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THESIS

BRAC AND CRIME: EXAMINING THE EFFECTS OF AN INSTALLATION'S CLOSURE ON LOCAL CRIME

by

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The decision to close a military base can generate both positive and negative effects on the local community. While research exists on the positive effects of Base Realignment and Closure (BRAC), such as the increase in federal funding or land reclamation, my thesis examines the effects a closure has on a community's crime rate. Using a difference-in-differences estimation strategy, I examine the differences in crime rates before and after a city had a BRAC relative to comparable control cities without such closures. First, I find significant declines in crime rates due to BRAC, for both property and violent crimes. Crime rates fall faster in BRAC cities compared to cities that do not experience a BRAC. Second, property crimes appear to fall faster than violent crimes due to a BRAC. Third, demographic and economic variables also have significant effects on particular types of property and violent crime.

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BRAC AND CRIME: EXAMINING THE EFFECTS OF AN INSTALLATION'S CLOSURE ON LOCAL CRIME

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ABSTRACT

The decision to close a military base can generate both positive and negative effects on the local community. While research exists on the positive effects of Base Realignment and Closure (BRAC), such as the increase in federal funding or land reclamation, my thesis examines the effects a closure has on a community's crime rate. Using a difference-in-differences estimation strategy, I examine the differences in crime rates before and after a city had a BRAC relative to comparable control cities without such closures. First, I find significant declines in crime rates due to BRAC, for both property and violent crimes. Crime rates fall faster in BRAC cities compared to cities that do not experience a BRAC. Second, property crimes appear to fall faster than violent crimes due to a BRAC. Third, demographic and economic variables also have significant effects on particular types of property and violent crime.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACS	American Community Survey
AFF	American Fact Finder
BLS	Bureau of Labor Statistics
BJS	Bureau of Justice Statistics
BRAC	Base Realignment and Closure
CJIS	Criminal Justice Information Services
CPI	Consumer Price Index
DD	Difference-in-Differences
DOD	Department of Defense
DOJ	Department of Justice
FBI	Federal Bureau of Investigation
FIPS	Federal Industry Processing Standard
GAO	Government Accounting Office
GDP	Gross Domestic Product
IACP	International Association of Chiefs of Police
LEMAS	Law Enforcement Management and Administrative Survey
MSA	Metropolitan Statistical Area
NBER	National Bureau of Economic Research
NCVS	National Crime Victimization Survey
NSA	National Sherriff's Association
OEA	Office of Economic Adjustment
OLS	Ordinary Least Squares
OSD	Office of Secretary of Defense
PEP	Population Estimate Program
REO	Real Estate Owned
RPAD	Real Property Assets Database
SASC	Senate Armed Services Committee
SAT	Substance Abuse Treatment Center
SECDEF	Secretary of Defense
UCR	Uniform Crime Report
USCB	United States Census Bureau

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I. INTRODUCTION

Military bases and installations are scattered throughout the United States, some deeply imbedded in their local communities. These military installations often contribute to the local economy through the transfer of federal dollars. In her article on the military's impact on state economies, Jennifer Schultz (2017) wrote, "According to an analysis by the DOD Office of Economic Adjustment (OEA), the department spent $408 billion on payroll and contracts in fiscal year 2015, approximately 2.3 percent of U.S. gross domestic product (GDP). Spending was highest in Virginia, followed by California, Texas, Maryland and Florida" (p. 1). While there may be positive economic benefits to having a military base, there could be negative effects on the local community as well.

The decision to close bases originates with the Base Realignment and Closure Commission (BRAC). The 2005 BRAC was the most recent round of base closures. While other rounds focused primarily on closure, the 2005 round of closure placed an emphasis on realignment of military forces, in order to meet the changes in the national security environment (Gonzales, 2009). Nevertheless, communities should be concerned about the potential for lost employment or income that is associated with military bases. Gonzales (2009) goes on to warn of the economic vulnerability associated with lost jobs from BRAC. This cost relies on how fast new jobs can be found and new opportunities for employment at the closed military installation (Gonzales, 2009). Ultimately, there are positives and negatives associated with the BRAC process. To date, however, there has been little systematic study of the effects of a military base closure on the extent of criminal activity in the local community. This thesis fills this gap in the literature.

A. PURPOSE OF STUDY

The purpose of my study is to estimate the effects of BRAC on crime. Using the bases closed from the most recent round of BRAC, I provide further

insight as to the economic costs shouldered by a community when a military base ceases activity. Further, I consider the possibility of a military base providing a deterrent effect on crime, and the implications of its removal.

B. SCOPE AND LIMITATIONS

For this study I utilize data from the 2005 round of base closures. The 4 previous rounds and their respective bases were excluded. Additionally, the time series for this thesis ranges from 2000–2014. Thus, the effects of BRAC on crime can only be estimated out to 10 years. This represents a significant limitation as to the effects BRAC has on the local crime rate. I also take into consideration the 20-year decline of crime in this country. Thus, the historical trend for all crime is downward sloping. This study also focuses on closure only; bases that saw military forces realigned or actually expanded under the 2005 BRAC were omitted.

C. METHODOLOGY

I examined annual crime data obtained from the uniform crime report (UCR) over the time period 2000–2014. This series encompasses the most recent BRAC authorized by Congress in 2005. Installations recommended for closure by the office of secretary of defense (OSD) began the deactivation cycle in 2005 and ended in 2014. This time series data encompasses all services affected by BRAC; it is not department specific. The level of criminal data from the Federal Bureau of Investigation (FBI) also matched population ranges of the cities where an installation closed. I did not utilize criminal data from metropolitan statistical areas (MSA) and population ranges below 25,000, as they are too small. Criminal data from the UCR are in nine distinct categories ranging from violent crime and property crime as ranked by the FBI. These crimes include: murder/manslaughter, rape, robbery, aggravated assault, burglary, larceny, and vehicle theft. To account for differences in population across cities, I analyze per capita crime rates, that is, total crimes reported per 100,000 population.

Using these data, I estimate the effects of BRAC on crime using a difference-in-differences empirical framework. This strategy mimics an

experimental research design, where changes in crime in cities that had a BRAC are compared to similar control cities. I begin with an ordinary least squares (OLS) baseline regression to estimate the difference-in-difference (DD) estimator. I then add to this model independent variables that represent social and demographic characteristics of a city that the academic literature reviewed notes are important predictors of crime. These variables include: unemployment rates, demographics, and law enforcement manning. Finally, my third model adds city-level fixed effects with the same controls used in the second. A Hausman test indicates that the fixed effects model is appropriate, and these fixed effects control for all other unobservable time-invariant differences across cities that had a BRAC and did not, that is correlated with crime.

The first outcome I examine is the effect of BRAC on property crime (*P_100k*). Property crime encompasses all crimes against property, to include burglary, theft, and larceny. I also examine effects on violent crime (*V_100k*). Violent crime includes crimes such as homicide, assault, and robbery. Finally, to gain further understanding of the effects of BRAC on crime, I use the crime, larceny, for a particular type of property crime, and the crime, robbery, for a particular type of violent crime.

D. FINDINGS

Table 1 describes the independent variables I used in my analyses.

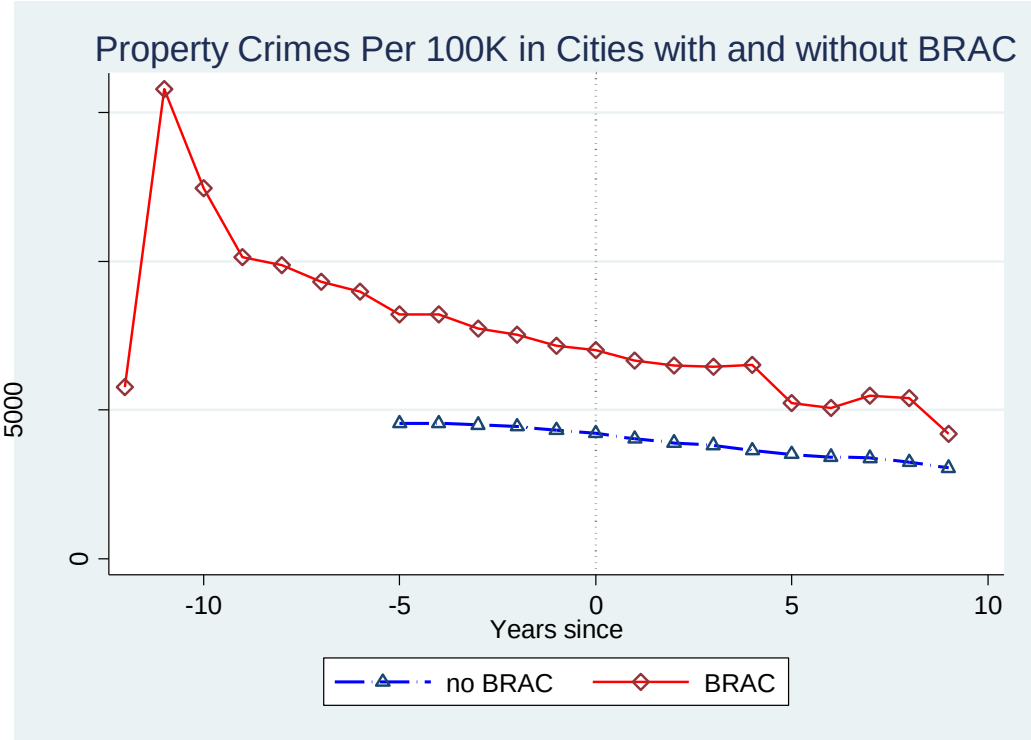
Table 1. Description of Independent Variables

Independent Variable	Description
Time	Time series for the years 2000–2014
Police_Lag	Police manpower lagged one year
Bud_Lag	Police Department operating budget lagged one year
Unemp	Unemployment rate
V_18_34	Average number of veterans between the ages of 18–34
Lnwa_male	Percent of the population that is White male
Lnbl_male	Percent of the population that is Black male
Lnh_male	Percent of the population that is Hispanic male
Lnaa_male	Percent of the population that is Asian male

The fixed effects estimates provide the most robust and significant findings of the effect of BRAC on crime. The DD estimate shows that crime falls significantly faster, especially 5 years after a BRAC, in cities with a base closure compared to those without. Social and demographic variables are also statistically significant in predicting crime, in a way that is consistent with the literature. These are: veteran population, unemployment, White males, Black males, Hispanic males, and Asian males. I now discuss the effects for each crime separately.

1. Property Crime

For property crime, the DD estimate shows a reduction in property crimes by 2,207 offenses per 100,000 in cities that experienced a closure each year compared to those that did not. The coefficient for unemployment shows property crime increase by 130.97 per 100,000 for every one percentage point increase each year in unemployment. This differs from the coefficient, *V_18_34*, which shows a decrease in property crime by 223 per 100,000. The sudden increase 10 years prior to closure reflects the peak of violent crime in 1991, which has consistently fallen ever since. Figure 1 displays the differences in both the treatment (cities that had a closure) and control groups (cities that did not).



