

## ABSTRACT

### Re-defining Rationality: An Analysis of Criminal Behavior

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At the core of economics is the idea that humans behave rationally and will maximize their own utility in any given situation. Illegal behavior, then, can be hard to explain; a criminal must reason that breaking the law is worth the potential benefit their action could bring. Traditional studies examining the motivations behind crime have been divided, with economic theory on one side and sociological, biological or psychological theory on the other. Only recently have researchers considered variables from both of these categories simultaneously in crime modeling. This thesis treats the combined model of Peter-Jan Engelen, Michel W. Lander, and Marc van Essen in "What determines crime rates? An empirical test of integrated economic and sociological theories of criminal behavior" as a basis for an exploring what factors determine crime rates, and expands upon it through the addition of five novel predictors. County-level panel data testing from North Carolina finds that previously unconsidered factors correlate to violent and property crime in the state. These results are then discussed in a legal context, with deterrence methods as well as the effectiveness of current sentencing and rehabilitation practices in mind.

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RE-DEFINING RATIONALITY: AN ANALYSIS OF CRIMINAL BEHAVIOR

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## PREFACE

Dear reader,

Whether you realize it or not, the choices you make every day are not merely your own. Your actions are a product of everything around you; your experiences, your community, your education, your government, etc. The moments of a life are like snowflakes in that they so unique that none can be replicated and so beautiful that it is tragic they might float away in an instant.

This is an important concept to understand in preparation for further reading of this thesis. I am not saying to deny responsibility for your actions, but rather acknowledge the things you can change with ease. For more difficult matters, give your fiercest effort to improve the surroundings that inevitably influence you and your peers.

This thesis concerns crime, and while the subset of the population involved in illegal activities might be small, do not think that the lessons in this paper are ones you are exempt from.

My future aspirations in the legal field as well as my love for economic thought inspired what comes next, but it is my sincerest hope that the concepts and research I expound upon are brought forth in an accessible manner so each reader can take with them the gift of a lesson, whatever that might be.

## ACKNOWLEDGEMENTS

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This project would not have been possible without the love and support of my amazing parents, Edward and Lynn Feragen, as well as my brother Mitchell Feragen and my grandfather Russ Abrams. My family will always keep me rooted to the ground in times of stress and carry me on their shoulders in times of success.

Lastly, I would like to thank the Honors College for pushing students like me to challenge academics and for harboring values of commitment and organization in their pupils.

I place on record my gratitude for all those who, in direct or indirect manners, have played a part in this grand venture.

## CHAPTER ONE

### A Literary Review of Crime, Economics, & Science

More often than not, the media's focus on justice is centered around crime. What the tabloids and news anchors highlight is the deed itself; the number of casualties, the price tag on the stolen car, or the high speed chase down the interstate. But the attention on the basic who, what, when, and where is ultimately hurting the effectiveness of the criminal justice system, and in turn, the productiveness of society as a whole. Instead, the question that should be asked and answered is why do these crimes occur. This proves much more difficult to answer, but is worth the time.

Two fields of study have made considerable strides towards tackling this issue: economics and the life sciences. Economists have created models of behavior that explain the cost versus benefit rationale that evolves from a world of scarcity, in relation to both short and long-term satisfaction. In this approach, it is vital that one treat those that do commit crimes just as those who don't—all humans are rational creatures that act for themselves. On the other hand, biologists and sociologists often use the differences between peoples to analyze their actions. How economics defines what is "rational," however, may differ from what the everyday individual sees as rational. Factors such as brain chemistry and childhood environment are taken into account in attempting to recognize what makes someone more or less likely to commit a crime. Unfortunately, there is little research that successfully resolves the gap between these two approaches. The issue at hand here is adjusting the traditional economic model to include these more recent scientific inputs, and applying this updated version to both the judicial and criminal justice systems to further reduce rates of recidivism. In resolving this divide,



crime can more effectively be deterred and even prevented, increasing the successes of both human beings and institutions.

### *The Fundamentals of Crime & Economic Theory*

Economics tells us that all rational decision-makers think at the margin. The choice of activity, legal or illegal, is made with the same thought process. When an individual sees the benefits of a crime outweighing the potential risks or costs involved, it is rational for them to partake in the illegal activity, because offenders respond to incentives the same way as those who keep their actions legitimate. The number of felonies committed, for example, is positively correlated to the calculation of potential gains, and negatively related to the same calculation of estimates of cost (Ehrlich, 1973). Crimes against persons and crime against property have similar elasticity, in this regard. Therefore, the legitimate opportunities available to someone surely impact how big the incentives in either direction may be. The research of economists has supported these fundamentals. Further discussion of economic decision-making is crucial to forming a context before addressing how to best handle crime.

Evaluating the potential of a person to commit a crime involves a series of relevant questions related to how one values long-term achievement over short-term gratification. Factors such as gender, race, and age can be considered in various approaches, but in doing so more variables are added to the equation. During the early part of the 21<sup>st</sup> Century, economist Jeffrey R. Kling helped pave the way for research in the field of crime economics. One of his most memorable studies involved the idea of propensity, or likelihood to commit a crime, in relation to where an individual lived. Looking at this connection via the Moving to Opportunity experiment (MTO), Kling and

others found that relocation to areas with less crime effected males and females differently (Kling et al, 2007). The move proved beneficial to young girls' mental health, and their levels of criminal behaviors lessened. On the other hand, boys experienced mixed or adverse effects in regards to problem behavior and property crime rates, as a comparative advantage in exploiting property existed in new locations (Kling et al, 2005). When a unique opportunity to steal in the form of new, higher-price property presented itself, the boys saw the risk as worth taking. Additional research performed by Kling on the MTO study found only 2% of the differences in violent crime arrest rates for young males could be explained by differences in neighborhood rates. The young men did not see new opportunity in violent crime as they had when considering property crime. Kling concluded the overall reduction in violent crime levels offset increased property crime rates, in a social-cost outlook (Ludwig & Kling, 2007). The link between a person's neighborhood and individual outcomes, known as "contagion," was found to be weaker than previously imagined. This finding bodes well for the traditional economic model, where the population is not often differentiated. On the other hand, Kling noted that attention should be paid to racial segregation and gang or drug activity. And thus, the early stages of research in crime economics began to rule out and identify factors of criminal choice. Nearly a decade after these studies were conducted, the same concerns are at the forefront of addressing crime.

One situation in which the weight might more naturally fall towards favoring crime is when wages or employment prospects are low. Again, economic opportunity has made itself a primary consideration in predicting choice. Authors Machin and Meghir explored the relationship between rising crime rates and the worsening labor

market positions of the most unskilled workers, taking data from England and Wales police force records from the mid-1970's to the mid-1990's (2004). A simple choice theoretical model of crime participation and labor supply was used, giving an individual four choices: 1) engage in crime and work, 2) engage in crime while unemployed, 3) avoid crime while employed, or 4) avoid crime while unemployed. The model predicted that crime should be higher where wages were at the bottom end of the spectrum. This trend was more apparent in areas of little opportunity, less effective policing, historically high crime rates, and high payout from criminal activity. Results point to a robust relationship between crime and wages; when wage rates were at their lowest, more crime (specifically property and vehicle crime) was committed (Machin & Meghir, 2004). This brings a new perspective to the relationship between choice and employment, with wages a crucial actor. How much influence this variable has when compared to other choice variables remains to be seen.

### *The Market for Crime*

Another side of the same coin, the economic benefits that can come from organized crime are worth noting in analyzing choice incentives. Organized crime can provide citizen consumers with desired illicit goods and services; e.g., the black market. Illegitimate businesses operate outside the control of the American government, making monopoly of certain fields a real option where the profits are tempting. When conflicts occur in illicit operations, they are often but not always resolved in a non-violent manner as to not draw attention. Most of the time, this involves extortion, the true business of organized crime. Choosing a target to extort involves numerous considerations, such as which victims' activities are most available to monitor, who owns a regular business that

is inescapable, and which victims will be able to meet demands, or tribute (Schelling, 1971). Solid cash-flow businesses like laundromats are most known for being able to pay this tribute. As additional profit, extortionists can install things like vending machines to meet racketeering purposes and argue that they provide property and protection. Interestingly enough, the biggest victims of organized crime are the bookkeepers themselves. Without the organization, they would have no business; they understand the difficulties of operating a legitimate company better than others (Schelling, 1971). In this sense, they are easily controlled, and organized crime can continue to do its job in suppressing supply by rival competitors. Remarkably, criminal activity is a marketplace of its own, with a multitude of capable actors. If the possibilities for legitimate and profitable jobs were wider, or the potential profits from illegitimate operations less, the choice between options might not portray organized crime as more favorable.

