lin (2009) analyzed the deterrence effect of police on crime utilizing state-level data from the Uniform Crime Report issued by the FBI. Within this analysis, tax rates were used as instrumental variables to estimate the effects of police presence on crime, under the notion in which: a change in tax rates leads to a change in revenue which changes the local government revenue from the state and in turn, this is related to a change in number of police which are related to a change in crime. Using OLS and 2SLS, the author finds that the police presence has a negative impact on crime. The 2SLS model resulted with an estimated elasticity of -0.9 for property crimes and -1.1 for violent crimes indicating that there is indeed a decrease in crime when police are increased. This study serves as a valuable asset for understanding the importance in utilizing police in an effort to decrease crime rates, even within a campus setting. Although the study was not done with respect to college campuses, the concept that crime is rational applies to both society and college campuses and therefore the impact of police should have at least a comparable impact on college campuses as well as in society.

Most recently, Cook, Gottfredson, and Na (2010) published a paper that discusses the steps necessary for crime control and prevention. Their study provides numerous policy implications that can be further studied once an understanding of the empirical relationship between campus crime and such variables as enrollment levels, police staffing, regional factors, and campus type is developed. Such policy implications that need empirical verification are: campuses will experience lower levels of crime when the schools monitor students (through such activities as employing a large police

staff) and control access to campus; and that cohesive, communal, and personalized environments will have the lowest crime rates.

The only antecedent economic analysis of campus crime examined the relationship between casinos and local crime rates through an analysis of crime data for residential colleges and universities in four Midwestern states. This study suggested that robberies and motor vehicle thefts, but not burglaries, are significantly higher in number for campuses located within 10 miles of a casino (Hyclak, 2011).

Although there have been limited studies conducted in the economics of campus crime, there is a fairly large literature on the economics of community crimes. In measuring the impact of police on crime, Cameron (1988) found that the majority of the literature showed either no relationship or a positive relationship between the level of police and crime rates. These findings are explainable by the cross-sectional methodology that failed to correctly account for the inherent simultaneity bias between crime and policing.

The second wave of research on the economics of crime began in the 1990s when researchers began to utilize larger datasets over several time periods. Economists utilized two techniques--Granger causality and instrumental variables estimation—in an attempt to account for the simultaneity bias that lead to a positive coefficient on the police variable. Marvell & Moody (1996) found that police "Granger cause" crime drops. They found that a 10% increase in an urban police force produced a 3% long-term decline in total crime. Levitt (1997) sought to correct for the simultaneity bias between policing and crime by utilizing the timing of gubernatorial elections as an instrumental variable. He estimated that an increase of 10% in the police force would lead to a 3% to 10% reduction in crime rates. Klick and Tabarrok (2005) provided strong evidence of the causal effect of police presence on the level of crime in Washington D.C. They find an elasticity of police on crime of – 0.3%. Most recently, Evans and Owens (2006) used the COPS (Community Oriented Policing Services) program to measure the effect of police on crime and found that more police lead to reduced crime. The main finding of these economic studies is that increases in police and greater incarceration lead to reduced crime (Levitt & Miles, 2006).

A study by Di Tella & Schargrodsky (2004) examines the impact police have on crime rates. As discussed earlier, a serious impediment in studying the link between police presence and crime rates is the simultaneous causality bias. This study provides an excellent way to mitigate that problem. The authors focused on three neighborhoods in the city that increased police presence after a terrorist attack and then compared with their previous history by utilizing a difference-in-differences approach.

Utilizing the difference-in-differences approach, an increase in police presence had a negative impact on car thefts, but they were localized impacts. By comparing the data from before an increase in police to after, this study found a 75% decrease in car thefts in the blocks that received additional police. This study further aides the literature due to the nature of importance on locality of police. Since the deterrent effects are local, campuses should be aware of this and strategically place police in the "problem" areas of campus assuming that campus crimes behave similarly to city crimes—an assumption explored by our paper.

This paper seeks to provide the empirical framework from which an understanding of the impact of policing on campus crime can be developed. We extend the literature on the economics of crime in the community setting to the campus setting. This research builds upon the previous work both by including an updated and national dataset and by expanding the explanatory power of previous studies through the examination of policing effectiveness by region, by campus setting, and by degree of urbanization.

Economic theory of crime

Since the publication of Gary Becker's "Crime and Punishment" (1968), the economics of crime established itself as a field for applications of economic theory based on the model of individual rational behavior. This literature has fundamentally relied upon a special case of the general theory of rational behavior under uncertainty: the crime deterrence principle that criminals respond to incentives. Crime deterrence mechanisms considered in the literature have focused on law enforcement measures in relation to increasing the probability of punishment that a criminal perceives. This probability of punishment can be increased by strengthening the presence of law enforcement officers.

Crime imposes tremendous costs on a society. Becker distinguished several types of costs that crimes bring to society: (i) cost of offenses such as a lower level of wealth and productivity or loss of human life, (ii) public expenditures on police and courts, (iii) public expenditure on imprisonment of offenders, and (iv) private expenditures on protection.