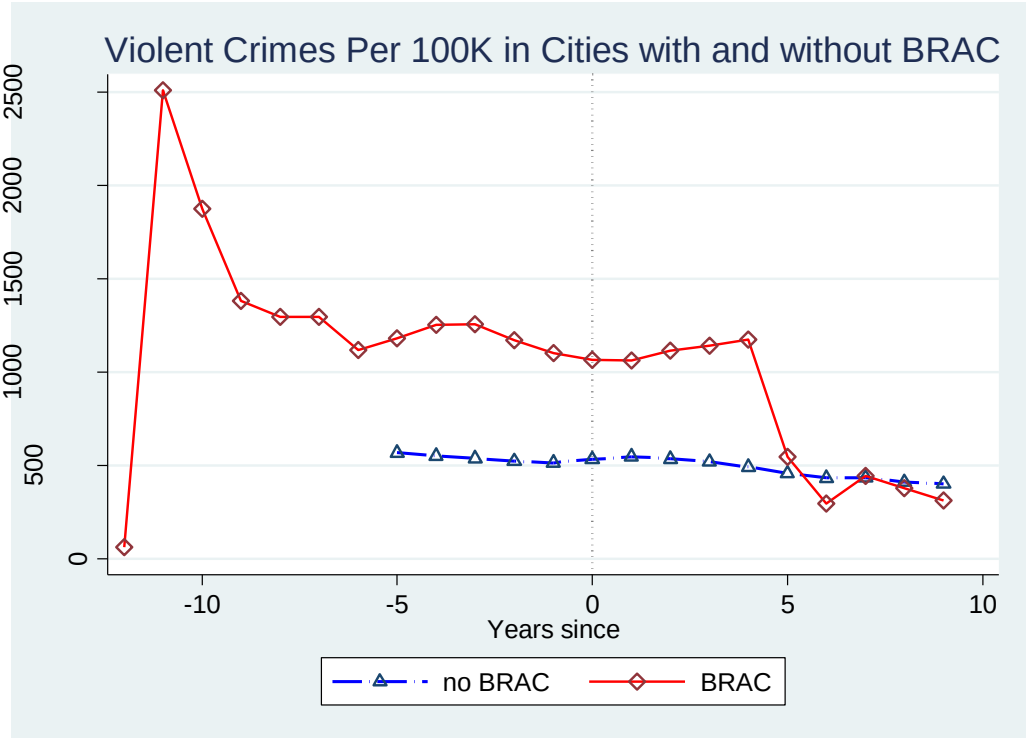
Data collection is detailed in Chapter IV.

Figure 1. Property Crimes in Treatment and Control Groups Post-Closure.

2. Violent Crime

For violent crime, the DD estimator shows a reduction in violent crime by 126.92 offenses, on average, in cities with a base closure when compared to those without. This represents a 25% reduction when compared to the mean. The coefficient, *Unemp*, shows that violent crime increases by 24.83 per 100,000 with every one percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that violent crime decreases by 44.37 per 100,000 with every veteran aged 18 to 34 in the population. The coefficient, *lnwa_male,* shows that a 1% increase in white males is associated with an increase of violent crime by 381.84 per 100,000. The coefficient, *lnba_male,* also shows that a 1% increase in black males results in an increase of violent crime by 247.41 per 100,000. These coefficients contrast with the coefficient, *lnh_male,* which showed that a 1% increase in Hispanic males results in a decrease of

violent crime by 272.72 per 100,000. Figure 2 displays the differences in both the treatment and control groups.

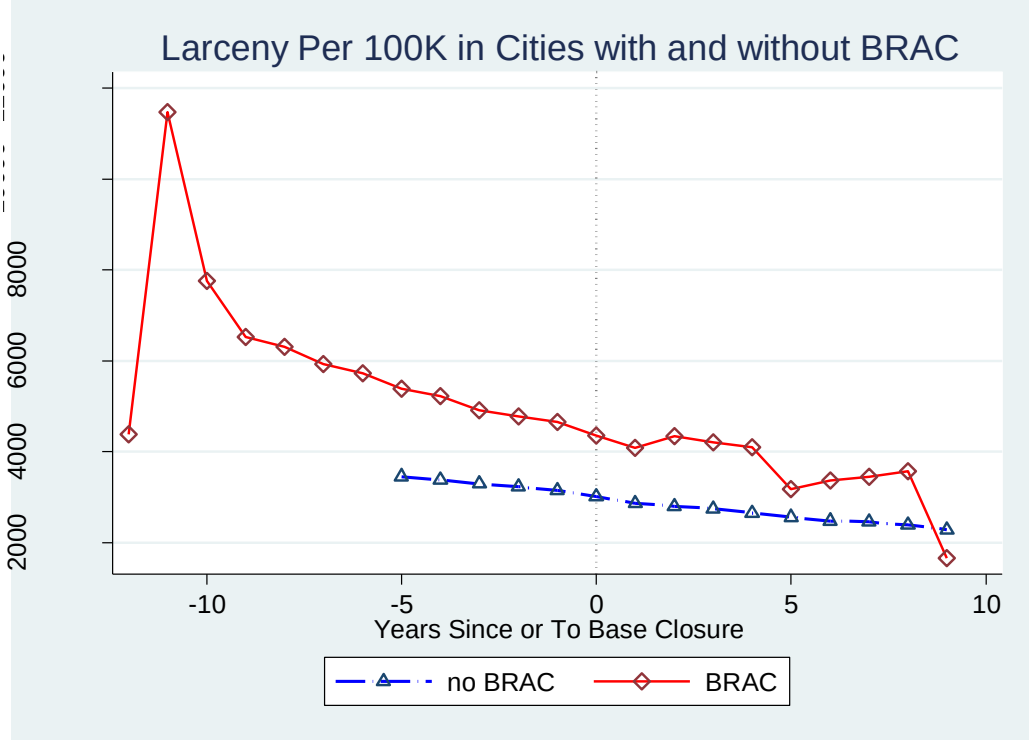


Data collection is detailed in Chapter IV.

Figure 2. Violent Crimes in Treatment and Control Groups Post-Closure.

3. Larceny

The DD estimator shows a decrease of 1623.34 larcenies, on average, per 100,000 in cities after a base closure, relative to comparison cities. This contrasts with the coefficient, *V_18_34,* which shows that larceny decreases by 159.43 per 100,000. The coefficient, *lnba*_male, shows that a 1% increase in black males is associated with a decrease in larcenies of 526.72 per 100,000. The coefficient, *lnaa_male,* which showed that a 1% increase in Asian males is associated with a decrease of larcenies by 741.33 per 100,000. Figure 3 displays the differences in both the treatment and control groups.



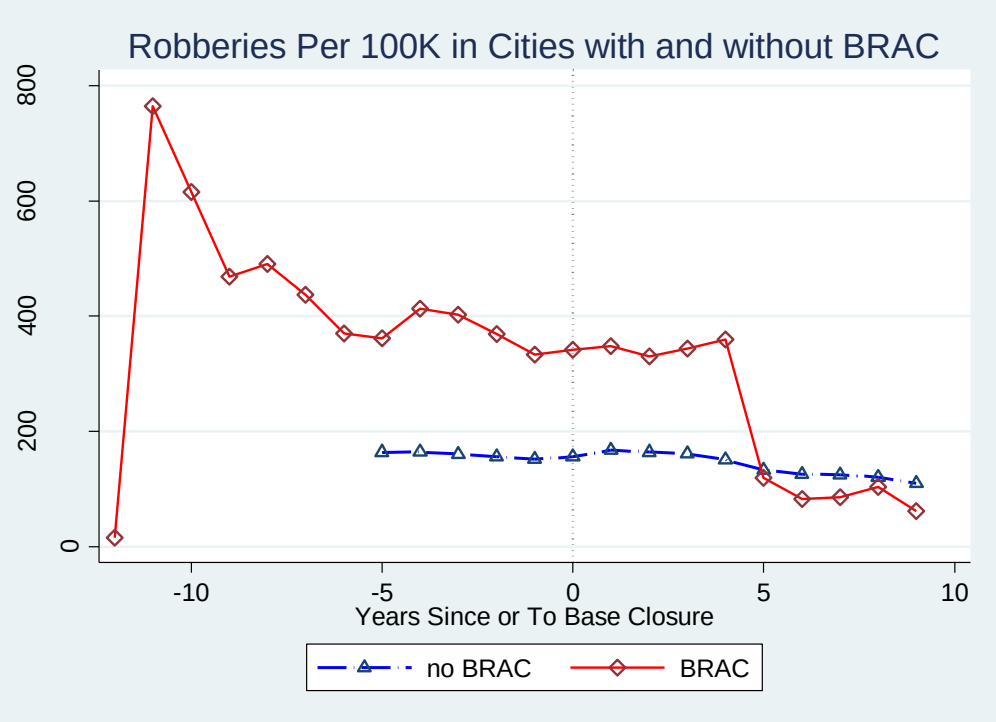
Data collection is detailed in Chapter IV.

Figure 3. Larceny in Treatment and Control Group Post-Closure.

4. Robbery

The DD estimator shows a decrease of 56.47 robberies, on average, per 100,000 in cities after a base closure, relative to comparison cities. The economic conditions and demographics prove to be statistically significant, as well, similar to previous results. The coefficient, *Unemp*, shows that robbery increases by 9.18 per 100,000 with every 1 percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that robbery decreases by 16.95 per 100,000 with every veteran. The coefficient, *lnwa_male,* shows that a 1% increase in white males is associated with an increase of robberies by 210.11 per 100,000. The coefficient, *lnba*_male, shows that a 1% increase in black males results in an increase of 139.27 per 100,000. These coefficients contrast with the coefficient, *lnh_male,* which showed that a 1% increase in Hispanic males is associated with a decrease of robberies by

140.52 per 100,000. Figure 4 displays the differences in both the treatment and control groups.



Data collection is detailed in Chapter IV.

Figure 4. Robberies in Treatment and Control Group Post-Closure.

E. OVERVIEW OF CHAPTERS

The rest of this thesis is organized in the following. Chapter II provides critical background information on the BRAC process. Chapter III critically reviews related literature on the economics of crime. Chapter IV describes the data utilized for this study and the methodology utilized for analysis. Chapter V discusses the findings from estimates of the models described in Chapter IV. Chapter VI summarizes and details conclusion from this study, the limitations encountered from the research, and recommendations for further research related to this subject.

II. BACKGROUND INFORMATION

A. FORCE STRUCTURE PLANNING

The establishment of a military installation is the result of implementing national security strategy (NSS), congressional brokering, and finding the right balance given constrained resources. For an installation to exist, it must be tied to a military objective, reinforcing the NSS. Legislators, aware of the possible jobs that an installation can bring to their district, lobby for their constituency. Additionally, they provide the authorization and subsequent appropriation of federal funds to those installations.

While it is true both the military and the community can benefit from the establishment of an installation, the military's decision-making criteria is not based on economic benefits to the area. For example, no consideration to a community's crime rate is given as selection criteria. Installations can be designed to support a service specific function or for the execution of joint operations. The process to commission a new installation is called force structure planning.

Force structure encompasses infrastructure, manpower, systems, and processes that the Department of Defense (DOD) uses to generate combat power or a war fighting function in accordance with the NSS objectives. Entire installations can organize by function, whether it is training, equipment, maintenance, etc. (Sorenson, 1998). The DOD typically plans out for a period of 20 years to match threats identified and capabilities required to meet strategic objectives. In essence, the DOD must tell Congress how it intends to spend its appropriations. Plans for additional capabilities (such as manpower and infrastructure) or future are submitted as part of this plan as well. In 2005, in accordance with Public Law 101–510, the DOD submitted unclassified force structure plans to the BRAC commission for fiscal years 2005, 2007, 2009, and 2011 (Defense Base Closure and Realignment Commission [BRAC], 2005).