### *Overconfidence: The Start of the Overlap*

An additional area of economic study that is relevant to crime research is overconfidence. Overconfidence is the difference between self and others-risk, and has been shown to be a pervasive human trait that affects all facets of life. While the relationship between crime and overconfidence is a relatively new field of research, it has been shown that overconfidence is likely to develop in outcomes of low probabilities and fast or clear feedback, which crimes provide (Loughran et al, 2013). People may underestimate their likelihood for the risk of apprehension, and because people tend to take too much credit for their successes, the signals provided by not getting caught are strong. These strong signals induce further crime (Loughran et al, 2013). Authors Loughran, Paternoster, Piquero, and Fagan examined the economic phenomena of

overconfidence by sampling high school students who committed minor offenses and serious juvenile offenders with felony arrests (2013). The study related perceived risk of others to perceived self-risk, and the subsequent risks involved in decision-making. Using surveys of the two groups and a model of self-reported delinquency allowing overconfidence (OC) to serve as a function of other risk, results revealed that overconfidence is positively related to offending. Additionally, the research showed a decreasing overconfidence in risk perception that became more in line with actual ability in serious repeat-offenders over time. Therefore, overconfidence is somewhat corrected through punishment. It unknown, however, how ones self-perception could be altered in favor of legal activities preemptively. Economics cannot answer this problem alone. Ultimately, overconfidence is a useful economic measure that introduces concepts from the life sciences, the next major category of research from which criminal behavior can be evaluated.

### *The Fundamentals of Crime & Life Sciences*

The life sciences involve studies of biology, psychology, and childhood development, among other areas. The exploration of these topics in relation to crime is a new development, and worth discussion. Understanding human nature and anatomy is at the core of understanding decision-making, which has already been established as an economic phenomenon. While crime in some aspects might be explained by rational thinking at the margin, it is possible that how a person defines what is rational may differ. It is in this matter that human nature proves itself to be an important part of understanding criminal behavior.

Criminology could benefit from addressing the psychological effects of criminal justice, both before and after punishment. The lack of focus on the crimogenic nature of incarceration is surprising, considering the potential of psychology to explain the root cause of relationships between incarceration and recidivism. Relapse into criminal behavior is something classic economics often wrestles with, as the justice system is meant to disincentivize crime (Walters, 2012). Antisocial cognition (Andrews et al, 2006), mental diagnoses (Quinsey, 2010; Stern, 2010), juvenile delinquency (Loeber et al, 1998; Janis & Mann, 1977), and the reliability of psychological checklists (Hare, 2003; Boccaccini et al, 2008) are all current areas of interest for psychologists. One of the most relevant applications of criminal psychology involves the overlap between drug use and crime (Hammersley, 2008). While this relationship has been recognized, its connection is still misunderstood. The “routine activity theory” has shed light in this area: it holds that crime requires a suitable target, a motivated offender, and the absence of capable guardians against crime. As explained by Mary McMurren, this theory links drugs and crime to social-cognitive psychological variables, which give way to the repetition of criminal behavior (McMurren & Ward, 2010). Additionally, relating antisocial cognition to the functions of risk, need, and responsivity that are central to crime provides a new response that could threaten the traditional rational standard economics relies on.

Bolstering the relevance of psychological influences, biological and environmental risk factors help explain the complicated foundation of criminal behavior. Michael Rocque, Brandon C. Welsh, and Adrian Raine surveyed risk factors (prior factors that increase the probability of criminal or deviant behavior) and tied them back to

the public duty of preventing crime (2012). While the connotation of biological crime prevention is poor due to the historical eugenics movement, the impact of biological triggers cannot be denied. For example, Rocque and others report that some homicides are linked to reduced glucose metabolism in the prefrontal cortex, and perhaps 70% of children diagnosed with conduct disorder go on to have a criminal conviction later in life. That being said, the authors recognized that the psychological portion of the biosocial equation is the one that can be most influenced through crime prevention strategies. Mental illness programs have been shown to help prevent the onset of disorders like psychosis and anxiety, leading to large implications for crime prevention. Other developmental prevention programs could find success as well, as research has found that early-life intervention encourages healthy brain development (Rocque et al, 2012). Of the four major categories of crime prevention programs (developmental prevention, community prevention, situational prevention, and criminal justice prevention) it can be seen that developmental prevention is the newest, holds the most potential, and deserves more attention in research (Rocque et al, 2012). That being said, economics does not adequately address the possibility of psychological rehabilitation. Instead, it focuses on disincentivizing crime rather than changing the criminal themselves. The environment of and attitude towards a person's life is crucial to the understanding of criminal choices, and should not be ignored in future models.

Choice is naturally a function of the brain, and theories of biological choice could change the way economists view rational behavior. The most developed of these ideas is the dual processes theory, which explains both choice processes and short-term immediate responses to stimuli by dividing cognitive processes into two groups, System

1 and System 2 (Coyne & Eck, 2015). In System 1, processes are "unconscious, universal, implicit, a default, and separate from working memory and intelligence," while System 2 processes are "conscious, controlled, high effort, rational, linked to intelligence and memory, and uniquely human". As System 1 is the primary method of thought and cannot be turned off, offenders often allow this system to make choices for them, only using System 2 to handle anomalies in their crime situations (Coyne & Eck, 2015). Additionally, as System 2 is responsible for self-control, this check on System 1's impulse is absent during the commission of a crime by someone experienced enough to use a heuristic or script. In relation to drug use for example, abuse of both legal and illegal substances cause altered brain chemistry that weakens the interactions of System 1 and System 2 (Coyne & Eck, 2015). Ultimately, the situational choice theory presented requires that crime prevention aims to alter the immediate setting of offender decision-making and take into account the value of changing the way these offenders think.

#### *Another Overlap: Bounded Rationality*

Just as the concept of overconfidence did for economics, the theory of bounded rationality has presented a middle ground that aims to find a solution to the independence between studies of economic choice and sociological choice (Coyne & Eck, 2015). Bounded rationality finds that people do weigh the pros and cons before making choices, but that full information is never available for this process. Instead, people use timesaving short cuts called heuristics that allow satisfactory, but not always optimal, decision-making. In addition to heuristics, "scripts" allow offenders to apply past experience to their choices. Scripts serve as patterned instructions for the brain to follow when a set is successful. In this regard, no true risk-reward evaluation is required to



perform a series of actions. For example, theft can be systemized into the following script: 1) make sure no one is watching, 2) remove price tag, 3) walk out of the store with item hidden. Recent studies argue that the term "rationality" in and of itself is not helpful in describing crime; considering heuristics and scripts, the pros and cons of each situation are not required to be weighed. Instead, "situational choice" is a favored term. Crime prevention from this point of view then diverges to two solutions. The first is to alter the situational stimuli to encourage the good behavior and discourage the bad; the second, to help people develop improved cognitive processes that lead to those desired good outcomes (Coyne & Eck, 2015).

#### *Addressing the World Post-Crime*

Now that the preemptory context of crime has been debated, the second portion of studying the interaction between economics and life sciences in regards to the criminal justice system comes via addressing prevention and recidivism. After conviction, the life of a criminal offender changes dramatically. Their home is an incarceration facility of the state, their family a community of like-minded delinquents, and their future prospects a remnant of what they once were. The severity of these results, however, varies on a case-by-case basis. With critics of the United States justice system noting issues such as overcrowding and long trial periods, one may question the effectiveness of such a damaged system of discipline. Additionally, judicial history reveals that the courts have treated cases differently: some through an empirical approach that suggest revisions to behavioral models, and others that take behavioral models as a given, applying specific areas of law to broader legal concepts (Hayden & Ellis, 2006). This question of proper legal interpretation is a broad and essential application that will receive attention in later

chapters. Surely the criminals themselves have the ability to recognize these faults and exploit them, both before and after committing a crime. In this essence, it is vital that the current standards of the justice process be evaluated in the effectiveness of its primary goal: reducing future crime. Before this step, any effective model of criminal decision-making would be rendered useless.

Once a criminal is locked away, little thought is given to their life on the inside. In "The Social Order of the Underworld," however, economics serves to explain the "seemingly irrational, truly astonishing, and often tragic world" that is prison life (Skarbek, 2014). Much of the book studies what is referred to as governance institutions, or the legal and social institutions that maintain order and economic activity through protection of property, allowing for mutually beneficial agreements, and facilitation of collective action. More often than not, criminals are denied the legal and political governance institutions we rely on, such as trustworthy police officers and fair judges. Additionally, some economic routes are not available to those incarcerated; the allure of future gains is meaningless if a criminal does not foresee future economic activity, as discussed in relation to job prospects. Prisoners thus create their own unique systems that meet their needs. Skarbek relays how in years past, "norms" have governed jails across the country, as a standard convict code placed social standards in writing, defining what is permitted versus what is not. Punishment for breaking a norm ranged in severity, as a convict could merely be ostracized or, for worse offenses, killed. While Skarbek notes that the code still exists, its impact on maintaining order in prison life weakened as the number of convicts grew fast. In the California system alone, between 1945 and 1970, the population increased 378% (Skarbek, 2014). With each additional jailing, the

proportion of violent offenders, young criminals, and minorities multiplied. The convict code could not ultimately unify the traditional prison population and the new one.