The first step for an economic approach to reducing crime is an understanding of a basic assumption: crime is rational. One chooses to partake in criminal activity because it is the most profitable option available to the criminal. The marginal utility of crime is higher than the marginal utility stemming from other activities, thereby creating the incentive for the criminal to engage in criminal activity. This leads to the conclusion that the most efficient way to deter crime is not to attempt to eliminate crime but rather to reduce the profitability of crime. We can reduce the profitability of crime by increasing the probability of being caught or by increasing the

punishment. The focus in this paper is on increasing the probability of being caught through increasing the level of police presence since universities have a direct influence on this policy, whereas the legal system determines the punishments.

Eide, Rubin & Shepherd (2006) provide a comprehensive review of the economics of criminal behavior. Economic models of criminal behavior must represent the gains and losses associated with criminal behavior such that all the benefits and costs that effect individual decision making are accounted for. The optimality condition resulting from the utility maximizing framework is that people will allocate time to criminal activity until the marginal benefits equal the marginal costs. The law-abiding individuals will normally have marginal benefits lower than the marginal costs. The gains that contribute to the marginal benefits include: monetary benefits such as those obtained from theft or robbery and psychic rewards such as the thrill of danger, peer approval, a sense of accomplishment, or the satisfaction of wants (as in the case of rape). Costs associated with criminal activity include the material costs, psychic costs, expected punishment costs, and opportunity costs associated with the decision to engage in criminal activity. Individual discount rates are also an important consideration in determining the benefits and costs of engaging in criminal behavior. An individual with a high discount rate will tend to engage in more criminal behavior than an individual with a low discount rate *ceteris paribus.*

The importance of policing a college campus stems from the assumption that an increase in police results in a decrease in crime. An increase in police should increase the marginal cost of crime and criminals would thus find it more costly to engage in criminal behavior. Police are valuable in deterring crime for a variety of reasons, but the very basic one is that by being seen, they act as a deterrent to crime because they increase the probability of getting caught for the criminal. In an effort to present the most valuable conclusion for how a college campus should staff their police force, we will analyze this relationship.

We expect that the incidence of each of the types of crime will be lessened by an increase in the police force. The incidence of pre-meditated crimes (such as murder or rape) will be affected less by an increase in policing than the opportunistic crimes (such as burglary or motor vehicle theft). Police lessen the opportunity criminals have to commit crimes. Therefore, the larger the opportunity cost of the crime, the more impact police will have on reducing crime. This can help in determining how to utilize police forces depending on the area of patrol. A university for instance, would have more opportunistic crimes than pre-meditated and therefore an increase in police on campus should have a very significant impact on crime rates.

Crime is a social behavior that can be associated with incentives, as with any economic decision. Through an empirical analysis of the relationship between police and crime and the various characteristics of college campuses, we can identify persisting relationships that aid policymakers in determining the optimal allocation of scarce resources.

Contribution of Criminal Justice Theories to the Economics of Crime

The criminal justice literature nicely complements the literature on the economics of crime. Economic theories are based upon the rational utility maximizing individual and preferences are usually assumed to be constant while norms are neglected. In contrast, criminological theories recognize the contribution of economics to the study of crime but suggest that an individual's environment has a significant impact on preferences and individual norms. One immediate difference between the criminal justice literature and the economics literature on crime is that economists have always attributed a statistically insignificant or positive impact of police on crime to a simultaneity problem; whereas, the criminal justice literature recognizes that police have many other duties than crime prevention and that only large increases in police resources may have a noticeable effect on crime. Moreover, the criminal justice literature recognizes the intuition of why there may be a positive or insignificant correlation between police and crime and explains this theoretically. The two main perspectives in criminological theory—the classical perspective and the positive perspective—help to shed light on our economic understanding of crime.

The most important assumption necessary in applying deterrence theory to policy is that individuals are rational. Research in behavioral economics and criminology suggests that people often engage in behaviors that they know are irrational and individuals' cognitive differences can limit rational decision making. This limitation is referred to as bounded rationality and it is not surprising that some studies find that attempts by police to deter potential offenders do not have much effect in preventing crime. The simple existence of a policing authority tends to deter people to some extent (Pratt, 2008). Thus, bounded rationality is one reason that a positive effect of policing on crime may not be surprising.

The classical perspective in criminological theory consists of two main theories: the rational choice theory and the routine activities theory. Rational choice theory is one that criminologists have adapted from economists and is the standard approach in studying the economics of crime. Under rational choice theory, an increase in police would reduce crime by reducing the incentives for criminals to engage in criminal activity (i.e. the opportunity cost of committing crime increases with a larger police force). Deterrence theory asserts that the certainty, severity and swiftness of a

punishment impact the effectiveness of a particular sanction. The certainty of punishment increases when the number of police officers increases since there is a higher probability of punishment due to the large police presence. Thus, classical deterrence theory provides a justification for increasing the number of police officers since it would increase the certainty of punishment.