These plans aided the BRAC members in their duties given their organization's selection criteria.

B. BASE REALIGNMENT AND CLOSURE

The BRAC commission governs the closure or realignment of military installations. The United States traditionally experiences difficulties in the closing of military bases to match the requirements of downsized forces with a changed composition (Lockwood, Siehl, & Holman, 2003). Congress appoints the BRAC commission members. This commission works with the secretary of defense and the president of the United States to reduce DOD real estate holdings to meet current force requirements. Congress votes on the final recommendations endorsed by the president.

Five BRAC commissions submitted recommendations for closure since the 1980s and the collapse of the Soviet Union. On October 24, 1988, Congress passed P.L. 100–526, Defense Authorization Amendments and Base Closure and Realignment Act, which codified the process for the OSD to formally close or realign defense structure (Defense Authorization Amendment and Base Closure and Realignment Act, 1988). Congress refined the BRAC commission process in P.L. 101–510, on November 5, 1990 (National Defense Authorization Act [NDAA] FY1991, 1990). The latter switched the appointment of the BRAC commission officials from the secretary of defense to the president. According to Lockwood et al. (2003), "the BRAC commissions would operate from 1988 to 1995, after which the commission's authority would end" (p. 2). P L. 101–510's language gave the commission specific guidelines as opposed to the verbiage of the previous legislation. Rather than a "one shot deal," the law specified BRAC closings to occur in 1991, 1993, and 1995. (Goren, 2003).

1. The BRAC Process

Under federal law, the BRAC commission follows a process that begins with the secretary of defense. The secretary of defense makes the initial recommendations for closure and/or realignment of DOD real estate related to

operational requirements. BRAC committee members receive the secretary's recommendations. Lockwood et al., (2003) wrote, "upon receipt of the recommendations, the commission could, and often would, add or otherwise delete from the secretary's original list" (p. 4).

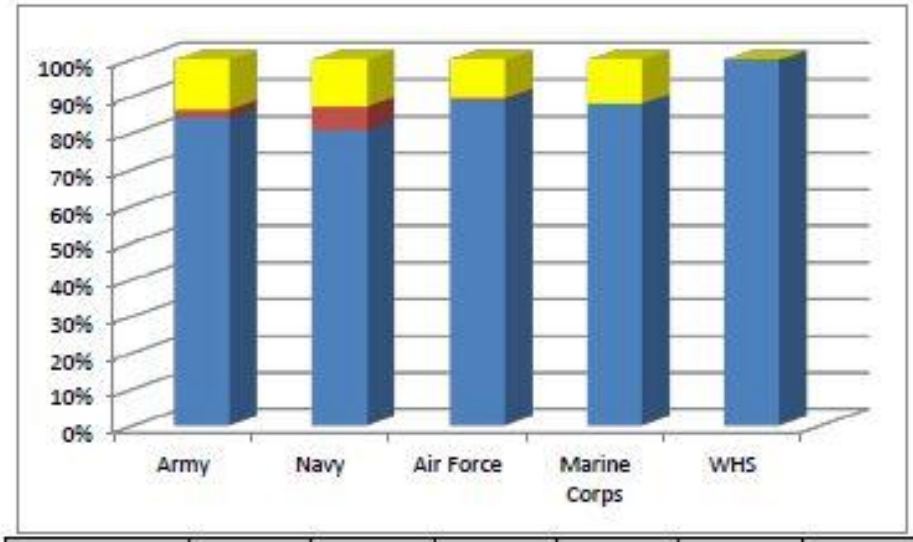
The president reserves the right to make any changes to the commission's list. The laws allowed the president to reject the list outright, thus terminating the BRAC closure for that given year without ever reaching Congress. Lockwood et al., (2003) wrote, "after the presidential review process, Congress is allowed a period of 46 days to pass a joint resolution of disapproval on the finalized list. Failure to pass a joint resolution within that time period results in the BRAC recommendations to automatically go into effect" (p. 4). The authority to execute the BRAC commission's recommendations lay with the secretary of defense.

2. Force Distribution and Benefits

The Government Accountability Office (GAO) stresses that a base's closure does not always equate to a large swath of land. In their 1998 status report on closure activity to Congressman John E. Sununu, the GAO emphasized installation diversity. Bases include a base, camp, post, station, yard, center, port, or a leased facility. These facilities range from a few acres to the hundreds of thousands in terms of space (GAO, 1998). The DOD formally defines an installation as "A military base, camp, post, station, yard, center, homeport facility for any ship, or other activity under the jurisdiction of the department of defense, including leased space, that is controlled by, or primarily supports DOD's activities" (DOD, 2014).

The DOD maintains management of its property using the real property assets database (RPAD). The DOD's FY15 baseline report (2014) states, "Even with these reductions, DOD is still one of the federal government's larger holder of real estate managing a global real property portfolio that consists of nearly 562,000 facilities (buildings, structures, and linear structures), located on over

4,800 sites worldwide and covering over 24.9 million acres" (p. 3). Figure 5 shows the distribution among geographic location and departments.



Area	Army	Navy	Air Force	Marine Corps	WHS	Total
United States	1,562	803	1,535	160	94	4,154
Territories	41	64	9	0	0	114
Overseas	255	128	182	22	0	587
DoD Total	1,858	995	1,726	182	94	4,855

Figure 5. Number of DOD Sites by Service/Agency in FY2015.
Source: DOD (2014).

Lockwood et al., (2003) stated, "two important aspects of analyzing costs and savings are associated with the BRAC closure process. The first relates to the time involved in the closure process while the second is related to the overall accuracy of the data utilized to estimate cost savings. With respect to time, the costs tend to be higher at the beginning and slowly decrease overtime" (p. 28). The data utilized to project the initial cost savings associated with each installation's closure change as information becomes available. Recalculations of original baseline figures increase costs and constrain planners.

3. 2005 BRAC Round

The decision to execute another round of BRAC occurred in 2001 (Lockwood et al., 2003). Previous attempts by Secretary of Defense William Cohen failed in Congress. Secretary Cohen's successor, Donald Rumsfeld, renewed efforts in Congress for another round of BRAC to occur in 2003, but eventually gained sufficient approval for 2005.

On February 27, 2001, the Senate introduced bill S.397, calling for the authorization of two additional rounds of BRAC to begin in 2003 and again in 2005 (Lockwood et al., 2003). Defense watchdog organizations championed the bill as a cost saving measure similar to the four previous BRAC commissions in the 1990s. The issue arose again in August 2001, when the secretary of defense provided his recommendations to Congress predicated on the passage of the bill. Secretary Rumsfeld requested only one round of BRAC vice two.

The Senate Armed Services Committee (SASC) debated the requests in a closed session, approving a new round of closures. The House of Representatives debated the language of the bill with a vote on December 13, 2001. The president signed the new bill into law on December 28, 2001 (NDAA FY2002, 2001). Table 2 outlines the timeline for the 2005 BRAC process.

Table 2. 2005 BRAC Timeline. Source: Lockwood et al. (2003).

SecDef sends initial selection criteria to defense committees	31-Dec-03
SecDef sends final selection criteria to defense committees, publishes criteria in federal register	16-Feb-04
Criteria final, unless disapproved by Act of Congress	15-Mar-04
President forms new BRAC Commission; sends nominees to Senate	15-Mar-05
SecDef sends closure/realignment list to Commission and defense committees	16-May-05
GAO reviews DOD's list, reports findings to President and defense committees	1-Jul-05
Commission sends its findings and recommendations to the President	8-Sep-05
President reviews SecDef's and Commission's list of recommendations	23-Sep-05
Commission may submit revised list in response to President's review	20-Oct-05
President certifies closure/realignment list (or process is terminated)	7-Nov-05
Work of closure/realignment Commission must be terminated	15-Apr-06

The information presented in this chapter provides the background on the DOD's force structure planning processes and the history of the most recent BRAC round. Real property owned and operated by the DOD supports national security objectives set forth in the NSS. These objectives chang with administrations and the security climate. The changing composition of the nation's Armed Forces resulted in a series of base closures and realignments. The most recent BRAC stemmed from planning in 2001 with congressional and presidential certification of the commission's list in November 2005.

III. LITERATURE REVIEW

In this chapter I provide a brief overview of the literature on the economics of crime, with an eye towards how military base closures may affect crime and the key variables correlated with crime.

In the economics of crime literature, researchers studied the relationship between the benefits and costs of crime, and how the economic conditions of the community determine crime. Of the many economic variables considered for the model explaining the community's ability to deter crime, none have estimated the direct effects of a military installation's closure.

A. PARTICIPATION IN ILLEGITIMATE ACTIVITIES

A review of relevant academic literature begins with the seminal economic model on crime developed by Nobel Laureate, Gary Becker. Becker's model lays out the relationship between crime and deterrence. In particular, Becker identifies that the optimal amount of law enforcement correlates with arrest expenditures, the nature of punishment, and the responses created by the actions of law enforcement (Becker, 1968).

In the framework set out by Becker (1968), "individuals make the decision to become criminals, when the expected utility to him exceeds the utility gained from legitimate means" (p. 177). Becker argues crime is economically important. Criminal activity encompasses more than traditional notions of crime, including white-collar crimes and crimes against property. While Becker's work is mostly theoretical, subsequent studies are analytical in their attempt to understand criminal behavior (Bushway & Reuter, 2008).

Ehrlich (1972) advances Becker's model by incorporating the costs and gains from legitimate and illegitimate activities rather than the cost of punishment alone. He attempts to identify behavioral characteristics of individuals who engage in illegitimate activities and the economic gains, if any, of a measurable law enforcement response. By specifying and estimating an econometric model

that relates crime to law enforcement approaches, Ehrlich provides a tentative estimate of law enforcement's effectiveness in deterring crime and the reduction of social loss from criminal activity (Ehrlich, 1972).

Both Ehrlich and Becker highlight that when the expected utility of illegitimate activities outweigh the expected utility from legal activities, rational individuals choose illegitimate activities, increasing the social loss felt by the community. Ehrlich hypothesized that as long as legal and illegal activities remain mutually exclusive, the individual would make their choice based on the greater utility of the two (Ehrlich, 1972). Ehrlich's analysis placed greater emphasis on an individual making a rational choice to engage in illegitimate activities than the moral legitimacy associated with the decision.

Ehrlich also examines recidivism or an individual's propensity to keep engaging in criminal activity. Ehrlich argues recidivism arises from a lack of opportunities as a result of scarce legitimate activities available to that individual (Ehrlich, 1972). Ehrlich's empirical analysis measures an individual's propensity to engage in crimes against property by measuring the effects of the potential illegal payoff on the median value of legitimate income (Ehrlich, 1972). Ehrlich estimates the effects of average prison time served by offenders, percentage of nonwhites in the community, median income, education, labor force participation, and a percentage of males in the population on property crimes (Ehrlich, 1972). The estimates from this regression prove inconclusive, but Ehrlich leaves open the possibility for further research regarding age and specific types of crime, vice property crime alone.