Alternatively, the demand for governance was met with a solution in prison gangs. Groupings of inmates were common in the past, but only in smaller niches of 3-4 persons who maintained self-protection ideals, rather than searching for overall control. Starting at the Deuel Vocational Institution (DVI) in the 1940's and 50's, gangs made names for themselves based on tendencies for violence, control of illicit prison marketplaces, and race, among other factors (Skarbek, 2014). The appeal of gangs often rises from demand-side factors like desire for protection. Gang members must respect a set of principles, and are often considered members for life, with obligations to help those still inside when they themselves are set free. From an economic standpoint, Skarbek states, prison gangs like the Mexican Mafia dominate the illegal drug trade, allowing the volume of substances to increase and the price levels for the prison populations to fall. The prison institutions themselves recognize the power of prison gangs, but as the more corrupt guards find benefit in aiding them, the end of this sort of social order is not in sight. With an understanding of how prisons function, it is clear that most decision-making by those incarcerated today weighs the costs of getting caught with benefits such as added protection, access to pleasures, and heightened or maintained reputation (Skarbek, 2014). This is not so different from the initial cost equation that lands offenders in jail.

If the effectiveness of the jailing system of crime is flawed, then the question of how many offenses should be punished versus unpunished remains. "Crime and Punishment: An Economic Approach" begins a discussion of crime by considering the

scope of punishable actions when compared with the properties shared by the legislative regulations (Becker, 1974). With \$4 billion in public expenditures each year on crime, in the study, Becker argues that the optimal amount of enforcement relies upon comparing this cost with the punishment and responses of offenders to change. Categories the model took into consideration included 1) the number of and costs of offenses, 2) the punishments metered out, 3) the number of convictions and public expenditures on subsequent police or courts, 4) the costs of imprisonment or punishment, and 5) the number of offenses and private expenditures on protection or apprehension of crime. The relationship between probability of conviction, punishment and convicted, and other variables is indicated as:

$$O_j = O_j(p_j, f_j, u_j)$$

The social-welfare function of modern welfare economics here gave weight to these variables, noting that when an increase in marginal damages occurs, the optimal number of offenses should decrease, changing optimal " $p_j$ " (probability the offense is convicted) and " $f_j$ " (size of punishment) values, while  $u_j$  is a portmanteau variable representing all other variables.  $O_j$  represents the total number of offenses committed during a particular period (Becker, 1974). While a potential criminal may ask if crime pays, the answer depends on the type of crime and the risks involved. With \$1 billion spent per year in the United States on punishments, the optimal policy may in fact be to combat illegal behavior by fining criminals, in order to minimize loss (Becker, 1974). Economic calculus should continue to be applied in order to determine policies that most effectively allocate resources, and thus, manage crime.

Preventing future crime, beyond the jailing system, can involve measures such as treatment programs. These initiatives seek to rehabilitate criminals from their addictions. As noted previously, substances such as illicit drugs can negatively impact the decision-making processes of the rational person. "Drug Abuse, Crime Costs, and Economic Benefits of Treatment" allowed authors Andrew S. Rajkumar and Michael T. French to compare the costs of drug abuse treatment in recent years to the effects of crime by drug-users in society (1997). The short and long-term costs of drug abuse were varied (treatment or rehab, the psychological suffering by users and their families, reduced productivity in the marketplace, etc.) but an estimate was made that 3/4ths of total social cost could be attributed to crime-related costs of drug abuse. Using data from the long-running TOPS treatment program, Rajkumar and French used the cost-of-illness method and the jury compensation method for analysis, attempting to add in intangible cost like mental harm when possible. In the end, they concluded that the benefits of avoided crime were greater than the average annual cost of rehabilitation treatment for drug users. This result reinforces the idea that preventing crime and reducing recidivism relies on much more than the punishment portion of the criminal justice system.

The core of justice institutions and their effects on the quantity of illegal actions is also a major part of disincentivizing crime. Papers "Police Bureaucracies, Their Incentives, and The War on Drugs" (1995) as well as "Relationship Between Illicit Drug Enforcement Policy and Property Crimes" (1991) led by author Bruce L. Benson have most developed this avenue. Explaining the history of the 1980's War on Drugs, the enormous increase in allocation of police resources from more serious Index I crimes to drug crimes seems to be explained by the Comprehensive Crime Act of 1984. One

section of this policy created an incentive for police agents: assets seized in the enforcement of drug crimes were shared between local/state authorities and federal authorities, which empirical evidence suggests benefited police bureaucrats (Benson, 1995). In current times, states have forfeiture statutes written into their laws to circumvent federal authority taxes and obtain the most from their seizure of contraband. Maximizing the return on losses in this manner is one post-crime measures that financially offsets the cost of illegal activities.

The difficulties of police budgeting are also at the forefront of the war on crime, as somewhat subjective measures like quality of work are determinants via number of arrests. Benson finds that traditional thought on drug crime is incorrect, and that increasing enforcement policies against its use does not in fact reduce the size of the drug market or reduce total crime commissions. Two explanations for this error exist: 1) if the demand for drugs is inelastic, and control efforts only fix the supply side, prices will rise and users will have to commit more crimes to afford drugs, and 2) if resources are shifted away from property crime to drug crime, property crime comes with less risk and is therefore more attractive (Benson, 1991). This second trend seems to most explain trends in recent years. For example, from 1982 to 1989, the percentage of those in Florida state prisons for drug use went from 9.74% to 36.6%, as drug arrests were increased three-fold (Benson, 1991). However, all categories of property crime rose by 20% or more in frequency during this period. The solution to political pressure on controlling drug markets is singular, and occurs through reallocation of resources, such as officers and cells. The "costs" of this redistribution are large; crowded resources create huge backlogs in court dockets and unsolved cases, the quality of punishment and rehabilitation efforts

in prisons decrease, and people become less willing to report crimes due to the queue (Benson, 1995). Increased efforts against drug crimes allows for increased property crime because of the increased attempts and success of previous criminals in property crime and the willingness of new persons to enter that criminal market. These issues of opportunity due to poor allocation of criminal justice resources go beyond the drug crime spectrum. It is up to justice institutions to make criminal opportunities less attractive in whatever means possible.

Finally, research has sought to demonstrate the overall effects of criminal decision-making on future prospects after serving one's sentence. If the impact on future prospects is large, and can be publicized, then crime becomes less attractive. Jeffrey R. Kling studied the negative effects of incarceration length on subsequent labor market outcomes in two separate papers of high regard. Research shows that while the jailing numbers have increased over time, much of this is due to policy (tougher sentences, call for drug arrests, increased post-release supervision) rather than a worsening in criminal activities (Kling et al, 2001). Spending time behind bars does not evenly damage employment prospects, but rather earmarks disadvantaged men and women whose job prospects were poor even before incarceration. On the other hand, earnings can suffer from the stigma of incarceration, penalties being seen from 10-30% of quarterly earnings on top of the wages lost from serving time. Minorities, as previously discussed, are more susceptible to disadvantages before and after incarceration. In the short-term after release, however, those with longer sentences are more willing to find meaningful work and generally have higher employment and income prospects, as their outside criminal connections have diminished. This is known as the "incarceration spell," and often can

be attributed to educational and vocational prison programs, like prison-based GED achievement (Kling et al, 2001). Even though the highest percentage graduates from these programs are white males, individuals that benefit the most from earning their GED while incarcerated are minorities. While the overall increase in quarterly earnings can range from \$109-181 for the first three years for graduates, after time, earnings between GED-holders and non-GED holders do not significantly differ (Kling et al, 2006).

### *The Big Picture of Criminal Behavior Research*

After much literary review, certain concepts are clear. The choices of criminals are, at the core, rational; in the end, the benefits of partaking in an illicit activity outweigh the costs. There is much more than a standard cost analysis that goes into these choices, however; humans are unique and should be evaluated as such. As much as a traditional, economic criminal propensity model is useful in predicting criminal behavior, the model has room for improvement through the addition of life science variables. Models are made in order to simplify trends or patterns, but too simple of a model will serve future generations poorly. Further, once a criminal is apprehended, the path that their punishment or rehabilitation can take is varied, especially due to the differences in judicial verdict approaches. This variation needs to be accounted for when attempting to find a unified approach that reduces crime. The current system of criminal justice is flawed, but addressing these issues can serve to correct it and improve the productivity of the nation. The next chapters will elaborate on a recent, chosen economic model of crime as well as courtroom applications of both new and old understandings of criminal behavior.



## CHAPTER TWO

### The Economic Model

Research has supported the idea that there are many options in creating a model to determine criminal propensity. Inputs that are economic have historically been separated from sociological variables. Why these points of views did not find harmony in past models is unclear—perhaps experts believed the two approaches were irreconcilable. Thankfully, the issue of criminal behavior has found itself in the limelight once again, and progress in crime modeling is being made. With the inclusion of both life science and economic factors, recent empirical testing can serve as a new foundation for the method in which crime is predicted, punished, and even deterred, leading to a safer world for all.

#### *Examining the Central Integrated Model*

The divide between the aforementioned foci of crime was recently addressed head-on by Peter-Jan Engelen, Michel W. Lander, and Marc van Essen in a publication named “What determines crime rates? An empirical test of integrated economic and sociological theories of criminal behavior.” In contributing to the body of literature on this subject, the researchers sought to start fresh: constructing a new database with 22 explanatory variables, paired with a detailed set of deterrence variables (e.g. conviction rate, sentence length), their test integrates variables from both social science and economic disciplines in a meaningful way.