Routine activities theory also assumes a rational decision-making offender and its framework emphasizes the presence of three factors that come together in time and place to create a high likelihood of crime and victimization. This theory considers the situational nature of crime since it assumes that most crime occurs during the daily routines of individuals who see and take opportunities to commit crime. The three factors that create a high likelihood of crime are a motivated offender, a vulnerable target, and a lack of guardianship. Locations that have a high convergence of these three factors are known as "hot spots". Figure 1 presents this relationship in the routine activities theory. This theory provides sufficient reason for campus policing since college students are often vulnerable targets and without a lack of guardianship, motivated offenders would be more plentiful since they would seize more opportunities to commit crime that exist in their daily routines.

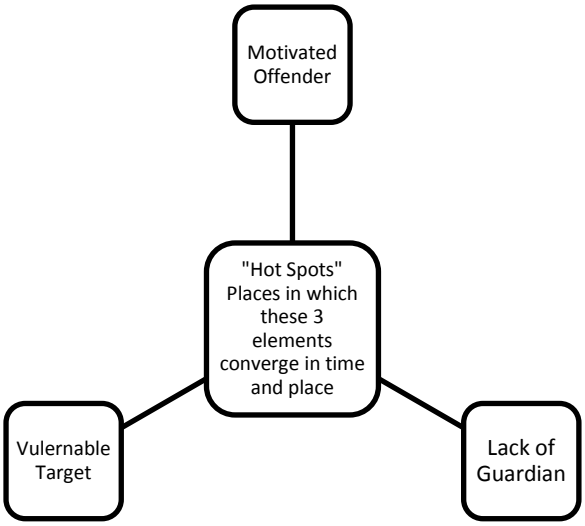

Figure 1: Routine Activities Theory (adapted from Tibbetts, p. 60, 2012)

The positive school perspective in criminological theory is that criminal behavior is the result of determinism, meaning that factors such as poverty, intelligence, early life experiences, and unemployment influence an individual's criminal behavior rather than rational decision making. One policy for college campuses stemming from this perspective is that crime awareness programs and college adjustment programs may be beneficial so

that students are aware of resources that are available to them (such as tutoring, career assistance, food bank programs, etc.), so that crime is prevented on a primary level.

Robert Sampson and John Laub (1993) proposed a developmental framework in criminological theory that emphasizes the importance of particular life events and life changes that impact an individual's decision to commit criminal activity. They strongly emphasize the salience of transitionary events such as marriage, employment, and military service in determining a person's criminal trajectory. Most importantly, they found that social structure factors such as poverty and family structure lead to problems in social and educational development, which in turn, impacts crime. Their research provides justification based on the social structure factors for why we would expect urban areas to have more crime than rural areas.

A recent contribution of the criminology literature to the understanding of crime is John Eck's application of the routine activity theory to policing. Eck (2003) emphasizes in his theory that police serve three roles: they handle offenders, guard targets/victims, and manage places. An increase in police does not necessarily mean that the police are utilizing the majority of their time to guard targets/victims and manage places; it could be that they spend a large amount of time engaging in administrative roles. Due to these multiple roles that police serve, the criminal justice literature provides the reasoning of why we might expect a positive or insignificant coefficient on the effect of police on crime.

Our policing variable in this study is the total number of law enforcement employees, total officers, and total civilians employed by the respective universities and colleges to deter crime. The criminal justice literature provides some essential observations about policing that serve to caution the reader when interpreting the policing elasticity of crime. First, police officers may be either deputies or patrol officers. If a university adds new police officers, they do not necessarily contribute to the deterrence efforts if their primary functions are administrative rather than patrolling. Another confounding factor is the overlapping jurisdictions of policing. When campuses have agreements with their local and state police forces, the policing variable for the campus may understate the degree of police presence on campus. For instance, a local police force adding officers will change the police elasticity of campus crime as long as the additional local officers contribute to the patrolling of the campus. Lastly, not all campus police officers are sworn officers (i.e. they have not taken an oath and do not have the power to arrest and detain individuals).

Data & empirical methodology

This paper utilizes data on known offenses that were obtained from the FBI's *Uniform Crime Report* (UCR). The sample contains 2,860 observations spanning from 2000 to 2010 for 260 colleges and universities. Two datasets were combined: one contained the crime levels[10] on each campus and the second dataset contained the number of law enforcement officers employed by the respective colleges and universities. All colleges and universities that reported to the Uniform Crime Reporting Program are included in the dataset as long as the following data were complete in the FBI database: 2000 – 2010 crime levels, enrollment levels, policing levels, and tuition levels.[11] UCR data is most useful for understanding trends in the data. However, in addition to non-reporting, the UCR data does have other limitations. For example, crimes of a sexual or violent nature tend to be underreported since universities have a vested interest in handling these crimes unofficially (Tibbetts, 2012). In addition, campus police departments are adept to the reporting process and may seek to maximize their government revenue by over-reporting particular crimes.