The overall effectiveness of law enforcement and its possible deterrent effect on crime represents another factor contributing to illegitimate activity (Ehrlich, 1972). Ehrlich, in an attempt to expand upon Becker's previous research, examines the relationship between a police department's operating budget and crime. He finds that larger budgets are associated with less crime. This relationship becomes strained as the population grows exponentially. The productivity and effectiveness of the local police department correlate negatively

with expanding population size and overall density of the community (Ehrlich, 1972). Furthermore, the expenditures associated with law enforcement extends from apprehension and incorporates the legal process and any subsequent incarceration.

To test Ehrlich's hypothesis, Forst (1976) examined data from inmates from all 50 states and the District of Columbia. Forst expanded upon the crime rate index by including additional variables representative of the community. Forst includes the probability of arrest, the average incarceration sentence, and average prisoner expenditure to determine the index, but added additional demographic variables to Ehrlich's model (1976). Forst felt that by censuring high income families within the community, he could test the notion that lower earning individuals are more willing to engage in illegitimate activities (1976).

Forst selects economic variables related to the labor force, but also adds variables that define the traits of the individuals within the community. Forst (1976) states, "the chief purpose of these additional variables is to ensure that the variables we are most interested in analyzing are purged of their dependence on factors that have been omitted" (p. 483). However, these community characteristics such as race and marital status are potentially endogenous. Nonetheless, Forst's analysis advances the literature by providing a better description of the households within a given community.

B. DETERRENCE VARIABLES FROM THE COMMUNITY

The first economic models of crime focused on the demographics of those within a community. Subsequent models turned their attention to the economic conditions of the community in an attempt to explain the deterrence effect, if any, on criminal activity. Bushway and Reuters (2008) clarify the viewpoint of an economist on crime: "the first is an emphasis on rationality, defined not as conformity to others' values but as the realization of one's own self-interests. The second is the focus on interactions, among parties with different self-interests, which has effects particularly at the aggregate level" (p. 395).

Regarding the relationship of a community in disorder and its citizens, Wilson and Kelling (1982) stated,

> first, outside observers should not assume that they know how much of the anxiety now endemic in many big-city neighborhoods stems from a fear of “real” crime and how much from a sense that the street is disorderly, a source of distasteful, worrisome encounters. The people of Newark, to judge from their behavior and their remarks to interviewers, apparently assign a high value to public order, and feel relieved and reassured when the police help them maintain that order. Second, at the community level, disorder and crime are usually inextricably linked, in a kind of developmental sequence. (p. 3)

Communities showing signs of decay such as broken windows in a building create a perception of growing disorder. If left unchecked, the community would fall victim to crimes of a more deviant nature. A study on the decrease in crime in city of New York from 1989–1998 estimated a deterrence effect for over 60,000 violent crimes (Hinkle & Weisburd, 2008). To capture aspects of the “broken windows” theory, Hinkle and Weisburd (2008) included as independent variables observable and perceived signs of social disorder, as measured by social disorder and police presence against citizens’ fear of crime as ordinal values. The authors defined social disorder as the total counts of people loitering, loud disputes, people visibly drunk or consuming alcohol in public, and the number of homeless people (Hinkle & Weisburd, 2008). The authors included police presence as an independent variable to “test the impact of the police intervention on fear of crime among residents of the targeted areas” (p. 507). This linked the propensity to commit crime against the community as a whole.

Bondurant, Lindo, and Swensen (2016) examine the relationship between illegitimate activities and community characteristics by focusing on the presence of substance abuse treatment centers (SAT). The authors use the offenses-known data from the FBI’s UCR as a dependent variable for the model. This data contains commonly reported violent and property crime, to include murder, assault, robbery, larceny, and vehicle theft (Bondurant et al., 2016). The presence of such facilities typically provoke public backlash concerning the type

of individuals such facilities are designed to serve. The argument suggests SAT create risks to the community by attracting those individuals already engaging in criminal behavior (Bondurant et al., 2016).

Research conducted by Cummings, Hockenberry, and Wen (2014) explored "the effects of substance abuse treatment itself, vice the presence of the actual SAT against crime rates" (p. 1). Certain types of crime within a community that provides treatment for substance abuse decreased. When estimated at the county level, a reduction on aggravated assaults became statistically significant (Cummings et al., 2014). A law enforcement variable with an emphasis on economic conditions of the community thus represent relevant explanatory variables (Bondurant et al., 2016).

C. FORECLOSURES, VACANT HOUSING, AND CRIME

Meanwhile prior research shows a connection between foreclosures and crime (Cui & Walsh, 2014). The foreclosure rate of a community serves as a key indicator of its economic health. When homes go into foreclosure, their upkeep and appearance generally decline. The presence and prevalence of foreclosed and vacant homes could then act as precursors for criminal activity. The most common theory regarding this relationship is broken windows theory, presented by James Wilson and George Kelling (Cui et al., 2014) and discussed earlier.

The effects of foreclosure on the surrounding neighborhood usually begin once the homeowner realizes foreclosure is a reality (Cui et al., 2014). Less care goes to the maintenance of the property, and sends a signal that deterrence from illegitimate activities is weaker than in other neighborhoods. This perception increases if the home neglect increases while vacant. Individuals seeking to engage in illegitimate activities use these properties to engage in criminal behavior. Research on the relationship between foreclosure and crime data in the city of Chicago for the year 2001 found a 1% increase in the foreclosure rate lead to a 2.3% increase in violent crime (Cui et al.,2014).

Cui et al. (2014) study the relationship between foreclosures and crime using geospatial analysis techniques to create buffers between their control and treatment groups. They use fixed effects at the neighborhood-quarter level of demographics consistently used in the literature. They are included in the empirical model and estimated to account for any omitted variable bias. Most importantly, the researchers, analyze the foreclosure process itself rather than a home labeled as foreclosed. They found that this allows for homes to be separated as pre-foreclosure, vacant, or real estate owned (REO), to more accurately measure the effects on crime (Cui et al., 2014). The researchers also control for specific housing characteristics within their buffer throughout the foreclosure process, including square footage, the assessment value, the number of bedrooms, and the last sales price (Cui et al., 2014). These characteristics help explain the relationship of crime with a specific housing unit in a state of foreclosure.

Finally, Arnio and Baumer (2012) explore the issue of foreclosure and its relationship to crime within a neighborhood. Foreclosure rates within a neighborhood, combined with traditional community traits such as demographics and economic health, contribute to a more accurate model to explain overall criminal activity. In fact, once conditioned on variables such as race or ethnicity, foreclosure is shown to have a positive association with property crime (Arnio & Baumer, 2012). “It shows that for both robbery and burglary, recent increases in foreclosure have not been germane to increases in crime across much of Chicago. However, there are notable sectors of the city in which foreclosure appears to have been highly influential in yielding elevated crime rates” (p. 474).

D. POLICE BUDGETS AND CRIME

Finally, the presence of law enforcement in the community contributes to an individual’s decision to engage in illegitimate activities. Becker (1968) noted, strict adherence to the law is not taken for granted. Law enforcement receives significant resources to prevent crime and apprehend offenders. Becker

advocated for a measure of social loss from offenses committed to find an optimal level of expenditure that minimizes those losses (1968). “The optimal amount of enforcement is shown to depend on, among other things, the cost of catching and convicting offenders, the nature of punishments” (p. 170).

McPheters and Stronge (1974) estimate the effects crime on police budgets and the public’s willingness to devote resources to the deterrence of such activity. Their decision to lag police budgets is “justified by the argument that crime is deterred not by actual police expenditures but by perceived police expenditures” (McPheters & Stronge, 1974, p. 638). They argue the budget for a police department is in part determined by historical crime rates for that community.

The additional independent variables in their model account for the public’s perception of urban decay: the deterioration of community fixtures. Police budgetary increases alone do not explain a decrease in criminal activity. Rather, police budget increases coupled with the public’s perception that its community has a crime problem is sufficient to decrease present criminal activities.

In addition, Griesinger, Tauchen, and Witte (1994) explore the deterrence effect of police resources on crime, but focused on a birth cohort present within a community. Young men in the city of Philadelphia between ages 10 and 18 serve as the birth cohort for their study. Griesinger et al. then examine the probability of arrest given traditional variables utilized to represent a community. Their research suggests that the deterrence against criminal activity is strongest with young men with the least interaction with the criminal justice system Within their model, the researchers found “increased real police budget per offense is consistently…associated with decreases in both the binary and index measure of crime” (p. 406).

Di Tella and Schargrodsky (2004) looked at the effects of increased police presence on crime. The additional police presence serves as a shock to the market, with its effects having a significant impact on criminal activity in the

treated area. Their research shows that over a nine-month period, increased police presence in treated neighborhoods resulted in fewer car thefts than neighborhoods left untreated (Di Tella & Schargrodsky, 2004).

Thurman, Zhang, and Zhao (2011) examine police budgeting further by focusing on agencies in receipt of the Community Oriented Policing Services (COPS) or the Making Officer Redeployment Effective (MORE) grants. These federal grants assisted law enforcement executives to cover initial hiring expenses for new police. Over a six-year period, more than 7 billion in COPS grants were awarded (Thurman et al., 2011). Grant money awarded to the agency constituted additional appropriation not allocated by traditional city revenues. It served as a sudden shock to the market. Their research found a negative correlation between additional funding and/or staffing, and a reduction in criminal activity (Thurman et al., 2011).

E. OTHER PREVIOUS RELATED LITERATURE

In contrast to the overall crime literature, there are few studies that focus on military installations and crime. One example is Freedman and Owens (2016), who examine the effects of a demand shock, specifically the sudden increase in demand for construction workers when the DOD announced a BRAC-realignment in San Antonio, Texas. Freedman and Owens utilize a difference-in-difference methodology to analyze the effects of BRAC on crime at the neighborhood level in San Antonio (2016). As with the previous literature discussed, Freedman and Owens included several demographic variables at the neighborhood level utilizing data from the Bureau of the Census (USCB). Their crime data is on the individual level, and the authors focused on one county, Bexar, within the city of San Antonio (2016). The time series for their data measures from 2000 to 2010 (2016). Consistent with the literature, Freedman and Owens (2016) use criminal data obtained from the UCR.

The researchers then measured the effects of these local economic improvements on crime. Specifically, they focus on the changes in criminal

behavior of those who, due to previous criminal activity, were ineligible to participate in the surging job market. These individuals were disqualified from the sudden surge for construction jobs aboard the expanding military installation due to existing federal hiring rules (2016). They found that increased demand for labor from federal construction dollars (for BRAC) to the city of San Antonio actually increased criminal activity in the adjacent area. While the authors acknowledge the existence of pre-treatment trends in criminal activity, the increase in crime after BRAC relates to an increase in criminal opportunities presented by the sudden demand for labor (2016). This research expands upon the seminal work of Becker and Ehrlich, who noted that the decision to engage in criminal activity relates to the probability of economic gains associated with such action.

The literature presented focuses on specific industry or community characteristics and their effects on crime. With the exception of Freedman and Owens, whose study examined the effects of a BRAC-realignment on crime, there is little information regarding the effects of an installation's closure on crime. This thesis will utilize those variables in the literature such as demographics, police budgets, and foreclosed homes, but also introduce as a variable, those installations physically closed as a result of the latest 2005 BRAC round.