The results of this model proved effectual at determining relationships between economics and crime rates, as well as sociological factors and crime rates. Higher

proportions of arrests, convictions, imprisonment, increased sentence severity, the presence of life and death sentences, as well as the size of the police force all showed to have a negative effect on both rates of property and violent crime. Deterrence methods seem to do their job or have no effect on criminal probabilities, except for the conviction rate: when high, results indicate higher levels of crime. From the sociologic theory of social disorganization, lower levels of population heterogeneity (cultural variance) and the absence of minority groups lead to lower levels of crime. Recall that social disorganization emphasizes that location matters; an individual's residence is as or even more important as a criminal behavior predictor than their demographics. Additionally, the routine activity theory held, as higher levels of household size and unemployment increase guardianship (the ability of household members to look after another) and reduce the possibilities for illegal behavior. This follows from the need for a capable guardian to prevent crime, as routine activity theory notes the lack of these guardians as a crucial condition for crime to occur. From structural strain theory, education expenditure per pupil was used as a means to calculate the possibility of realizing culturally aspired goals. With more concrete societal structures, like a supported educational system, an individual will be affected in a positive manner and have a better outlook on their own opportunities. These results are generally consistent with previous literature such as Becker and Ehrlich, but it is more so the inclusive model through which they were determined that makes its defining mark on the field.

Ultimately, the integrated model was found to impact the results of some traditional testing. Certain variables lost their potency once they were introduced alongside variables that they were normally not compared to in purely economic or social

models. But since the comprehensive models show a better fit with the data as compared with simple models, it can be argued that it is worth the effort to include additional variables to this integrated test. Society cannot be separated into areas of economics and social behavior, and so it is not ideal for models to do so. In continuation, this paper seeks to mimic the model of Engelen, Lander, and van Essen through running additional analysis on the original model, but more notably by introducing and testing five new variables of both economic and sociologic importance to determine their impact on an individual's propensity to commit a crime.

### *Replication & Novel Economic Research*

To replicate the “What determines crime rates? An empirical test of integrated economic and sociological theories of criminal behavior” results and conduct new testing, panel data regressions were run in the statistical analysis program STATA. Regressions were specified with a North Carolina “county identifier” (a number 1-100 based on an alphabetical listing of counties) and the time variable “year.” This follows a random-effects OLS panel model, specified with robust standard error testing. Tests were conducted using variables that were classified into groupings from the paper: economic variables, social variables, and control variables. Tests themselves were separated into three sets, as well: an economic model, a sociological model, and an integrated model that included all variables. To address terminology, any mention of “mimicking” or “replicating” the original study refers to this process in which an update was created with a data set similar yet not identical to that of the Engelen paper. Figures 1 and 2 reveal replication results for both violent and property crime. This update was necessary for analysis, and while much of the county-level data used by Engelen and his cohorts was

recovered, not all data for proxies is identical. Reaching out to the authors of "What determines crime rates? An empirical test of integrated economic and sociological theories of criminal behavior" proved unsuccessful, and no comment was received on their research. Chapter 2 discusses regressions of both replicated and new variables of interest in regards to the economic model, while Chapter 3 does the same with the sociological model and Chapter 4 the integrated model. With an understanding of methods, three novel economic variables introduced in this thesis and their impact on crime habits can now be evaluated in context.

#### *Variable 1: Future Employment*

The first economic variable of interest is the future employment prospects of those who are convicted of criminal charges. Employment information is considered economic in nature because employment and wages not only impact a person's personal life (through means of disposable income, taxes paid or benefits received, etc.) but also contributes to national-level information like the unemployment rate and a country's GDP. Literature in Chapter 1 indicates that the impact on future prospects in this area is mixed after conviction and release from the justice system; in many cases, employability suffers but wages do not. Recent "redemption" research has studied the interaction between fact and perception in regards to offenders who have reintegrated into daily life. Someone's propensity to commit a future violent crime decreases as the person's crime-free duration of living increases (Moses, 2014). Unfortunately, while redemption research provides this scientific support, criminology has not generated enough evidence to enable it to provide "actuarially-based judgments as to when individuals with a criminal background...pose no significant likelihood of committing a new crime"

(Moses, 2014). As this thesis goes to show, the task of predicting criminal likelihood is too complex for any one theory to tackle with success.

With the negative first impression that a criminal history provides, it is no wonder that inmate reintegration programs exist to aid newly released convicts with finding occupations, among other tasks. The success of these programs has been debated, but one study finds that those of age 27 and older are statistically less likely to report crime and arrest when they are provided with employment opportunities, versus when they are not (Uggen, 2001). It is not often that studies like these turn the typical discussion of “how does criminal history effect employment” on its head. In this research, the question of how does employment opportunity effect criminal propensity is of much more value.

In order to measure for employability prospects, a proxy was derived from the number of service providers in each county qualified to assess or aid in the area of “employability” via the North Carolina Department of Corrections County Resource Guide. The annual number of providers was calculated based on the inception of each institution. Because the list is constantly updated and earlier versions are unavailable, failed or closed agencies are not accounted for. Data was retrieved for all 100 North Carolina counties for both time period groupings, 2001-2005 and 2007-2010. The “employability” life area, as it is referred to by the NC DPS Office of Research and Planning, includes organizations that issue employment credentials (e.g. social security cards), organizations that provide training program services to assist ex-offenders in securing employment (both public and private), and not-for-profit employment services that are community and faith-based. Quantities from all three categories were totaled for each county in order to best assess the overall accessibility of employment aid for ex-

cons. Because the job prospects of ex-offenders are limited in comparison to their options before incarceration, turning this data on its head will point to where the failures of criminal rehabilitation may hinder the effectiveness of the justice system itself.

To begin statistical analysis on the original economic model of Peter-Jan Engelen, Michel W. Lander, and Marc van Essen, their results were replicated using the same economic variables and control variables. First, the model was replicated with the ratio of violent crime as the dependent variable. This led to a regression with only 56 total observations. This low number of observations was due to the automatic dropout of “rsmonths,” the number of prison months on averaged served in each county, and “rpolice,” the average number of police officers in each county, which respectively had observations of 200 and 321 due to the lack of available data. Because not much could be concluded with these variables included, they were subsequently left out of the subsequent regression. This subsequent regression replication had 676 observations, which is higher compared to that of the original paper. This is in part due to the added updated time period of 2007-2010, alongside the replication of 2001-2005. Creating this more recent dataset allows for further annual comparisons, and goes to show if past trends continued. High statistical significance was found ( $p < .01$ ) for the proportion of arrests to offenses and Western location. Western location was determined from a listing from The North Carolina Office of Archives & History in association with The University of North Carolina Press (“Western North Carolina.”) There was also marginally statistical significance ( $p < .05$ ) for the following: the proportion of convictions to arrests and the poverty ratio. All of these variables were also found to be statistically significant in the model’s research. In the new replication, the variable measuring the

proportion of imprisonments to convictions lost the significance it held in the model study, as did the variable measuring density of population. The authors of the model paper failed to note if their measures of offenses, arrests, convictions, and imprisonments were county-level, even though most other variables in their paper are described as such. The only available data for these measures used in this thesis were state-level. County-level information could not be found through the author's directed methods of data acquisition. If the model paper's data was collected at the county level, it could explain the loss of significance of the ratio of imprisonments to convictions because trends for counties versus statewide trends for these numbers might differ.

The next step was to include the first new variable of interest, future employment prospects, into the economic model using the proxy "employability," a ratio of employability centers to county population. This regression also resulted in 676 observations, a valuable sample. Alongside the other variables, "employability" was not found to be statistically significant ( $p=.325$ ) while the four aforementioned variables of significance kept their same levels of statistical significance. This result leads to the conclusion that future employment prospects are not a factor contributing to the likelihood that an individual will commit a violent crime.

The same steps were then taken with the ratio of property crime as the dependent variable. Once again, the inclusion of the ratio of months served and the ratio of police officers severely limited the dataset and was not included in the regression discussed at length here. This resulted in a property crime ratio regression of 676 observations. The following variables were highly significant: proportion of arrests to offenses, proportion of convictions to arrests, and Western location. The following variables were moderately

significant: proportion of imprisonments to convictions and poverty ratio. Once again, the replication held similar results as the model, with slight differences. Proportion of convictions to arrests was not found to be significant in the model, and the same explanation of possible state versus county-level data applies. In the model, density of population and urban location were found to be significant, but lost their significance in the replication.

The proxy for future employment prospects was then added to the property crime regression, but once again results indicated that the ratio of employability centers was not significant in predicting criminal activities.