The measure of crime is aggregated to include both violent crime (murder and nonnegligent manslaughter, forcible rape, robbery, and aggravated assault) and property crime (burglary, larceny-theft, and motor vehicle theft) as reported by university/college law enforcement agencies that report data to the UCR Program. We model our regression specifications in terms of total crime levels; however, our results are robust to utilizing per capita crime and per capita police specifications as well.

To study the impact of policing on the campus crime level, we model our multivariate regression analysis utilizing a panel data approach with university-level fixed effects. Our empirical model (1) is as follows:

$$\ln(TotalCrimes_{it}) = \beta_0 + \beta_1 \ln(Police_{it}) + \beta_2 ln(Enrollment_{it}) + \beta_3 ComCollege_i + \beta_4 Residential_i + \beta_5 Urbanization_i + \beta_6 Region_i + \alpha_i + u_{it}$$

The police staff level variable, $Police_{it}$, represents the total number of law enforcement employees, total officers, and total civilians employed by the respective universities and colleges, i, in year t to deter crime. Our enrollment variable, $Enrollment_{it}$, takes into account both part-time and full-time students and include observations from four-year universities, junior

[10] We utilize crime levels rather than rates since the offenders on campuses are not limited to the student body. The per capita results (crime rates) are presented as a robustness check in the results section.

[11] All public universities and colleges are required to report crime data under the Clery Act. However, data are missing for some years for particular colleges. Illinois data is not included in our dataset due to multiple missing observations.

colleges, and health and medical centers. $ComCollege_i$ is a binary variable for whether the campus is a community college. The campus setting variable, $Residential_i$, is an indicator variable for whether the campus is primarily residential or primarily commuter. This measure is based upon the Carnegie Classification of Size and Setting where campuses are classified by the degree in which they are residential. Degree of urbanization, $Urbanization_i$, is based on urban-centric locale codes that were assigned through a methodology developed by the U.S. Census Bureau's Population Division. The locale codes identify the geographic status of a school on an urban continuum ranging from "large city" to "rural". In the first portion of our study, we define an urban setting to be one lying on the continuum between "suburb: midsize" to "city: large". Similarly, we define a rural setting to be one lying on the continuum between "rural: remote" to "town: fringe". $Region_i$ represents a vector of regional dummies for each of the U.S. Census regions. Institutional-level fixed effects, α_i, are also included in our specification.

We expect the coefficient on police to be negative since an increase in the police level should lead to a reduced tendency for more crimes to be committed in the student body. However, it is plausible that the coefficient on police could be positive or insignificant since an increase in the police force may be primarily utilized for activities other than crime prevention. Many factors in addition to policing affect the crime level on college campuses, including enrollment numbers, the degree of urbanization of the surrounding area, whether the campus is primarily residential or commuter, the structure of the college as either a community college or a four year, and crime reduction programs such as campus escort services.

The enrollment level and the crime level are hypothesized to have a positive relationship. Basic intuition tells us that as a campus becomes more populated, the crime level will increase given the increased opportunity to commit crimes. Nolan (2004) goes into detail about the effects of population growth on crime rates; his results show that there is indeed a positive relationship between higher populations and higher crime rates. His analysis of the 2000 UCR crime data for 1,294 cities with populations over 25,000 revealed a significant positive relationship between crime rate and population size, indicating that the higher populated cities reported the higher crime rates.

Another factor in determining campus crime levels and type is examining whether a campus is primarily residential or commuter. This factor is very important since on residential campuses students are on campus most of the time and with commuter campuses students do not stay on campus and commute to school on a daily basis. If a large portion of the student body lives on campus, then they have more time and greater

opportunity to commit campus crimes or be victims of crime, therefore raising the crime levels at the schools that are primarily residential. Since residential colleges typically have high amounts of campus housing, this brings in a larger level of crime that commuter colleges do not experience. For example, more personal property is brought onto residential campuses giving students more opportunity to commit crimes such as robbery, burglary, larceny/theft and property crimes. Students being around other students' property at all times and having access to other's living quarters provides opportunity for property crime. Another factor to consider with students living on campus is that daily activities such as showering, changing, and college partying occur which increases the chance of sexual assault crimes to rise compared to commuter schools. Therefore, we expect that residential campuses will have higher crime levels than their counterpart commuter campuses. Interestingly, the Chicago School in criminology defines a slum as an area exhibiting three characteristics: heterogeneity, poverty, and mobility. The criminal justice literature clearly shows that slum areas experience higher crime. A campus dormitory is similar to a slum in that it exhibits the same three characteristics in general. Students living in dorms are from various backgrounds (heterogeneity), may not have much income (poverty), and dorms have a high turnover rate in occupancy (mobility). While dorms are certainly not slums as most people consider the term, the similarity in these characteristics leads us to expect higher crime for residential campuses where a large portion of students live in dormitories.