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IV. DATA

A. THE UNIFORM CRIME REPORT

The FBI maintains the UCR database for national and state statistics on criminal activity. “The program’s primary objective is to generate reliable information for use by law enforcement administration, operation, and management” (FBI, 2017). The Criminal Justice Information Service (CJIS) provides technical support for the database. Law enforcement agencies submit crimes known to police to state UCR representatives on an annual basis to generate national level crime data. The FBI encourages all law enforcement’s participation in the program. This includes law enforcement at the local, state, tribal, and other federal law enforcement agencies. “To date, over 18,000 law enforcement agencies participate in the UCR program” (FBI, 2017). The program’s primary objective supports the generation of reliable information for use by law enforcement administration, operation, and management (FBI, 2017).

Origins for the UCR date to 1930, when the International Association of Chiefs of Police (IACP) and the National Sherriff’s Association (NSA) developed a standardized method to report criminal activity (FBI, 2017). In the same year, Congress enacted Title 28, Section 534 of the United States code, authorizing the U.S. attorney general the power to gather information on criminal activity in the country (FBI,2017). The U.S. attorney general delegated this responsibility to the director of the FBI.

The UCR exists as one of two national databases that report on criminal activities across the United States (FBI, 2017). The Bureau of Justice Statistics (BJS) maintains the second database, the national crime victimization survey (NCVS). “The NCVS collects information on nonfatal personal crimes (rape or sexual assault, robbery, aggravated and simple assault, and personal larceny) and household property crimes (burglary, motor vehicle theft, and other theft) both reported and not reported to police” (BJS, n.d.).

1. Crime as a Dependent Variable

I constructed my dependent variables using data from the UCR. This thesis used the FBI's UCR data tool, capturing criminal activity known to law enforcement from 2000 to 2014. To measure each state's crime statistics, I focused on each of the Part-I violent crimes and Part-I property crimes for law enforcement agencies representing cities or towns with populations under 1 million persons. My decision to exclude cities with a population of 1 million or greater reflected my desire to avoid MSA cities altogether.

The totals for each Part-I crime follows the FBI's methodology. Totals represent crimes known to law enforcement and count towards only the most serious offense. I omitted criminal data for the District of Columbia known to law enforcement and the U.S. territory of Puerto Rico. The collection of UCR data for the cities under 1 million across the United States totaled 1638 cities. Next, I calculate the per capita crime rate as the total number of crimes committed in each city for a given year, divided by 100,000 persons. This per capita rate matches the rate in the UCR's methodology. I focused on the following criminal activity as my dependent variables: murder, rape, larceny, assault, burglary, robbery, vehicle theft, as dependent variables representative of crime.

B. BRAC, TIME, AND THE VARIABLE TW AS A DD ESTIMATOR

Utilizing the 2005 BRAC commission's report to the president, I constructed an indicator variable equal to 1 for cities that were on the BRAC list. Specifically, cities with a military installation selected for closure between 2005 and 2014 were assigned a value of 1. Cities without an installation received the value of 0. A total of 15 cities in the data received the BRAC value of 1. The control group totaled 1,637 cities. In addition, I created a dummy variable, *Time,* that is equal to one for years after a BRAC closure within the time series 2000–2014. For example, the city of Tooele received the values of *BRAC=1* all throughout the time series, and *Time=1* for the years after its closure, 2005. An

interaction between the two variables, defined as *TW*, then captures the effects of BRAC on crime before versus after the closure.

C. INDEPENDENT VARIABLES

After coding the dummy variables and crime data matched to respective cities, I turned to the collection of socio-economic variables referenced in the literature. The United States Bureau of Labor Statistics (BLS) provided unemployment information for each city in the dataset. Each city's annual unemployment rate for the time series, 2000–2014, was recorded in a separate database for economic controls. Additionally, I used data from the BLS on the consumer price index (CPI) for each city in the dataset. The BLS lacked the data for years 2013 and 2014.

The FBI's CJIS division provided data on the staffing of police departments throughout the United States. Law enforcement agencies in the data voluntarily participate in the FBI's UCR program. This allowed for the pairing of law enforcement agencies to their respective city's UCR statistics. The variable, *Police,* represented the actual on-hand staff for each department for a particular city given a particular year in the dataset.

The most accurate source of operating budget data came from BJS, which published average amounts for departments given a respective population range they had jurisdiction over. BJS compiles this data from the law enforcement management and administration survey (LEMAS). Specific budgets for cities in the dataset were unavailable. Instead, I used average operating budgets for a given population range or jurisdictional size served as a sufficient substitute. LEMAS surveys provided data for the years 2000, 2003, 2007, and 2013 respectively. Thus, I matched the operating budget for the given years with the city by its placement within the assigned population ranges.

Demographic information on the cities in the master dataset originated from the USCB. The variable, "population" constitutes information from the USCB's 2000 and 2010 census. The USCB's population estimate program (PEP)

contained data for the inter-censal years. Using the data from the official census and the PEP, I included annual city population as a control variable.

The USCB provided another independent variable, “demographics” consistent with the literature on crime. This variable separates the population by sex, and races into, White, Black, Hispanic, and Asian nationalities. These data originated from the USCB’s American community survey (ACS) and PEP. However, the National Bureau of Economic Research (NBER) regularly collects and updates these data for research purposes. This thesis obtained data from NBER for the years 2000–2010 and 2011–2015, then merged the two datasets together to represent demographic data at the county level. After combining the two datasets, I then calculate the mean county-level of each demographic variable by taking an average across counties for each state in the controls dataset. Aggregated data on White, Black, Hispanic, and Asian ethnicities of both sexes served as demographic variables at the state level for the entire time series.

Given the literature and emphasis on BRAC, it was important to measure the effects of the military population on crime. Veteran data separated by conflicts, sex, and age ranges served as a substitute for the actual military population. The USCB’s American fact finder (AFF) system provided access to this data at the state level for the years 2005–2014. Using the AFF, data for every state’s male and female veterans of Korea, Vietnam, and the Gulf War as well as age brackets from age 18 to 75 collapsed by the mean to reflect average veteran variables.

D. MODELS UTILIZED

For this study, I utilized the following models to estimate the effects of BRAC on crime. The first model estimates the effects on property crime. The second estimates the effects on violent crime. The third estimates the effects on larceny, which is a particular type of property crime. Finally, the fourth model estimates the effects of robbery, a particular type of violent crime.

$$P\_100k_{it} = \beta_0 + \beta_1 Time + \beta_2 BRAC + \beta_3 TW + \beta_4 Police\_lag + \beta_5 Budget\_Lag + \beta_6 Unemp\_ + \beta_7 Lnwa\_male + \beta_8 Lnb\_male\_ + \beta_9 Lnh\_male + \beta_{10} Lnaa\_male + a_i + \varepsilon_{it}$$

$$V\_100k_{it} = \beta_0 + \beta_1 Time + \beta_2 BRAC + \beta_3 TW + \beta_4 Police\_lag + \beta_5 Budget\_Lag + \beta_6 Unemp\_ + \beta_7 Lnwa\_male + \beta_8 Lnb\_male\_ + \beta_9 Lnh\_male + \beta_{10} Lnaa\_male + a_i + \varepsilon_{it}$$

$$Lar\_100k_{it} = \beta_0 + \beta_1 Time + \beta_2 BRAC + \beta_3 TW + \beta_4 Police\_lag + \beta_5 Budget\_Lag + \beta_6 Unemp\_ + \beta_7 Lnwa\_male + \beta_8 Lnb\_male\_ + \beta_9 Lnh\_male + \beta_{10} Lnaa\_male + a_i + \varepsilon_{it}$$

$$Rob\_100k_{it} = \beta_0 + \beta_1 Time + \beta_2 BRAC + \beta_3 TW + \beta_4 Police\_lag + \beta_5 Budget\_Lag + \beta_6 Unemp\_ + \beta_7 Lnwa\_male + \beta_8 Lnb\_male\_ + \beta_9 Lnh\_male + \beta_{10} Lnaa\_male + a_i + \varepsilon_{it}$$

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V. RESULTS

In this chapter, I report the results on the analyses of the different data described in the previous chapter. The findings on the effect of BRAC on criminal activity separate into two types of categories: violent crime and property crime. Within these two categories, I selected the particular crimes of larceny and robbery, to gain a better understanding how of an installation's closure affects crime.

A. DESCRIPTIVE STATISTICS

The descriptive statistics provided in Table 3 describe the explanatory variables utilized in my models. The statistics in Table 4 report the means of my explanatory variables by BRAC status. The variables listed are the variables utilized in the fixed and random effects models. All cities listed under the category, *BRAC=1*, are cities where a military installation closed between the years of 2005–2014. Cities listed under the category, *BRAC=0*, are cities where a military installation remained open or no closure occurred within the same time range.

Table 3. Description of Independent Variables

Independent Variable	Description
Time	Time series for the years 2000–2014
Police_Lag	Police manpower lagged one year
Bud_Lag	Police Department operating budget lagged one year
Unemp	Unemployment rate
V_18_34	Average number of veterans between the ages of 18–34
Lnwa_male	Percent of the population that is white male
Lnbl_male	Percent of the population that is black male
Lnh_male	Percent of the population that is Hispanic male
Lnaa_male	Percent of the population that is Asian male

Table 4. Means and Standard Deviation of Independent Variables

Descriptive Statistics Mean and Standard Deviation			
	(1)	(1)	(2)
VARIABLES	Combined	NO BRAC	BRAC
Time	0.663	0.666	0.366
	(0.472)	(0.471)	(0.483)
Police_Lag	178.396	178.703	146.388
	(313.415)	(314.368)	(186.906)
Bud_Lag	1.70E+07	1.69E+07	1.71E+07
	(2.47E+07)	(2.48E+07)	(2.27E+07)
Unemp_	6.345	6.337	7.198
	(3.250)	(3.256)	(2.409)
v_18_34	4.717	4.709	5.613
	(3.588)	(3.58)	(4.348)
lnwa_male	8.784	8.791	8.047
	(0.931)	(0.928)	(1.000)
lnba_male	6.599	6.605	5.858
	(1.228)	(1.226)	(1.191)
lnh_male	6.849	6.856	6.037
	(1.647)	(1.645)	(1.755)
lnaa_male	5.649	5.656	4.775
	1.652	(1.650)	(1.650)

Data collection is detailed in Chapter IV.

The average number of police officers available in cities without a closure is 178.703. For cities with a base closure, the amount is 146.388. For police operating budgets, the average was $1,690,000 while the amount for cities with a closure was lower at $1,171,000. The average unemployment rate for cities without a base closure was 6.337%. The unemployment rate for cities that experienced a base closure was higher at 7.198%. The average number of veterans aged 18 to 34 among cities without a base closure was 4.709, whereas in cities that experienced a closure, the average number is 5.613. This shows almost no difference in the average amount of veterans in the population. The population size of cities without a base closure tends to be larger. The population of white males for cities without a base closure was 8.791 log-points and for

cities that experienced a closure, 8.04. This means a difference of 75% more white males in cities without a base closure. Similarly, the difference in population of black males amounts to 74% more black males among cities without a base closure. The log-point difference in Hispanic males shows a difference of 81% more Hispanic males in cities without a base closure. Finally, Asian males shows a difference of 88% more Asian males among cities with a base closure.