#### *Variable 2: Organized Crime*

Another variable considered as an economic measure for the purposes of this thesis is the presence of organized crime. It should not be forgotten that criminal organizations are in control of their own economic opportunities as a unit, operating within a black market unique to illegal activities. Gangs in particular are formed because individuals see banding together as a method to enhance their group activities and influence (Abadinsky, 1990). Because organized crime groups are vertically integrated, with agents being individual criminal firms, controlling them may involve different tactics than the individual criminal. Deterrence policies must involve specific regulation by government policies and rules against common organized crime tactics of hiding group assets such as money laundering and investment of illegal funds into legal entities (Garoupa, 2001). The traditional police tactics of enforcement may even prove more effective when less severe in regards to organized crime. The structuring of criminal organizations creates innate barriers to entry, making the life of crime less appealing, but



the barriers are destroyed when the police shut down illegitimate businesses. Further, additional police presence increases the pool of potential officers to be corrupted and participate in or turn a blind eye to the criminal group's activities (Garoupa, 2001). Similar results were found in relation to gangs and their criminal output: when gangs are shown to respond to local deterrence efforts, more deterrence may increase the level of criminal activities by the gang in competitive oligopolistic markets like that of cocaine or heroin (Garoupa, 2001). The market for crime is thus a key feature of gang presence, which makes it valuable for observation as an economic variable. Too often, gangs are viewed as the spark for crime, causing individuals who may be underappreciated or facing other personal struggles to turn to a group where they can have some form of protection, recognition, and economic opportunity. However, the marketplace for crime must already be in place for such gangs to survive. Considering gang presence as an input into criminal behavior speaks to local economic environment and tells a story of survival in a cutthroat underworld.

The organized crime proxy for data collection purposes was the number of gangs reported in a given county by local law enforcement agencies. Agencies input their observations into a state-wide database known as NC GangNET, and results are then reported each year by the Criminal Justice Analysis Center (CJAC) in a comprehensive update to the North Carolina General Assembly. Data was not available from 2001-2003 and 2005 as annual reports were not required until 2008; further, the 2007 and 2008 publications recorded a range for the number of gangs, and so the median of this range was reported for data collection. Not all 100 North Carolina counties reported observations to GangNET in the years of interest. While these imperfections could be

considered limitations on the results drawn in regards to the impact of organized crime on criminal propensity, the NC GangNET data is the first database in the state to standardize what classifies a “gang” or “gang member” and was the only system used consistently by numerous law enforcement agencies state-wide. Therefore, the 332 gang observations used to generate results should be given attention as appropriate proxies.

Methods for this replication parallel those conducted when considering future employment prospects, as discussed above. The proxy for organized crime was formatted into the variable “gangs,” which measured the ratio of gangs compared to population in each North Carolina county. When added into the economic regression in relation to violent crime, the total number of observations was 254. The proportion of arrests to offenses as well as poverty ratio variables were highly significant, while urban and Western location variables were moderately significant. Compared to the original model, urban location gained significance while population density, the proportion of convictions to arrests, and the proportion of imprisonments to convictions lost significance. Ultimately, the proxy for organized crime lacked statistical significance at  $p=0.649$ . One can conclude, then, that the presence of organized crime in the form of gangs in a given location does not necessarily impact the likelihood of commission of a violent crime.

Next, property crime was tested as the dependent variable using 254 observations. Including the variable for gang presence, items of high significance were proportion of arrests to offenses, proportion of convictions to arrests, proportion of imprisonments to convictions, and poverty ratio. Urban location held moderate significance in the replication. When compared to the original model, proportion of convictions to arrests

gained significance, while population density and Western location lost significance. Once again, gang presence was found not to be statistically significant ( $p=0.505$ ).

### *Variable 3: Overconfidence*

The third of the economic variables of interest is overconfidence. As discussed in Chapter 1, overconfidence is a human characteristic that makes an individual think in a way that underestimates their probability of being detected for committing a crime and overestimate their ability to escape the costs of such crime (Loughran et al, 2013). Overconfidence can be thought of as an economic phenomenon in the sense that it involves a cost-benefit analysis for any given decision. The bar for rationality shifts; traditional at the margin thinking does not apply, because those exhibiting overconfidence have moved that margin to a place that gives more value the product of crime and less value to potential cost of criminal behavior. Various different types of overconfidence have been identified. For example, “overestimation” involves overestimating our own abilities, “better-than-average” effect makes one believe they have more ability relative to others, and “overprecision” occurs when individuals are overconfident about their abilities to estimate uncertain future events (Loughran et al, 2013). The connection between overconfidence and crime is newly established, and because it can serve difficult to measure quantitatively, it is often ignored as an input into crime behavior models.

That being said, recent research has established ground rules in this area. “‘A Good Man Always Knows his Limitations:’: Overconfidence in Criminal Offending,” for example, found that the difference between perceived probability of apprehension between the risk to one’s self and to a generalized other (overconfidence) was pervasive

for all levels of crime (Loughran et al, 2013). To some degree, overconfidence is exhibited in all criminal behavior. Additionally, perceptions of overconfidence were related to self-reported offending. Overconfident people are more likely to offend in an unwise manner, therefore increasing their risk of apprehension (Loughran et al, 2013). If these facts remain true in present testing, one should expect a measured significant level of overconfidence to increase the probability of offending.

In regards to the current model, overconfidence requires results through the use of data via a proxy. The proxy here is the number of admitted gamblers in various counties of North Carolina. This data is collected from the North Carolina State Center for Health Statistic's annual Behavioral Risk Factor Surveillance System (BRFSS) over the years 2007-2010. Unfortunately, the survey did not take place in years prior and 2001-2005 data was not available. Respondents were asked to record "yes/no" answer to the following questions:

- 2007/2008: "Have you ever played games for money, such as casino gambling, scratch card games, video poker, or the lottery?"
- 2009/2010: "In the past 12 months, have you gambled or played any games for money?"

The lowest annual number of respondents was in the 2009 survey at 5,439 and the highest in the 2008 survey at 15,183. These surveys were conducted via landline telephones, where users would self-report. The method provides its own limitations. Many low-income households do not have landline phones, some households have switched to cell-phone only, limiting the number of responses. Further, the self-reported nature of this data relies on a level of honesty that cannot be controlled; respondents may not have

accurately answered to their gambling habits based on societal stigmas or personal feelings. Regardless of these limitations, the proxy reports 92 observations and is worth consideration as a valuable measure of overconfidence, a variable that is incalculable without creative methods of data collection. The data is formatted as a percentage of the respondents. For 2007 and 2008, the proportion of respondents who answered “yes” is displayed. For 2009 and 2010, the input is the proportion of respondents who answered something other than “never” in relation to gambling, calculated by subtracting the proportion of “never” responses from 1. Just like crime, gambling is a behavior that involves a certain level of risk, which can be underestimated when faced with the potential rewards of a big win. It is hypothesized then that the counties with higher numbers of gambling participants will see more criminal activity.

In regards to violent crime as a dependent variable, when “gamble” is included (using 92 county-level data observations) the total number of observations is 73. While this severe dropout of data is not ideal, the survey was conducted during a limited time span as discussed above, and reported in less than half of the total number of state counties. Therefore, it is best that conclusions using this data be considered with less absoluteness. The only variable of high significance in this regression is proportion of arrests to offenses, while variables of moderate significance are ratio of life sentences, poverty ratio, and population density. Compared to the model, proportion of convictions to arrests, proportion of imprisonments to convictions and Western location lost their significance, while life sentence ratio picked up statistical significance. The proxy for overconfidence was found not to be statistically significant, with a  $p=0.126$ . This result indicates that overconfidence (as measured by gambling habits) does not contribute to the

likelihood of committing a violent crime. This being said, the limitations of the dataset may overshadow the potential importance of this economic variable. In future testing, additional survey results or a different unique proxy for overconfidence should be considered.

The same process was completed after changing the dependent variable of interest to property crime, leading again to a total of 73 observations. The proportion of arrests to offenses was again found to be highly significant, while the population density was discovered to be moderately significant. It is worth noting that the proportion of imprisonments to convictions, the poverty ratio, and Western and urban location variables lost their original significance in this replication. Surprisingly, “gamble” held low significance ( $p=0.09$ ) in this regression, and is the only novel economic variable to do so in this thesis when placed into the model regression.

To complete economic testing, all new variables were tested in a regression with the same variables from the model study. With employability, gambling, and gang variables tested together, only 67 observations carried through. This limitation is due to lack of available data for these proxies. None of the new variables in this encompassing economic regression were considered statistically significant.

While organized crime and overconfidence are categorized as economic variables for the purposes of this thesis, research into the psychological nature and impacts of these phenomena also points to the overlap between economics and social science. It is with this in mind that one can continue to Chapter 3, which explains the choosing of two final testing variables whose effects on the crime propensity model are truly sociological.

## CHAPTER THREE

### The Sociological Model

With the impact of economic inputs into the combined model of criminal behavior explained, a focus can now be placed on the sociological side of this experiment. Beyond analyzing the costs and benefits of crime, research is placing emphasis on crime determinants like the level of social integration, cultural conflict, social inequality, and breakdowns of social control (Cohen, Klugel & Land, 1981). Criminals interact with their surroundings just like those who keep their pursuits legal, but are influenced or motivated in a negative fashion. Each classroom, household, and neighborhood alike holds their own communities and harbor unique interactions between members. The environment that a criminal lives in, therefore, speaks to the way a criminal sees and understands their world.

In the model paper by Engelen, Lander and van Essen, the approach of the authors was to first discuss the economic and sociologic motivations for crime individually, and then to quantify the relationship between these two sides of the field with regression analysis. In relation to sociological theories on crime, five are noted: routine activity theory, social disorganization theory, structural strain theory, deprivation theory, and subcultural theory. While the basics of many of these theories have been identified in Chapter 1 of this thesis, now is the point at which each deserves its own attention and background with the help of literature from the social sciences.