We expect that urban areas will experience higher levels of campus crime than their rural counterparts due to the proximity to high levels of activity from surrounding areas and the larger population that has access to campus. In considering the levels and type of crime by urban setting, we use the entire urban continuum rather than identifying portions as "rural" and "urban".

When analyzing our estimates across regions, we utilize the U.S. Census Bureau's classification of four regions: Northeast, Midwest, South, and West. Studies from criminal justice indicate that community crimes are often higher in the South and West than in the Northeast and Midwest, so we expect this to be the case in our model of the determinants of campus crime (Tibbetts, p. 21, 2012). One plausible explanation for this result is that the poverty levels in the South and West are higher and this may be a driving force for the higher level of community crimes.

In order to correct for the problem of endogeneity (i.e. the simultaneous determination of policing and crime), we instrument the policing variable by utilizing a presidential dummy variable and a tuition level variable. The presidential dummy variable indicates whether the president of the institution changed in a given year. We hypothesize that a

presidential change impacts the amount of resources that are devoted to campus police and the subsequent hiring or firing of police employees as new budgets and priorities are proposed under new presidents. This hypothesis has been confirmed at the county level by Levitt successfully instrumenting his policing variable by the gubernatorial election year variable (Levitt, 1997). Our second instrument is the tuition level which is hypothesized to be related to the level of police on campus since an increase in tuition may allow the university more funds that can be allocated to the police staff. We expect our tuition instrument to be exogenous because tuition is not determined by a university in most cases, and is instead determined at the state level.

Summary statistics for our dependent variables (the measures of campus crime level), key independent variables, instrumental variables and per capita variables are provided in Table 1. The average number of crimes in our sample was 219.04 with 5.72 being violent crimes, on average. The average campus had 1.15 forcible rapes during a given year. We have 1,408 observations where no forcible rapes were committed on a given campus. Although this number may seem very small, it is important to recognize that reported forcible rapes do not take into account the sexual assaults that are not reported by the victims. A recent study done by the National Institute of Justice (2006) estimated that one-fifth to one-fourth of women in college are victims of sexual assault. The average campus in our sample experienced about 213 property crimes during a given year. The largest component of this was larceny/theft with a mean of 179.93 crimes.

We find that the average enrollment level for our sample was about 15,361 students. The average number of campus law enforcement officers employed was about 34.67. Our sample also includes 10% community colleges as we are interested in the difference between community colleges and four-year universities' crime levels. The presidential change dummy variable and the tuition variable instrument the endogenous police employees measure. The average tuition level for a university in a given year of our sample is approximately $19,885. We also find that 8% of our sample had presidential changes over the sample period.

It is also useful to report the per capita crime levels as well so that a judgment can be made as to how many crimes per student enrolled are committed. Table 1 also presents the per capita total crimes and per capita police employees. It indicates that the average college or university in our sample had 15 crimes per 1,000 students enrolled and about 3 law enforcement officers per 1,000 students enrolled. On average, there was 1 property crime for every 70 students and 1 violent crime for every 2,326 students.

Table 1: Descriptive Statistics

Variable	Mean (Standard Deviation)	Variable	Mean (Standard Deviation)
Total Crimes	219.04 (222.38)	**Enrollment**	15,360.6 (10,951.3)
Violent Crimes	5.72 (7.00)	**Total Police employees**	34.67 (28.62)
Murder	0.013 (0.120)	**Community College**	0.10 (0.30)
Rape	1.15 (1.73)	**Presidential Change**	0.08 (0.27)
Aggravated Assault	3.00 (4.14)	**Tuition**	19,885.14 (10,177.79)
Robbery	1.55 (2.96)	**Total Crimes per capita**	0.0147 (0.0111)
Property Crimes	212.65 (216.62)	**Violent Crimes per capita**	0.00043 (0.00058)
Burglary	25.43 (32.94)	**Property Crimes per capita**	0.0142 (0.01085)
Larceny/Theft	179.93 (185.39)	**Campus Police Employees per capita**	0.0026 (0.0019)
Motor Vehicle Theft	7.02 (12.11)		
Arson	1.02 (2.35)		

Since we are interested in the differences in policing by degree of urbanization and by campus setting, we conduct difference-in-mean tests to see if there is a statistical difference in our key variables by degree of urbanization and by campus setting. Our results are presented in Table 2 and we conclude that there are statistical differences in crime levels, enrollment levels, and policing between urban campuses and rural campuses as well as between campus settings. Namely, we find at the 1% level of significance that urban campuses have more crimes, a larger enrollment, and a larger campus police force than rural campuses. In considering campus settings, we find that residential campuses have higher crime levels and policing than commuter campuses, but residential campuses have enrollments that are lower than commuter campuses.