B. EFFECT OF BRAC ON CRIME

To form empirical estimates of the effects of BRAC on violent crimes as well as property crimes, I estimate three regression models for each type of crime in order to identify the best fit. I begin with a baseline OLS regression, and then systematically add additional controls. I then conduct a Hausman test to determine whether a fixed effects or random effects model is appropriate for this panel data analysis. The results from the test indicate a random effects for the baseline model is preferred. The p-value from the Hausman test is .0724. However, when I add controls, the Hausman test indicates a fixed effects model is preferred. The p-value from the Hausman test with controls is 0.0.

As discussed in the previous chapter, the dependent variables are expressed in rates. For instance, the dependent variable *P_100k*, is calculated as the total number of property crimes per 100,000. This denominator or per-capita figure is what is typically utilized by law enforcement. The variable, *V_100k*, constitutes the aggregated amount of all crimes classified as violent crime per 100,000. I utilize identical independent variables for each of these dependent variables in my estimations. Table 5 reports the results for violent crime as outcomes.

Table 5. Effects of BRAC on Violent Crime

VARIABLES	(1) OLS	(2) OLS w/ Controls	(3) FE w/ Controls
Time	-64.548***	-118.974	284.671**
	(12.838)	(109.638)	(114.632)
BRAC	761.135***	565.131***	258.141
	(76.282)	(167.909)	(259.895)
TW	-238.764*	68.870	-126.926
	(124.989)	(332.721)	(299.382)
Police_Lag		0.076	0.089
		(0.075)	(0.080)
Bud_Lag		-0.000	-0.000
		(0.000)	(0.000)
Unemp_		68.239***	24.838***
		(5.746)	(8.946)
v_18_34		-7.044	-44.370***
		(15.392)	(16.005)
lnwa_male		-22.849	381.848***
		(58.113)	(144.774)
lnba_male		104.017***	247.414***
		(21.154)	(62.741)
lnh_male		26.496	-272.725***
		(25.437)	(65.776)
lnaa_male		-118.107***	-159.530*
		(33.950)	(93.095)
Constant	537.672***	227.178	-1,802.381**
	(10.561)	(327.120)	(802.701)
Observations	19,663	3,721	3,721
R-squared	0.008	0.059	0.034
Number of Place_FIPS			1,248

Data collection is detailed in Chapter IV.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The first column shows the baseline OLS regression model estimates. The coefficient on *Time* shows violent crime is on a downward trend during this period; Violent crime incidents fell by 64.54 per 100,000 in the years among cities that had a BRAC relative to before the closure. Meanwhile the coefficient on *BRAC* shows that violent crime is higher by 761.13 per 100,000 among cities that had a BRAC. The coefficient on *TW*, the DD estimator, shows a significant effect of BRAC on violent crime. Violent crime fell 238.76 per 100,000 in cities after a base closure,

relative to comparison cities. This estimate is statistically significant at the 5% level, or with 95% degree of statistical confidence.

In the second column, I added controls consistent with the literature. The coefficient on *Time* still shows a downward trend of 118.97 per 100,000 but is no longer statistically significant. The coefficient, *BRAC,* shows that violent crime increased by 565.13, a figure slightly smaller than the baseline OLS model but is highly statistically significant. We see that the addition of these controls resulted in an increase of 68.87 violent crimes, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is, however, no longer statistically significant.

In the third column, I report the fixed effects estimates with the same controls, given the results of the Hausman test. This time, the coefficient on *Time* shows an increase by 284.67 per 100,000 that is statistically significant. The coefficient *BRAC* shows an increase of 258.14 per 100,000, but is not significant. This estimate is also much smaller than the previous models. Finally, the DD estimator, *TW,* shows a decrease of 126.92 violent crimes, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is also no longer statistically significant.

This time, it is the economic conditions and demographics that prove to be statistically significant. The coefficient, *Unemp*, shows that violent crime increases by 24.83 per 100,000 with every one percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that violent crime decreases by 44.37 per 100,000 with every veteran aged 18 to 34 in the population. The coefficient, *lnwa_male,* shows that a 1% increase in white males is associated with an increase of violent crime by 381.84 per 100,000. The coefficient, *lnba_male,* also shows that a 1% increase in black males results in an increase of violent crime by 247.41 per 100,000. These coefficients contrast with the coefficient, *lnh_male,* which showed that a 1% increase in Hispanic males results in a decrease of violent crime by 272.72 per 100,000. This is also true for the coefficient, *lnaa_male,* which showed that a 1% increase in Asian males results in a

decrease of violent crime by 159.53 per 100,000. The coefficient of determination for my fixed effects model was .03.

The next table, Table 6, provides the results for property crime. As with violent crime, I estimate three regression models in order to identify the best fit. I begin with a baseline OLS regression, then add additional controls, and finally estimate using a fixed effects model with controls identical to the previous models.

Table 6. Effects of BRAC on Property Crime

VARIABLES	(1) OLS	(2) OLS w/ Controls	(3) FE w/ Controls
Time	-861.387***	-1,498.964***	1,042.207*
	(63.081)	(531.144)	(566.103)
BRAC	4,503.113***	3,324.126***	624.232
	(377.224)	(843.977)	(1,227.294)
TW	-1,723.830***	-1,139.615	-2,207.053
	(618.064)	(1,672.594)	(1,492.277)
Police_Lag		0.602	0.415
		(0.377)	(0.402)
Bud_Lag		-0.000	-0.000
		(0.000)	(0.000)
Unemp_		270.036***	130.974***
		(28.771)	(44.197)
v_18_34		34.226	-223.692***
		(75.058)	(79.400)
lnwa_male		-602.960**	1,264.030*
		(285.690)	(715.653)
lnba_male		158.264	-137.571
		(105.770)	(305.094)
lnh_male		325.520**	-644.010**
		(126.799)	(321.788)
lnaa_male		-610.125***	-973.466**
		(166.843)	(452.561)
Constant	4,475.523***	8,771.517***	3,568.717
	(52.153)	(1,595.355)	(3,960.568)
Observations	20,140	3,797	3,797
R-squared	0.019	0.079	0.045
Number of Place_FIPS			1,259

Data collection is detailed in Chapter IV.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The first column shows the baseline OLS regression model estimates. The coefficient on *Time* shows property crime is on a downward trend during this period; Property crime incidents fell by 861.38 per 100,000 in the years among cities that had a BRAC relative to before the closure. Meanwhile the coefficient on *BRAC* shows that property crime is higher by 4503.11 per 100,000 among cities that had a BRAC. The coefficient on *TW*, the DD estimator, shows a significant effect of BRAC on property crime. Property crime fell by 1723.83 per 100,000 in cities after a base closure, relative to comparison cities. This estimate is statistically significant at the 5% level, or with 95% degree of statistical confidence.

In the second column, I added controls consistent with the literature. The coefficient on *Time* still shows a downward trend of 1498.96 per 100,000. The coefficient *BRAC* shows that property crime increased by 3324.12, a figure slightly smaller than the baseline OLS model. We see that the addition of these controls resulted in a decrease of 1139.61 property crimes, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is no longer statistically significant at the 5% level, or with a 95% degree of statistical confidence.

In the third column, I report the fixed effects estimates with the same controls. This time, the coefficient on *Time* shows an increase by 1042.20 per 100,000. The coefficient *BRAC* shows an increase of 624.23 per 100,000. This estimate is much smaller than the previous models. Finally, the DD estimator, *TW,* shows a decrease of 2207.05 property crimes, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is also no longer statistically significant at the 5% level, or with a 95% degree of statistical confidence.

Again, it is the economic conditions and demographics that prove to be statistically significant. The coefficient, *Unemp*, shows that property crime increases by 130.97 per 100,000 for every one percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that

for every veteran in the area, property crime decreases by 223.69 per 100,000. The coefficient, *lnwa_male,* shows that a 1% increase in white males results in an increase of property crime by 1264.03 per 100,000, although this is not statistically significant. This coefficient contrasts with the coefficient, *lnh_male,* which showed that a 1% increase in Hispanic males results in a decrease of property crime by 644.01 per 100,000. This is also true for the coefficient, *lnaa_male,* which showed that a 1% increase in Asian males results in a decrease of property crime by 973.46 per 100,000. The coefficient of determination for my fixed effects model was .04.

C. EFFECT OF BRAC ON PARTICULAR CRIMES

To further examine the effects of BRAC on violent crimes, I utilized the dependent variable, *Rob_100k*, and kept identical control variables from the previous models. Table 7 shows the results from the 3 models ran using the crime, robbery, as the dependent variable.

Table 7. Robbery per 100,000 as the Dependent Variable

VARIABLES	(1) OLS	(2) OLS w/ Controls	(3) FE w/ Controls
Time	-19.545***	-46.416	125.762***
	(4.800)	(40.502)	(44.716)
BRAC	276.909***	163.745**	178.245*
	(28.713)	(64.374)	(95.538)
TW	-104.310**	92.982	-56.476
	(47.046)	(127.575)	(117.931)
Police_Lag		0.027	0.039
		(0.029)	(0.032)
Bud_Lag		-0.000	-0.000
		(0.000)	(0.000)
Unemp_		22.507***	9.184***
		(2.194)	(3.489)
v_18_34		-0.603	-16.954***
		(5.722)	(6.270)
lnwa_male		-8.358	210.111***
		(21.753)	(56.502)
lnba_male		46.481***	139.274***
		(8.065)	(24.061)
lnh_male		-9.276	-140.527***
		(9.666)	(25.266)
lnaa_male		-20.924*	-60.410*
		(12.702)	(35.640)
Constant	165.712***	9.486	-1,356.413***
	(3.969)	(121.463)	(312.740)
Observations	20,156	3,800	3,800
R-squared	0.007	0.045	0.043
Number of Place_FIPS			1,259

Data collection is detailed in Chapter IV.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The first column shows the baseline OLS regression model estimates. The coefficient on *Time* shows robbery is on a downward trend during this period; Robbery incidents fell by 19.54 per 100,000 in the years among cities that had a BRAC relative to before the closure. Meanwhile the coefficient on *BRAC* shows that robbery is higher by 276.90 per 100,000 among cities that had a BRAC. The coefficient on *TW*, the DD estimator, shows a significant effect of BRAC on

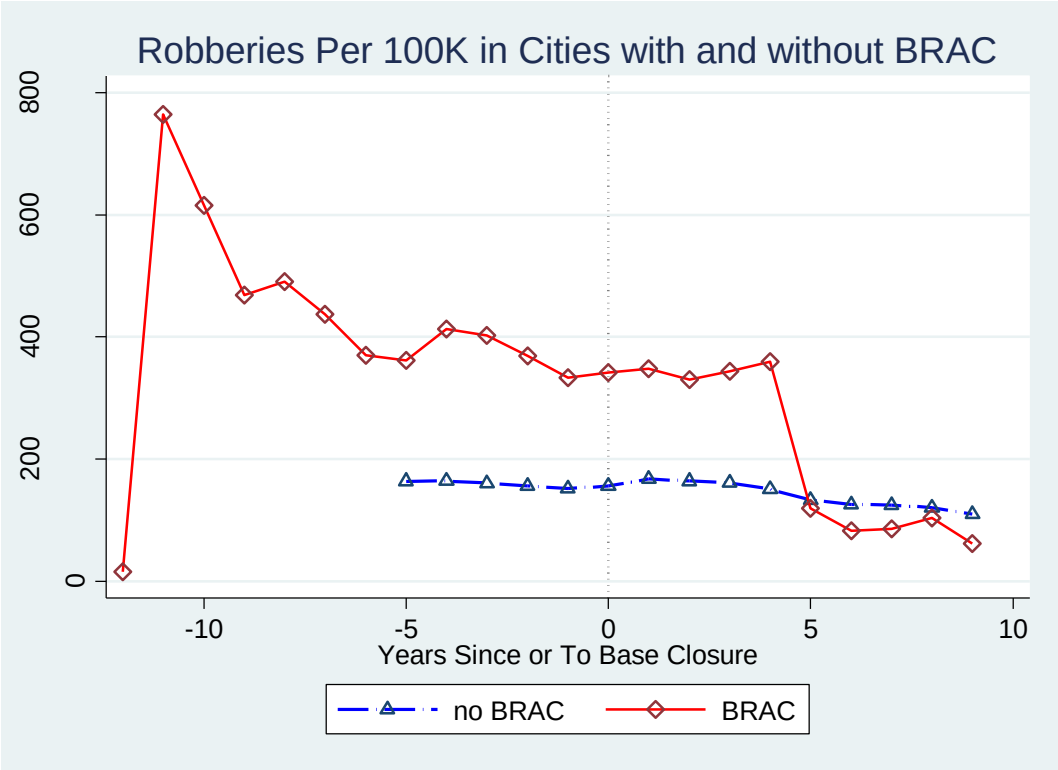
robbery. Robbery fell by 104.31 per 100,000 in cities after a base closure, relative to comparison cities. This estimate is statistically significant at the 5% level, or with 95% degree of statistical confidence.