#### *A Handful of Social Theories Concerning Crime*

First, routine activity theory describes how the circumstances under which a crime is committed must involve a likely offender, a suitable target, and the absence of a capable guardian against (Cohen and Felson, 1979). This hypothesis, describing the perfect storm, has been used to explain changes in crime trends over time, and has become a cornerstone of environmental criminology, which places focus on the importance of opportunity in determining the distribution of crime (Argun and Daglar, 2016). Understanding each element is crucial to application of the theory. A suitable target can be described as a “person, an object or a place which can be attractive and fruitful for criminals” (Argun and Daglar, 2016). Whether a wallet on the side of the street or a lost child, these targets are seen by attackers as approachable and valuable. The second element, a possible offender, takes advantage of the situation placed before them in which no one is protecting their taking of the target. Likely offenders include serial criminals and novices alike; in both cases, these people fall into the temptations of a moment. Guardians are thus important in crime prevention, in that these physical or symbolic presences act to deter likely offenders (Argun and Daglar, 2016). A simple model such as routine activity theory provides a framework for crime prediction that all can understand and use.

If the tenants hold true, it would follow that prevention is possible with a simple removal of one of the three elements. The presence of a guardian is a simple thread for law enforcement agencies to follow; more police presence would mean less perfect storm-type situations. But guardians can also come in the form of family, as the more people in a household, opportunities for potential criminals to be alone with targets.



Unemployment and household size are of interest in the model study for these guardianship purposes (Engelen et al, 2015).

Social disorganization theory relates levels of crime to both structural and cultural factors, arguing that lack of regulation in neighborhoods results in failed social interactions or delinquent subcultures (Rengifo, 2009). Location is viewed as a substantial factor in predicting crime. Once again, a discussion of opportunities applies; in counties with less social stability, residents may not have a high respect for their local governments and policies, or even their neighbors. This is due to the fact that communities displaying social disorganization fail to realize the common values of its residents and maintain effective social controls (Sampson & Groves, 1989). A controlled system can become ineffective when communities are disrupted by variables such as low economic status, cultural heterogeneity, and high levels of residential mobility (Engelen et al, 2015). Therefore, median income, the level of heterogeneity (societies harboring many unique ethnicities) in a county, and the proportion of minorities in a population were sociological factors considered in the model.

The theory describing structural strain goes hand in hand with structural disorganization, but focuses more narrowly on the failure of communities to provide legitimate channels for achieving personal goals (Burton & Cullen, 1992). This failure can come in the form of a gap between aspirations and expectations, e.g. how much schooling would one like to receive versus how much they ought to receive, or even a blocking of opportunities by regulations or institutional traditions (Burton & Cullen, 1992). Chapter 2 considered the lack of economic opportunities a location with lower socioeconomic status may provide, but it is important to keep in mind that these

opportunities might be more than financial in nature. Engelen and his co-authors, for example, use county educational expenditures and unemployment as measures of structural organization (4). People will do the best with what they have or create their own fortune, so when the options are limited, the most frustrated individuals will exhibit this theory through seeking out illegitimate channels to serve their aspirations.

Deprivation theory, which is included in the analysis via a measure of poverty, links measures of inequality to crime potency in any given location. With economic success and social influence almost innate desired features of living, those that find themselves far from these things become frustrated and defeated. A certain amount of social pressure then prompts the “self-unmade man” to attempt success via channels outside the law, in order to avoid failure (Kawachi et al, 1999). When socioeconomic status is highly inconsistent in the population, the more intense the pressure is to close this gap in income by whatever means necessary (Kawachi et al, 1999). It can be hypothesized then that high levels of poverty in a county would reflect high levels of deprivation, and thus, increased criminal activity.

Finally, subcultural theory states that certain subcultures have values and attitudes that induce them to crime (Cohen & Short, 1958). A number of groups have been identified since the 1970’s: rockers, skinheads, drug users, and bouncers are a few such communities that are considered “outsider” subcultures (Banks & Moxon, 2013). When individuals with tendencies towards illicit activities or behaviors form well-organized memberships in this manner, their mutual interests (e.g. drug consumption) fuels a criminal fire. Gang presence, as introduced in Chapter 2, could serve as a reflection of the prominence of subcultural theory. Subcultures proxies of interest in the model include

urbanization, county location, population density, and the youth male population (Engelen et al, 2015). While the authors were not forthright with what values and attitudes these groups might hold that push them towards illegitimate activities, it could be said that members of each region have some form of pride in their geography or stage in life that makes them more malleable to peer influence.

### *Replication & Novel Sociological Research*

As in Chapter 2, the first step in regards to regression analysis is replication of the original model. The 476 observation sociological model by Engelen and peers included social variables of minority population, unemployment, median income, education expenditure, household size, and heterogeneity, as well as demographic variables of population density, Western location, central location, urban location, and young male population. All of the variables were included in the current replication, with the exception of heterogeneity and household size. The author's Herfindahl index measure of four ethnic groups for heterogeneity was not replicated due to lack of appropriate ethnic group data. However, the minority proxy provides a similar insight into the ethnic makeup of each county; heterogeneity is thus somewhat repetitive in the original model. No county-level data could be found in relation to household size, and thus it is not discussed in regards to this replication.

When conducting the violent crime regression, 388 observations were produced. Highly significant variables ( $p < .01$ ) include the ratio of unemployed and the population density, and while no variables were considered moderately significant ( $p < .05$ ), the minority ratio came close at  $p = 0.57$ . Comparing these results to the original sociologic model, urban location lost its significance, as did the omitted heterogeneity, while the

ratio of unemployed gained statistical significance. Running the property crime regression gave 392 observations. Population density was discovered to have high statistical significance, with urban location carrying moderate statistical significance. The incalculable heterogeneity and household size were found to carry weight in the original paper, as was the proportion of young males, which lost its significance in the new property crime sociological regression. Population density and urban location kept their statistical significance as in the model regression.

#### *Variable 4: Mental Health*

The first social science variable new to the crime modeling in this thesis is mental health. Mental health was not considered as an input variable in the Engelen model, and is added in this thesis to provide another sociological consideration. Crime is certainly a psychological matter, with individuals relying on mental checklists or patterns (Hare, 2003; Boccaccini et al, 2008) and their own perception of “rationality” to come to decisions. In many cases, it cannot be determined with certainty if an offender suffered from mental illness before their crime, or perhaps developed after commission of the crime. Diagnoses such as psychosis, schizophrenia, and affective disorders have been linked to murder, for example (Matejkowski et al, 2008) but the relationship between these items is not clear correlation or clear causation. The link between crime, recidivism, and those with mental health disorders is still strong, with evidence revealing that more than half of youth with mental disorders are re-arrested after their first offense (Cuellar et al, 2004). This bodes troubling for the future of criminal justice, as recidivism from an early age would further strain resources, produce more victims, and in a general sense make crime more commonplace.

Hope for lower crime rates comes in the form of mental health programs and therapy, provided by psychologists, rehabilitation centers, and imprisonment institutions. The close relationship between the mentally ill and the legal system comes from the intrinsic needs of the population, with interactions occurring at every junction of administering justice (Arboleda-Florez, 2009). Treatment of mental illness in the form of psychotherapy services address main goals like mental illness recovery, emotions management, institutional functioning, re-entry, risk-need, and personal growth (Bewley & Morgan, 2011). In catching diagnoses and treating individuals suffering from mental health issues early on, it is hypothesized that crime levels would fall. In exploring mental health as a determinant of crime, however, a proxy was used in the form of practicing psychologists. County-level data was obtained from the North Carolina Health Professions Data System. It is predicted here that more psychologists in a given county would indicate the need for additional mental health services, and that crime rates in these counties will be higher than those with fewer psychologists.

In running a panel regression of the same parameters as discussed in Chapter 2 for violent crime including the practicing psychologist ratio measure, 388 observations were recorded. The only statistically significant variables, the ratio of unemployed and the population density, held high significance. Compared to the original model's regression, heterogeneity and household size went untested (as they do in all further regressions) while urban location lost its statistical significance and the ratio of unemployed gained significance. The failing of the mental health proxy indicates that the number of practicing psychologists in each county does not contribute to the level of violent crime in these counties.

The same regression was run in relation to property crime, yielding 392 observations. Once again, the population density proved highly significant as an influence to property crime, while urban location proved moderately significant. The original study's finding of statistical significance for the ratio of young males did not match these results. Both the ratio of unemployed individuals and the ratio of practicing psychologists carried marginal significance ( $p=.065$ ,  $.066$ ) but are worth noting as somewhat reliable predictors considering the large sample size of this test. When considering psychologist ratios, gender and age specifications (e.g. young males) are overshadowed in weight by the prediction powers of unemployment. It could be hypothesized that the socioeconomic status of a county and its cultural attitude towards seeking help for mental health issues influences individual's need to compensate for losses through theft and other property crimes.