Table 2: Difference-in-Mean Test for Urbanization & Carnegie Campus Setting Classification

Variable	Urban Campuses	Rural Campuses	Difference-in-mean	T-stat
LN(CRIME)	5.085	4.543	0.542***	13.122
LN(ENROLL)	9.523	8.977	0.546***	18.406
LN(POLICE)	3.411	2.749	0.662***	20.918

*** indicates significance at the 1% level

Variable	Commuter Campus	Residential Campus	Difference-in-mean	t-Statistic
LN(CRIME)	4.761	5.185	-0.425***	12.036
LN(ENROLL)	9.457	9.323	0.134***	5.036
LN(POLICE)	3.146	3.383	-0.237***	8.305

Empirical results

Table 3 provides coefficient estimates of the instrumental variables fixed effects regression specification given by equation (1). All variables are statistically significant and of the expected sign. The policing variable was effectively instrumented in our model by the presidential change dummy variable and the tuition variable. The instruments were found to be strong and valid. The Sargan statistic indicates that our instruments are valid since we fail to reject the null hypothesis that the instrumental variables are uncorrelated with the residuals (p=0.4453). The F-statistic was also found to be approximately 34.81, displaying the strength of our instruments.

The coefficient of police indicates that an increase of police will have a highly significant inverse impact on the campus crime level.[12] For a 1% increase in the policing level, the number of crimes decreases by -1.405%. We can conclude at the 95% level of significance that the police elasticity of crime is elastic. That is, for a one percentage increase in total police employees, we can expect greater than a one percent decrease in the total amount of campus crimes. This finding has significant policy implications about police hiring at public universities. Our results become much stronger when we consider the effectiveness of policing by other characteristics. Campus police seem to be a larger deterrent for campus crime than community policing is a deterrent for community crimes. Previous literature on the effect of policing on community crimes finds an inelastic response—for a 10% increase in police, the crime rate decreases by 3% to 10% (Levitt, 2006).

The coefficient of enrollment indicates that an increase of enrollment will have a significant positive impact on the campus crime level. For a 1% increase in enrollment, the number of crimes increases by 0.29%. We find that community colleges have lower crime than the four-year college counterparts, residential colleges have higher crime levels than their non-residential counterparts, and urban colleges experience higher campus crime than their rural counterparts.

[12] When we utilize OLS, we find a positive sign for the coefficient on our policing variable that suggests that an increase in policing leads to an increase in crime. This shows the importance of instrumenting the policing variable.

Table 3: IV Regression Results for the Logarithm of Total Campus Crimes

Variable	IV estimation with university-level fixed effects
LN(POLICE)	-1.405 (0.179)***
LN(ENROLL)	0.290 (0.073)***
COMCOLLEGE	- 0.375 (0.138)***
RESIDENTIAL	2.527 (0.238)***
URBANIZATION	2.025 (0.164)***
CONSTANT	3.746 (0.462)***
N	2858
Absolute values of standard errors are in parentheses. An *, **, *, indicates significance at the 10%, 5%, and 1% level, respectively**	

We consider our results by campus setting in Table 4 utilizing the same approach as in the past table. We find that for a 1% increase in enrollment, the number of campus crimes increases by 0.759% in campuses that are primarily commuter campuses and increases by 1.717% in primarily residential campuses. This result suggests that the enrollment elasticity of crime is inelastic for commuter campuses, but highly elastic for residential campuses as intuition would suggest. More interestingly, for a 1% increase in the policing level, the number of campus crimes changes by – 0.734% in commuter campuses and – 2.772% in residential campuses. The policing elasticity of crime is highly elastic for residential campuses and policing is more effective in deterring crime in residential campuses.

Table 4: IV estimation with university fixed effects by Campus Setting

Variable	Primarily Commuter	Primarily Residential
LN(POLICE)	- 0.734 (0.249)***	- 2.772 (0.634)***
LN(ENROLL)	0.759 (0.134)***	1.717 (0.303)***
COMCOLLEGE	- 1.254 (0.185)***	- 1.953 (0.898)**
URBANIZATION	0.836 (0.185)***	2.007 (0.384)***
N	1528	1330

We find that the degree of urbanization is significant in our previous regression specifications, so in Table 5 we utilize a similar approach as in the regional analysis and analyze our results by degree of urbanization. We find that for a 1% increase in enrollment, the number of campus crimes increases

by 0.234% in cities, 0.473% in suburbs, 0.192% in towns, and 1.034% in rural campuses. Rural campuses have the highest enrollment elasticity of crime. For a 1% increase in the policing level, the number of campus crimes changes by – 0.931% in cities, - 1.021% in suburbs, - 0.286% in towns, and - 1.008% in rural campuses. The policing elasticities of crime are not statistically different for cities, suburbs, and rural areas.