In the second column, I added controls consistent with the literature. The coefficient on *Time* still shows a downward trend of 46.41 per 100,000. The coefficient *BRAC* shows that robberies increased by 163.74, a figure slightly smaller than the baseline OLS model. We see that the addition of these controls resulted in an increase of 92.98 robberies, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is no longer statistically significant at the 5% level, or with a 95% degree of statistical confidence.

In the third column, I report the fixed effects estimates with the same controls. This time, the coefficient on *Time* shows an increase by 125.76 per 100,000. The coefficient *BRAC* shows an increase of 178.24 per 100,000. Finally, the DD estimator, *TW,* shows a decrease of 56.47 robberies, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is also no longer statistically significant at the 5% level, or with a 95% degree of statistical confidence.

The economic conditions and demographics prove to be statistically significant, similar to previous results. The coefficient, *Unemp*, shows that robbery increases by 9.18 per 100,000 with every 1 percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that robbery decreases by 16.95 per 100,000 with every veteran. The coefficient, *lnwa_male,* shows that a 1% increase in white males is associated with an increase of robberies by 210.11 per 100,000. The coefficient, *lnba*_male, shows that a 1% increase in black males results in an increase of 139.27 per 100,000. These coefficients contrast with the coefficient, *lnh_male,* which showed that a 1% increase in Hispanic males is associated with a decrease of robberies by 140.52 per 100,000. This is also true for the coefficient, *lnaa_male,* which showed that a 1% increase in Asian males is associated with a decrease of

robberies by 60.41 per 100,000. The coefficient of determination for my fixed effects model was .04. Figure 6 shows the changes in the treatment and control groups occur at 5 years post-closure and again at 10 years post-closure.



Data collection is detailed in Chapter IV.

Figure 6. Robberies in Treatment and Control Group Post-Closure.

To further examine the effects of BRAC on property crime, I utilized the dependent variable, *Lar_100k*, and kept identical control variables from the previous models. Table 8 shows the results from the 3 models ran using the crime, larceny as the dependent variable.

Table 8. Larceny per 100,000 as the Dependent Variable

VARIABLES	(1) OLS	(2) OLS w/ Controls	(3) FE w/ Controls
Time	-689.612***	-973.685***	688.340*
	(44.596)	(372.098)	(366.162)
BRAC	2,858.919***	2,122.918***	929.204
	(266.279)	(591.211)	(797.950)
TW	-1,342.068***	-950.008	-1,623.342*
	(436.278)	(1,171.638)	(964.192)
Police_Lag		0.305	0.256
		(0.263)	(0.259)
Bud_Lag		-0.000	-0.000
		(0.000)	(0.000)
Unemp_		56.609***	51.108*
		(19.275)	(28.205)
v_18_34		27.810	-159.438***
		(52.561)	(51.291)
lnwa_male		-406.167**	639.023
		(198.794)	(461.552)
lnba_male		67.404	-526.728***
		(73.569)	(198.109)
lnh_male		236.602***	-24.808
		(88.478)	(207.909)
lnaa_male		-456.181***	-741.335**
		(116.117)	(292.126)
Constant	3,307.343***	7,204.427***	5,302.003**
	(36.880)	(1,108.980)	(2,555.129)
Observations	20,090	3,781	3,781
R-squared	0.020	0.072	0.058
Number of Place_FIPS			1,253

Data collection is detailed in Chapter IV.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

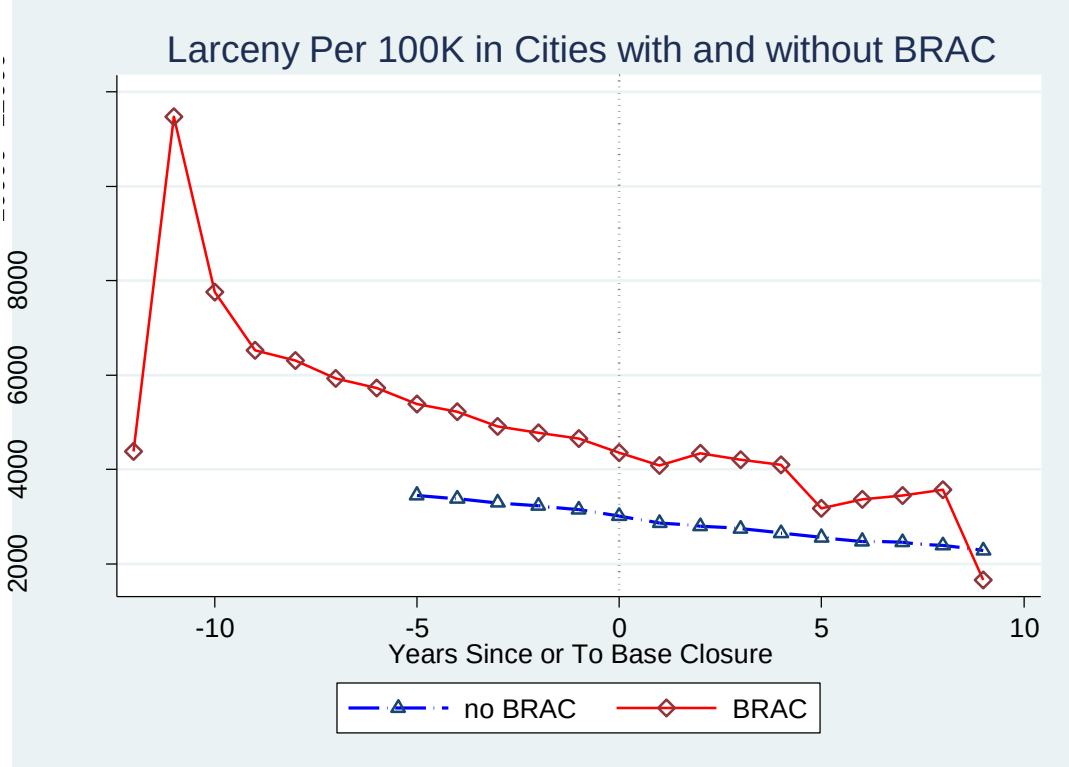
The first column shows the baseline OLS regression model estimates. The coefficient on *Time* shows larceny is on a downward trend during this period; larceny fell by 689.61 per 100,000 in the years among cities that had a BRAC relative to before the closure. The coefficient on *BRAC* shows that larceny is higher by 2858.91 per 100,000 among cities that had a BRAC. The coefficient on *TW*, the DD estimator, shows a significant negative effect of BRAC on larceny.

Larceny fell by 1342.06 per 100,000 in cities after a base closure, relative to comparison cities. This estimate is statistically significant at the 5% level, or with 95% degree of statistical confidence.

In the second column, I added controls consistent with the literature. The coefficient on *Time* still shows a downward trend of 973.68 per 100,000. The coefficient *BRAC* shows that larceny increased by 2122.91 per 100,000, a figure slightly smaller than the baseline OLS model. We see that the addition of these controls resulted in a decrease of 950 larcenies, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is no longer statistically significant at the 5% level, or with a 95% degree of statistical confidence.

In the third column, I report the fixed effects estimates with the same controls. This time, the coefficient on *Time* shows an increase of 688.34 per 100,000. The coefficient *BRAC* shows an increase of 929.20 per 100,000. Finally, the DD estimator, *TW,* shows a decrease of 1623.34 larcenies, on average, per 100,000 in cities after a base closure, relative to comparison cities. This estimate is statistically significant at the 10% level, or with a 90% degree of statistical confidence.

The economic conditions and demographics here also prove to be statistically significant. The coefficient, *Unemp*, shows that larceny increases by 51.10 per 100,000 with a 1 percentage point increase in unemployment. This contrasts with the coefficient, *V_18_34,* which shows that larceny decreases by 159.43 per 100,000. The coefficient, *lnba*_male, shows that a 1% increase in black males is associated with a decrease in larcenies of 526.72 per 100,000. The coefficient, *lnaa_male,* which showed that a 1% increase in Asian males is associated with a decrease of larcenies by 741.33 per 100,000. The coefficient of determination for my fixed effects model was .05. Figure 7 shows the changes in the treatment and control groups occur at 5 years post-closure and again at 10 years post-closure.



Data collection is detailed in Chapter IV.

Figure 7. Larcenies in Treatment and Control Groups Post-Closure.

D. ROBUSTNESS CHECKS

To test for the presence of heteroskedasticity in my models, I utilized two tests. First, I tested for its presence using a Breusch-Pagan test. This test allowed for a test of heteroskedasticity in linear form (Williams, 2015). I created predicted values for two of my previously utilized dependent variables, property crime and violent crime. I then estimated these auxiliary regressions and obtained F-test values of 0. The results for property crime and violent crime both show an absence of heteroskedasticy.

I also conducted a White test to check for heteroskedasticity which allowed for more generalized testing (Williams, 2015). My results showed F-tests of 0 for both categories of crime utilized in my research indicating the absence of heteroskedasticity. Next, I re-estimated my models with standard errors adjusted for heteroskedasticity utilizing the “robust” option in STATA 14.2. Upon

examination, the standard errors and adjusted standard errors remained relatively the same. I also log-transformed some of my control variables as further specification checks. Appendices A and B contain visual displays of my robustness checks. Appendix C reports the results with heteroskedasticity-adjusted standard errors.

To summarize, the results from this study indicate significant reductions in property crime and violent crime for cities where an installation closed when compared to cities with no closure. The descriptive statistics show a lesser amount of police manpower available in cities that experienced a closure relative to those without. Police operating budgets were smaller in cities that experienced a closure compared to those that did not. Additionally, the unemployment rate was higher in cities that experienced a closure compared to cities that did not. Thus, in models controlling for these other factors such as police manpower and operating budget, as well as city fixed effects, it makes sense that the negative effects of BRAC on crime dampened and became less significant.