#### *Variable 5: Drug Use*

The final new variable introduced for purposes of crime prediction in this thesis is drug usage. As discussed in Chapter 1, the use of drugs has many implications on the decision-making processes of a future offender and overall criminal outcomes. In the brain, abuse of drugs weakens the relationship between logical thought and instinctual action (Coyne & Eck, 2015), and both the short-term and long-term costs of crime are amplified when drugs are a part of the equation (Rajkumar & French, 1997). While a causation effect between drug usage and the commission of a crime is debated, the results of crime are amplified with drug usage: "among offenders who use multiple types of drugs, individual predatory crime commission frequencies are typically two or three times higher among offenders when they use multiple types of drugs than they are for the

same offenders when they are in drug treatment or abstain from drug use” (Chaiken & Chaiken, 1990). Just as with mental health, there are options for treatment through rehabilitation centers, but in numerous cases this form of treatment is a punishment doled out by the court system rather than a preventative crime measure. Because drug use produces dangerous behavior, the law often limits drug usage in a manner justified by attempting to prevent self-damaging use and preventing harm to others (Blum et al, 1969). Unfortunately, fear of the law does not put an end to illegal drug use and all drug abuse, so the relationship between drugs and crime is one worth utmost consideration in the modern age.

To measure for drug use in the following regressions, a proxy calculating the ratio of deaths in a North Carolina county caused by drugs (whether intentional or unintentional, medication or illegal substance). This data was collected from the North Carolina Health and Human Service’s Injury and Violence Prevention Branch. In counties with higher percentages of deaths related to drug use, we should expect higher levels of crime, considering the aforementioned effects of drugs on rational choice.

The newly formed violent crime regression resulted in 388 observations when drug deaths ratio was included as a variable. The population density continued to hold high significance, and the ratio of unemployed gained high statistical significance in comparison with the model study. The ratio of minorities was found to have moderate statistical significance, where it did not on the original paper. Further, urban location lost its significance in the new regression. Population demographics matter more so than location, then, when drug usage is considered. Drug-related deaths and drug use in general is related to the racial makeup of a county, possibly pointing to a cultural trend

based on race. The ratio of drug deaths did not contribute to violent crime in a significant fashion.

The property crime regression conducted in the same manner drew from 392 observations after the inclusion of the drug use proxy. Again, the population density was found as highly significant, and urban location as moderately significant. Compared to the original model, the ratio of young males lost its power and the ratio of unemployment gained moderate significance. It is worth noting that the ratio of drug deaths was found to have a marginal level of statistical significance ( $p=0.073$ ) in relation to property crime.

An integrated model of sociological crime includes the same variables discussed from the model regression, as well as the proxies for mental health and drug use. With these both considered, a more complete picture of the social, psychological, and scientific nature of criminal behavior is presented than in past literature. In the violent crime calculation with 388 observations, the ratio of the ratio of unemployed and the population density are highly significant, while the ratio of minorities is moderately significant. The two novel variables presented in this thesis to measure sociological phenomena, the ratio of drug deaths and the ratio of psychologists at the county level, are not meaningful in their contributions to violent crime rates. In the property crime calculation with 392 observations, only the population density carries high significance while replicated variables of moderate significance include the ratio of unemployed, urban location, and the ratio of psychologists. The ratio of drug use deaths holds marginal significance ( $p=0.068$ ).

In conclusion, it has been shown through data analysis that a person's likelihood to commit a crime is at least partially a product of their social environment through



demographics, location, psychological features, and substance usage. The hypothesis, that the number of mental health facilities and the levels of drug in North Carolina counties use would impact respective crime levels, was supported with some statistical significance. It is now that an integrated model of crime in its totality—testing both traditional and novel economic and sociologic variables—is worth exploration. Chapter 4 follows with these results and provides some insight to subsequent implications on the legal field, as well.

## CHAPTER FOUR

### The Integrated Model, The Law, and Future Considerations

The exploration into criminal behavior and motivation is relatively new as a field of study, and thus, its methods have not been perfect. Although some basic economic and sociological theories have revealed their worth in the field time and time again, very few publications have connected the dots between these subjects. It was the aim of this thesis to discuss the merits of both economic inputs and social science inputs into a general equation predicting criminal propensity. By combining variables from both sides into one all-encompassing regression, this chapter will determine the strength of the effects of both economic and sociologic factors on crime rates. To conclude, these results as well as past literature will give insight into how the law treats criminals and what can be done to limit future crime.

A fully integrated model is produced in the Engelen paper, with their economic, social, and demographic variables tested in unison. 435 observations held through in the violent crime modeling, while 431 observations were used in coming to conclusions on property crime. The format of the regression implemented the standard panel data used in previous chapters. Figures 4 and 5 reveal results for fully integrated violent and property crime models. In attempting a first violent crime replication, variables considering household size and heterogeneity were not included (as in Chapter 3) due to lack of available data and repetition. A regression with the remainder of variables resulted in 0 observations, due to the overlap in dropout of the following variables: the ratio of police (321 observations), and the ratio of average months served in prison (200 observations). When these variables were subsequently removed from the regression, the

resulting data yielded results using 380 observations, a more reliable measure to compare against the model paper results. Similarly, no observations could be recorded with all variables in play for property crime analysis; the ratio of police and ratio of average months served in prison again were the cause. Additionally, a measure of fines paid used in the model was not included in this thesis due to lack of available data. The subsequent regression excluding these variables was parallel to that of violent crime in using 380 observations.

Mimicking the original integrated violent crime equation found the proportion of arrests to offenses as well as the population density to have high statistical significance ( $p < 0.01$ ), while variables of moderate statistical significance ( $p < 0.1$ ) include the poverty ratio as well as the ratio of minorities. No variables held moderate significance ( $p < 0.05$ ). The model replication found the proportion of imprisonments to convictions, as well as urban location, to have statistical significance, which was lost in the replication. The low significance variables here did not yield any statistical significance in the original regression.

Turning to the property crime replication, the proportion of arrests to offenses and the population density once again came in at highly statistically significant, while urban location holds moderate significance and the ratio of unemployed came in at low significance. Compared to the original regression, the ratio of those in poverty lost its significance, and the ratio of unemployed gained value.

#### *The Novel Comprehensive Model: An All-Inclusive Regression*

Now, it is appropriate to include all of the new proxies this thesis considered into the integrated regression: the ratio of psychologists, the ratio of drug deaths, the proportion

of gamblers, a measure of employability preparation offices, and the ratio of gangs.

Because of the low observation counts for gangs (332) and gamblers (92), a final violent crime integrated regression resulted in 67 observations used. While this smaller sample size is not ideal, including this regression is crucial for a basis in understanding how the novel variables interact with each other and those of the model. Variables of high statistical significance include the ratio of psychologists and the proportion of arrests to offenses. Western location holds moderate statistical significance, while the ratio of minorities holds low statistical significance. Looking at the coefficient signs on these variables, the following general conclusions can be reached:

- Violent crime is lower when the proportion of practicing psychologists is high ( $p=.000$ ). This provides evidence that additional mental health resources could be successfully treating the greater mental disability needs of the county.
- Violent crime is lower when the probability of arrests to offenses is high ( $p=.000$ ). Potential criminals in North Carolina respect the higher risks of arrest, and the scale tips so crime is no longer beneficial to them.
- Violent crime is higher when the potential criminal lives in a Western county ( $p=.028$ ). The cultural norms or social institutions in these counties might be fractured in a way that makes illegal actions more palatable; for example, the “bandwagon effect” discussed subsequently could apply.
- Violent crime is higher when the proportion of minorities is high ( $p=.098$ ). Social disorganization theory could explain this phenomenon, if cultural and social relationships between minorities encourage violent crime, or if they are so weak between Caucasians and minorities that tensions cause this crime.

In the same test considering property crime as the dependent variable, again only 67 observations made up the results. The ratio of psychologists and the proportion of arrests to offenses were variables considered highly significant. Moderately significant variables were the ratio of minorities as well as the median income and Western location.

- Property crime is lower when the proportion of practicing psychologists is high, as explained for violent crime ( $p=.000$ ).
- Property crime is lower when the probability of arrests to offenses is high, as explained for violent crime ( $p=.000$ ).
- Property crime is higher when the proportion of minorities is high, as explained for violent crime ( $p=.039$ ).
- Property crime is higher when the household median income level is higher ( $p=.044$ ). The opportunities to benefit from taking these lucrative targets, as explained by rational choice theory, are great because the home carries items of high value. Criminals see the potential profit in their actions more than the risk.
- Property crime is higher when the potential criminal lives in a Western county, as explained for violent crime ( $p=.048$ ).

In order to best honor these results, they must be discussed in the context of application.

The most pertinent application is that of the law and criminal justice.

### *Consequences of the Integrated Model on Criminal Justice*

Arguably, the best tool to de-incentivize crime is the law. Some of the factors discussed above, like location features, are more fixed and cannot be impacted in a major way by rules and regulations. Some behavioral economics is built into legal doctrine; the

endowment effect, for example, describes how people value items they already own more than they would pay to acquire the same items (Hayden & Ellis, 2006). Therefore, the law's punishments for property crimes are more severe than the sticker value of the item. This being said, however, it is important to remember that all crime is a product of incentives in any given moment or environment. Structuring incentives on a grand scale is a job best done by governments, through the arm of the law (Hayden & Ellis, 2006).