Table 5: IV estimation with university fixed effects by Urbanization

Variable	City	Suburb	Town	Rural
LN(POLICE)	- 0.931 (0.186)***	- 1.021 (0.309)***	- 0.286 (0.191)*	- 1.008 (0.588)*
LN(ENROLL)	0.234 (0.082)***	0.473 (0.143)***	0.192 (0.370)	1.034 (0.311)***
COMCOLLEGE	- 4.764 (0.445)***	- 0.939 (0.839)	- 0.948 (1.827)	- 0.851 (0.355)**
RESIDENTIAL	- 4.450 (0.359)***	5.986 (1.10)***	5.212 (2.557)**	1.053 (0.369)***
N	1649	538	495	176

In Table 6, we estimate variation in crime by U.S. Census region. We find that for a 1% increase in enrollment, the number of crimes increases by 0.197% in the Northeast, 0.668% in the South, 0.513% in the Midwest, and 0.875% in the West. Our results for the enrollment elasticity of crime are significant at the 1% level for the South, Midwest and West but insignificant in the Northeast. The coefficient on police indicates that an increase of police will have a highly significant inverse impact on the campus crime level. For a 1% increase in the policing level, the number of crimes changes by - 1.933% in the Northeast, - 0.422% in the South, - 2.636% in the Midwest, and – 0.776% in the West. These results for the policing elasticity of crime are significant at the 1% level for the Northeast, Midwest, and West and significant at the 10% level for the South. These results suggest that policing is relatively more effective, on average, in the Northeast and Midwest than it is in the South and West. This raises policy questions that can be further investigated. For instance, the investment in policing in the Northeast and Midwest may be generating a greater return since the responsiveness is elastic, whereas, the investment in policing in the South and West is currently generating a lower return since the responsiveness is lower. The South and West may be best to invest in other forms of crime deterrence such as Campus Escort services and crime prevention awareness programs, assuming that the resources and given police technologies are the same across universities. It may be that the South and West should invest more in

their policing resources in order to increase the policing responsiveness to levels similar to the Northeast and Midwest where it is elastic.[13]

Table 6: IV estimation with university fixed effects By Census Region:

Variable	Northeast	South	Midwest	West
LN(POLICE)	- 1.933 (0.638)***	- 0.422 (0.232)*	- 2.636 (0.786)***	- 0.776 (0.292)***
LN(ENROLL)	0.197 (0.272)	0.668 (0.143)***	0.513 (0.104)***	0.875 (0.170)***
COMCOLLEGE	- 3.292 (0.505)***	- 0.980 (0.175)***	- 0.346 (2.917)	- 1.062 (0.223)***
RESIDENTIAL	1.867 (0.582)***	0.659 (0.126)***	5.212 (2.557)**	0.894 (0.164)***
URBANIZATION	10.094 (1.717)***	0.606 (0.174)***	7.779 (1.365)***	0.748 (0.203)***
N	418	1296	484	660

In each of our regression specifications throughout Tables 4-6, we find that community colleges have a lower level of crime than their four-year counterparts. The equality of coefficients across equations was tested and all of the differences in our coefficients by specification are significant at the 1% level. For instance, the difference between our coefficients of the policing elasticity of crime in the Northeast and South were tested and found to have a significant difference at the 1% level. Our results have shown how both the enrollment elasticity of crime and the policing elasticity of crime vary by regions, by degree of urbanization, and by campus setting.

Robustness Checks

We also utilize the Arellano-Bond dynamic panel GMM estimator to cope with several potential econometric problems: the simultaneous causality leading the endogenous regressor to be correlated with the error term; the time invariant institutional characteristics may be correlated with the error term; the autocorrelation that results from properly taking into account the crime level in the previous period; and the small time dimension and larger institutional dimension.

Our base specification econometric model including a lag of the total crime level leads to several econometric problems in estimation. First, the policing variable, $Police_{it}$, is endogenous because causality may run in both directions leading the regressors to be correlated with the error term. The time invariant institutional characteristics (fixed effects) may be correlated with the explanatory variables. The fixed effects are contained in the error

[13] It is not necessarily the effectiveness of police that is driving this result. Other regional and cultural factors likely have an influence as well. For instance, campuses in the Northeast are usually older and smaller than their counterparts elsewhere.

term in the equation, which consists of unobserved institution-specific effects, v_i, and the observation-specific errors, e_{it}:

$$u_{it} = v_i + e_{it} \quad (2)$$

Another problem in estimating the equation is that the presence of the lagged dependent variable gives rise to autocorrelation. Lastly, the panel dataset has a short time dimension (T=11) and a larger institution dimension (N=260).

In order to solve the first problem, we first utilized fixed-effects instrumental variables estimation (two-stage least squares). Our instruments, the presidential dummy variable and the tuition level, were found to be exogenous and strong. However, the strength of the instruments can always be improved since weak instruments cause the fixed-effects IV estimators to be likely biased in the way of the OLS estimators. In order to increase the strength of the instruments and thereby minimize the biasedness of the estimators, we utilize the Arellano-Bond (1991) difference GMM estimator first proposed by Holtz-Eakin, Newey & Rosen (1988). Instead of using only the exogenous instruments—the presidential dummy variable and the tuition level—we utilize the lagged levels of the endogenous regressors. This makes the endogenous variables pre-determined and, therefore, uncorrelated with the error term.