The results of the Hausman test indicated that a fixed effects model was preferred. For property and violent crime, both economic and demographic variables proved to be statistically significant. Regardless of the year of closure, the reduction of crime for the treatment group declined faster than the control group after approximately 5 years and again at 10 years.

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VI. CONCLUSION

A. CONCLUSIONS FROM STUDY

The purpose of my thesis was to examine the effects a military installation's closure has on crime in a given community. Base closures occur through a formalized process called BRAC, which works with the DOD and Congress to close or realign military forces across the United States. BRAC is seen as a cost-saving measure for the DOD, or as a means to achieve national security objectives as outlined by the president. The most recent BRAC began in 2005 and resulted in the closure of bases up until the year 2013.

To study the effects of BRAC on crime, I estimated a difference-in-differences model utilizing panel data of cities over the period 2000–2014. For my dependent variables, I employ crime data collected by the FBI's UCR program, which relies on law enforcement agencies across the United States to report crimes known to police. The UCR separates these crimes into crimes against property and violent crime. I began with a baseline OLS estimate of the difference-in-differences estimator, and then included independent variables consistent with the literature on crime. These variables are unemployment rates, veteran populations, and demographic composition of the communities. Finally, I estimated the effects of BRAC on crime using city fixed effects.

To examine the effect BRAC has on various crimes, I focused on property and violent crime totals. Next, I estimated the effects of BRAC on a particular type of property and violent crime, in particular larceny and robbery.

Overall, my estimates indicate that I can confidently reject the hypothesis that the presence of a military base serves as a deterrent against criminal activity. There are three main findings. First, the effects of BRAC on property and violent crimes is such that cities that had a BRAC saw crime rates significantly fall compared to cities that did not experience a BRAC. Second, there seems to be a greater decline in property crime than in violent crime associated with a

BRAC. Third, the data shows that demographics and economic variables have a statistically significant effect on certain types of crime. Ultimately, my study requires more research to explain the reductions in criminal activity.

B. RECOMMENDATIONS FOR FURTHER RESEARCH

My thesis focused on data from the most recent BRAC, which occurred in 2005. This round of closures was the most recent, with the earlier BRAC closures occurring over 20 years ago. Given how recent the closure round was, I am only able to estimate the effects of BRAC on crime for about 10 years after an installation's closure. I would encourage further research on the effects of BRAC on crime utilizing an expanded time series to examine the long-term effects on a community. Additionally, I recommend the variables below be refined in order to better capture their effects in the models utilized in my study.

1. Law Enforcement Manpower

One of the limitations of my research was the inclusion of law enforcement support staff into the total number for police manning as an independent variable. For accuracy of the true effect of policing power, I recommend isolating support staff and incorporate only those officers with arresting powers for police staffing. The decision to aggregate the data on police departments with jurisdictional authority over the cities included in the study was made based on the limited amount of time and resources available. The aggregate data is directly available from the FBI's CJIS department, which maintains manpower records on all law enforcement agencies that participate in the UCR program.

2. Foreclosure Data

The literature I reviewed indicated a connection between foreclosures and crime (Cui & Walsh, 2014). Foreclosed homes tend to be in a poor condition compared to occupied homes in the community, creating the perception that illegitimate activities occur there. The deterrence effect is weakened, and crime increases. I was unable to obtain foreclosure information for my thesis for the

time series and locations utilized in my sample. However, this information is available from realty companies for purchase. The inclusion of this data as an independent variable may provide further insight as to the effects of BRAC on crime.

3. Military Population

Another limitation of this study relates to the independent variables capturing population sizes by racial/ethnic category. An additional variable to capture demographics should be the size of the military population in a particular town. Analyzing the military population in relation to a city's particular crime rate provides a more accurate interpretation of the changes, if any, following a BRAC for a given installation. The population variables provided by the census data vice the specific military population for the installation may also fail to fully capture the de-population that occurs with a base closure, as well as failing to capture the time constraints and opportunities for crime.

This thesis focused on the changes occurring at the city level, utilizing comparable economic factors for other cities in a control group. Additional research on the BRAC process resulting in an installation's realignment or expansion vice closure may lead to credible data on a military installation's ability to create a deterrence effect on local crime.

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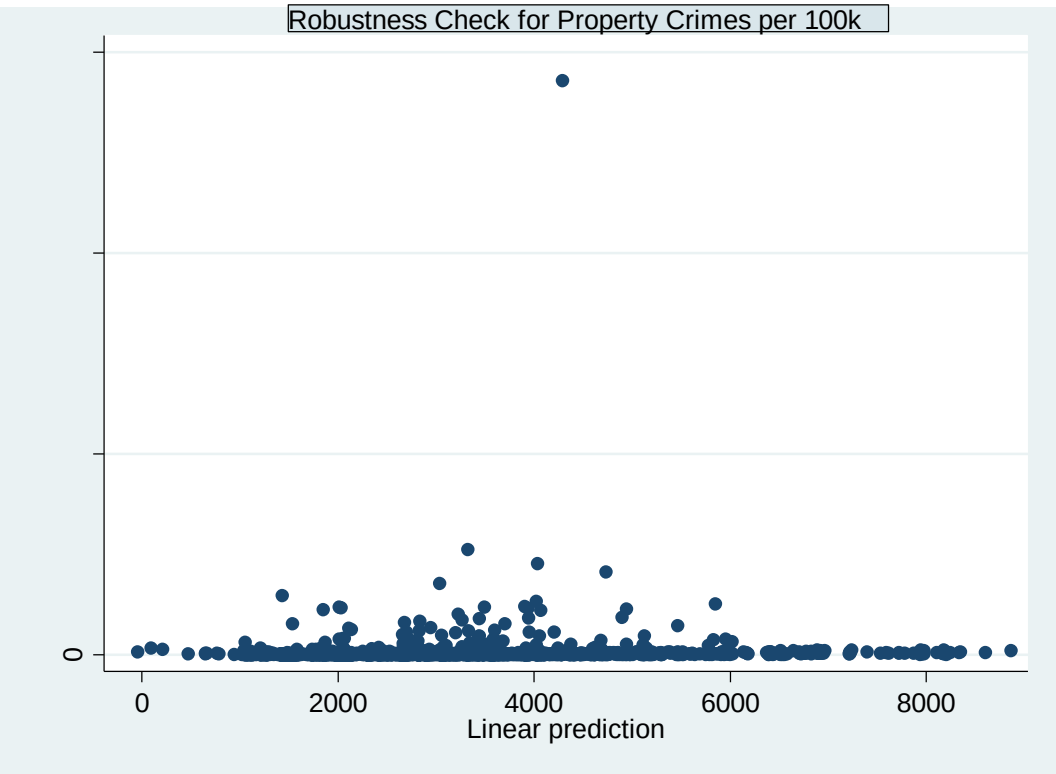
APPENDIX A. ROBUSTNESS CHECK FOR PROPERTY CRIME AS THE DEPENDENT VARIABLE



Data collection is detailed in Chapter IV.

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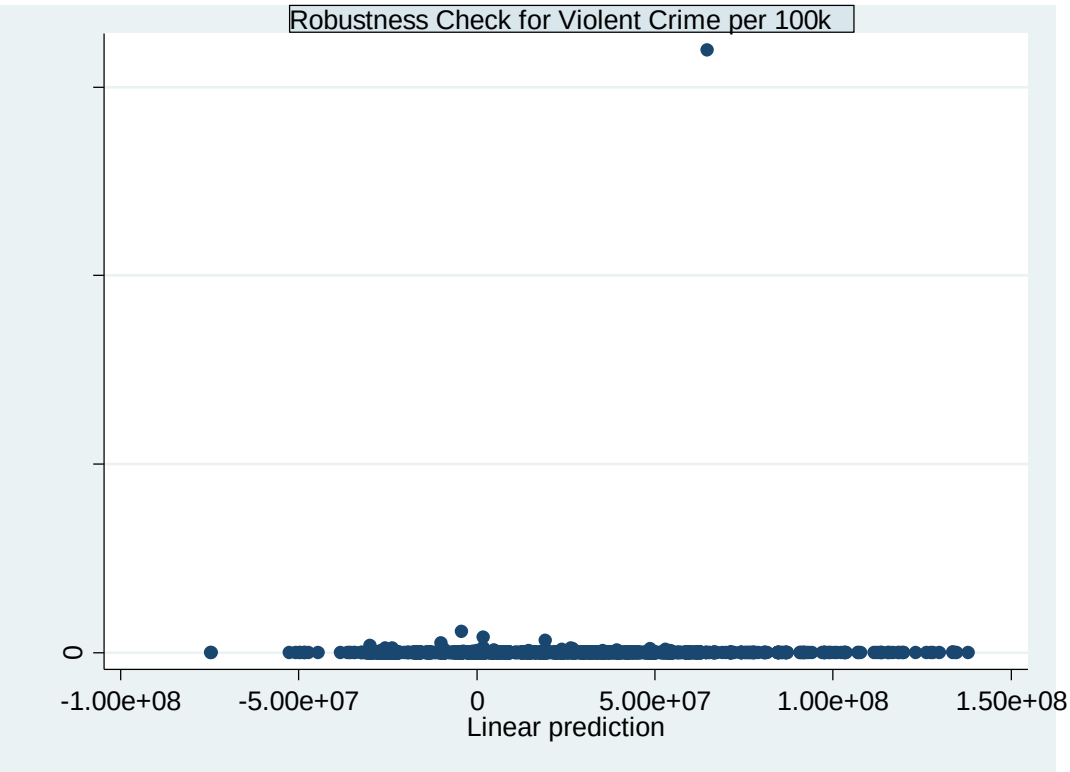
APPENDIX B. ROBUSTNESS CHECK FOR VIOLENT CRIME AS THE DEPENDENT VARIABLE



Data collection is detailed in Chapter IV.

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APPENDIX C. ADJUSTED STANDARD ERRORS FOR PROPERTY CRIME

VARIABLES	(1) Adj SE
Time	1,042.207*
	(597.936)
BRAC	624.232
	(5,561.596)
TW	-2,207.053
	(1,393.745)
Police_Lag	0.415
	(0.429)
Bud_Lag	-0.000
	(0.000)
Unemp_	130.974*
	(74.941)
v_18_34	-223.692**
	(93.483)
lnwa_male	1,264.030
	(1,920.900)
lnba_male	-137.571
	(1,144.793)
lnh_male	-644.010
	(1,622.471)
lnaa_male	-973.466
	(1,599.521)
Constant	3,568.717
	(12,448.508)
Observations	3,797
Number of Place_FIPS	1,259
R-squared	0.045

Data collection is detailed in Chapter IV.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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APPENDIX D. ADJUSTED STANDARD ERRORS FOR VIOLENT CRIME

VARIABLES	(1) Adj SE
Time	284.671***
	(96.235)
BRAC	258.141
	(1,068.309)
TW	-126.926
	(370.118)
Police_Lag	0.089
	(0.074)
Bud_Lag	-0.000
	(0.000)
Unemp_	24.838
	(17.429)
v_18_34	-44.370***
	(16.221)
lnwa_male	381.848
	(370.966)
lnba_male	247.414
	(205.423)
lnh_male	-272.725
	(310.887)
lnaa_male	-159.530
	(294.284)
Constant	-1,802.381
	(2,361.703)
Observations	3,721
Number of Place_FIPS	1,248
R-squared	0.034

Data collection is detailed in Chapter IV.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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