In order to cope with the second problem (fixed effects), the difference GMM uses first-differences to transform the equation. By transforming the regressors by first differencing, the fixed institutional-specific effect is removed, because it does not vary with time.

The first differenced lagged dependent variable is also instrumented with its past levels in the Arellano-Bond dynamic panel specification. Lastly, the Arellano-Bond estimator was designed for when the panel dataset has a short time dimension and a larger institution dimension (small-T large-N panels). In small-T panels a shock to the university's fixed effect, which shows in the error term, will not decline with time. Similarly, the correlation of the lagged dependent variable with the error term will be significant. In these cases, the Arellano-Bond estimator is preferred over the fixed-effects IV estimators.

We present our results utilizing the Arellano-Bond dynamic panel generalized method of moments estimator in Table 7. All of our coefficient estimations are significant at the 1% level in this specification. We find that a 1% increase in crimes in the previous period persists into the current period and leads to a 0.381% increase in crimes in the current period. The policing elasticity of crime is – 1.484% and the enrollment elasticity of crime is 0.146%. These results are very similar to what we found in Table 3 utilizing instrumental variables estimation with university-level fixed effects.

Table 7: Regression Results for Total Campus Crimes

Variable	Arellano-Bond Dynamic Panel GMM Estimator
LN(LAGCRIME)	0.381 (0.039)***
LN(POLICE)	-1.484 (0.389)***
LN(ENROLL)	0.146 (0.038)***
CONSTANT	4.870 (0.437)***
INSTRUMENTS	50 INSTRUMENTS
N	2337

As an additional robustness check, we utilize per capita crimes as the dependent variable and a per capita policing variable as the independent variable. However, we prefer the total crimes specification rather than modeling per capita level since the population at risk isn't strictly limited to students. Nevertheless, all of our coefficient estimations are significant at the 1% level in the per capita specification. We find that a 1% increase in per-capita crimes in the previous period persists into the current period and leads to a 0.564% increase in per-capita crimes in the current period. The policing elasticity of per-capita crime is – 0.57%.

Conclusion

This paper examined some of the determinants of campus crime, namely: enrollment levels, police staffing, degree of urbanization, and campus setting. This paper has expanded on the relevant literature by using an updated, national dataset that previous studies have not. Further research and policy implications can be drawn from this research study.

We found that policing is relatively more effective, on average, in the Northeast and Midwest than it is in the South and West. This carries the policy implication that campuses in the Northeast and Midwest may be best to increase their campus police force since the responsiveness is elastic, whereas, the South and Midwest may be best to invest in other forms of crime deterrence such as Campus Escort services and crime prevention awareness programs. However, clearly this area needs more investigation through fieldwork and survey research to generate a definitive policy conclusion. Furthermore, we find that the enrollment elasticity of crime is inelastic for commuter campuses, but highly elastic for residential campuses as intuition would suggest. Lastly, we found that the policing elasticity of crime is highly elastic for residential campuses and policing is more effective in deterring crime in residential campuses.

Endogeneity was a problem in our model that we mitigated by instrumenting the police variable with the presidential dummy variable as well as the tuition level. We found that these instruments are successful in instrumenting the police variable. The Arellano-Bond specification served as a robustness check for our results. We find a negative impact of police on crime even after taking into consideration the level of police in the prior period. It may be that economists have neglected to consider the reasons for a positive coefficient on policing; however, our results demonstrate that policing clearly reduces campus crime. Police may have other duties than crime prevention and this specification helps to account for this critique of the criminal justice literature on the economic approach by including the level of police in the prior period.

There are four possibilities when a crime is committed on campus: both the perpetrator and victim are students; both the perpetrator and victim are non-students; the perpetrator is a student and the victim is not a student; or the perpetrator is not a student and the victim is a student. One assumption made in our analysis was that police presence will affect each victim-perpetrator dyad equally. We recognize that criminological theory asserts that police presence will not affect each dyad equally. It would be interesting to compute the policing elasticity of campus crime for each of the dyads if such data were available.

This paper has aided the current literature in criminal justice, higher education, and public policy by providing the first study considering campus crime elasticities by region, by degree of urbanization, and by campus setting. The nationwide campus policing elasticity suggests that a 10% increase in the campus police force would lead to a 10.5% to 17.6% decrease in campus crime. The impact of the campus police force on campus crime is elastic, whereas, other studies have found that the impact of community policing on community crime is relatively inelastic (producing only a 3% to 10% decrease in community crime for every 10% increase in policing). The results of this study may be used by policymakers to determine the potential effectiveness that allocating additional revenues to hiring a larger police force may have based upon the campus setting, region, and urbanization.

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