### *The Law and Efficiency*

Historically, judges have come to decisions that are implicitly connected to the fundamentals of economics and reflect an "efficiency hypothesis." This hypothesis recognizes that rules, procedures, and case outcomes are meant to maximize societal wealth (Hayden & Ellis, 2006). As we have seen, the economics of crime are often much more quantifiable than sociologic factors. For example, unemployment follows certain trends in North Carolina counties and countries in general that can be forecasted for. Even making evaluations for fines or damages in a case involves putting a price tag on the losses caused by crime. For these reasons, it is natural that the law and economics intermingle. But as no approach is perfect, economic theory does have its shortcomings. Economics gives an account of human action that is too simplistic, and generates policies too severe to be just (Kahan, 1997). Often times, economics ignores inputs like mistakes, social norms, and cultural roles (Hayden & Ellis, 2006). These are precisely the inputs that social science attempts to understand and quantify.

### *The Law and Human Values*

Another approach that lawmakers and those who interpret the law can subscribe to evaluates shared human values as an explanation for the extent of crime.

Subcategories of this train of thought include theories such as social organization, moral credibility, social meaning, and social influence (Kahan, 1997). Because points of view and values contribute to how a possible offender perceives their opportunities for crime, these theories should be considered routes to

Social organization evaluates the connections between the strength of social or civic associations and criminal activities, such as family bonds, strength of friendships, and social support (Kahan, 1997). Without these fundamental social institutions in place, individuals cannot be expected to operate with empathy towards other or respect for their communities. Fixing social disorganization is rooted in changing the bigger picture of how individuals interact with others and groups, the law can do its part through actions like enforcement of curfew and loitering regulations, so social responsibility is placed on guardians (Kahan, 1997). Even though the ratio of drug deaths in a county did not yield statistical significance in this report, drug use may still effect other variables of crime, such as the household size or unemployment. The law's current high punishments for nonviolent drug crimes breaks up families (Kahan, 1997) and decreases the number of available capable guardians as described by routine activity theory. With stronger and healthier interactions among societal groups, alongside appropriate legal support, variables such as minority ratios may not play as crucial of a role in predicting crime rates.

Moral credibility is the idea that individuals follow the law more often when they feel the legal system accords with their values (Kahan, 1997). Just as someone's

perception of what is rational can differ, so can his or her interpretation of justice. An example of this is that people agree that attempted crimes should not be as harshly punished as completed ones (Kahan, 1997). Considering the statistical significance of mental health in relation to crime, then, it seems justifiable that separate pleas and rehabilitation options exist for offenders that suffer from psychological disorders. These individuals do not see their options through the same lens, and their interactions with justice should be adjusted by that lens as well.

Social meaning theory describes how the economic approach of reducing crime down to the value of an action in dollars is poor, as is reducing punishment down to its effectiveness in deterring crime or inflicting punishment (Kahan, 1997). This somewhat reflects the sentiments of this thesis that economic analysis is not enough on its own to determine criminal behavior and the subsequent punishment that might ensue. Fines seem to say to offenders that they may buy the privilege of breaking the law, while reduced sentences of community service turns something that society should participate in voluntarily into a mandatory provision (Kahan, 1997). This approach places value on context, which is unique in each case of criminal action. Sometimes, context can be given through evidence, witness statements, or past relationships. But other times, this context is not as tangible, making it more difficult for judges to consider. For example, those who gamble come from a context of possible desperation, or love of thrill, which contributes to them breaking the law more than others (Kahan, 1997). While frequently overshadowed by other variables in the regressions of this paper, overconfidence in the form of gambling habits falls into this categorization of incentives, which are social or psychological and difficult to measure.



Finally, social influence identifies the propensity of individuals to conform to the behavior and expectations of others; i.e, the bandwagon effect (Kahan, 1997). Organized crime is a variable demonstrating social influence, as success of gangs and other groups depends on both the marketplace and shared ambitions of its members. Through vertical integration, conforming to the wills of the group is essential. Media and rule also play their role, as a policy that creates the impression that a certain crime is widespread makes other individuals or collective crime groups more attracted to do the same, regardless of an increase in punishment (Kahan, 1997). This phenomena is supported in part by the general lack of statistical significance in variables accounting for the proportion of life and death prison sentences; potential high costs in these forms do not outweigh the blatant opportunities for profit that a popular sector of crime is offering. People will always find crime a suitable option to meet their needs, and seemingly more so when their neighbors are in on the market, too.

### *The Law and Biology*

Biological features and theories have their place in the law, as well. The number of articles in law journals that mention biology and evolution is increasing from year to year at a rapid pace (Jones, O'Connor & Stake, 2011). Commission of a crime certainly involves changes in biological features: a thief who steals a precious jewel may experience a raised heart rate due to nervousness, a rush of endorphins, and even increased sweat production as he sits in an interrogation room after being caught. Behavior biology is equipped to predict preferences and behaviors, explaining anomalies where people act in a fashion that does not maximize their own interests (Jones, O'Connor & Stake, 2011). Often times the reality of crime is that it does not maximize

utility for a person who thought it might. The strengths of biology come from its abilities to deal with issues like scarcity (natural selection), with efficient behavior tending to survive and repeat, and pinpoint behavior causes for behavior (Jones, O'Connor & Stake, 2011). Just like any other discipline with weaknesses in predicting needed specific legal changes (Jones, O'Connor & Stake, 2011), it would do best to combine biological considerations into a legal model that evaluates all aspects of economics and social constructs.

### *Final Thoughts*

The current judicial system does not have the capabilities to interpret and assign values of harm to the specific nature and background of crimes. While punishments on state crimes are more variable and at a judge's discretion, the index crimes discussed here (major violent and property crimes) are federal in nature. Figure 6 outlines the federal sentencing for crimes based on the level of crime committed and the offender's previous criminal history ("Sentencing Table"). There is of course value in standardizing the sentencing of high-level criminals across the country; the law is based on a prescription of fairness for all accused. That being said, the two vectors of consideration used in federal sentencing tables denies the reality that much more comes into play when criminals commit crimes. The specific amount of months sentenced within the range, then, should allow for discretion towards the significant economic and sociological factors discussed at length here.

To conclude, there is much work still to be done before crime is managed with success. The world will never see a crime rate of 0%, but further research must be done into what level of crime would be optimal for all and how the legal system can best

impact that level. Advances in law and economics have slowed to an extent, because “insights gleaned from a model with a rational, static-preference, statue-reading actor have reached their logical stopping point” (Katyal, 1997). But with sociology and biology reaching legal consideration as well, more emphasis should be placed on integrating these fields. With more knowledge comes more power, and until more studies such as this thesis attempt to integrate various inputs into criminal behavior, societal progress in reducing the immense loss crime causes will come to a standstill.

FIGURE 1  
VARIABLE DEFINITIONS AND SUMMARY STATISTICS

<i>Variable</i>	<i>Description</i>	<i>Observations (n)</i>	<i>Mean</i>	<i>Std Dev</i>	<i>[Min, Max]</i>
CR <sub>VIO</sub>	The ratio of violent crime to county population	728	0.0017721	0.0019951	[0, 0.0191163]
CR <sub>PROP</sub>	The ratio of property crime to county population	732	0.0195968	0.0194595	[0, 0.1579301]
P <sub>a</sub>	The probability of arrests to offenses	725	1.684092	13.51521	[0, 246.4]
P <sub>ca</sub>	The probability of convictions to arrests	900	0.2984117	0.0173332	[0.266659, 0.3280576]
P <sub>pic</sub>	The probability of convictions resulting in prison sentences	900	0.4649587	0.0160732	[0.4297029, 0.4971504]
V <sub>recovered</sub>	The value of property recovered in a county	886	10.33821	9.426411	[0, 75.69579]
S <sub>LIFE</sub>	The ratio of life imprisonment to the number of total convictions	884	0.0004367	0.0006273	[0, 0.0138223]
S <sub>DEATH</sub>	The ratio of death sentences to the number of total convictions	841	0.0000209	0.0000272	[0, 0.000183]
Poverty	The ratio of families who money income before taxes I below a set threshold level	900	0.01487778	0.0155348	[0.125, 0.174]
Minority	The ratio of the county population that is minority or is nonwhite	900	0.2527703	0.1763563	[0.0136838, 0.6710418]
Unemployment	The ratio of the county population that is unemployed	900	0.0803322	0.0320734	[0.03, 0.217]
Education expenditure	The average education level in a county	599	0.2206835	0.3572419	[0.0052692, 2.955286]
Median income	Median household income in a county	500	1.549854	1.763938	[0.0509472, 11.87756]
Density	The ratio of county population to county total area	900	181.9736	234.2335	[8.834666, 1762.804]
Western	The probability of dummy variable equal to 1 for the counties in the Western region	900	0.28	0.4492485	Dummy Variable [0,1]
Central	The probability of dummy variable equal to 1 for the counties in the Central region	900	0.34	0.4739722	Dummy Variable [0,1]
Urban	The probability of dummy variable equal to 1 if a county is included in the metropolitan statistical area and has a population of over 50,000 citizens	900	0.3	0.4585124	Dummy Variable [0,1]
Young male	The ratio of the county population that is male and between the ages of 15 and 24	900	0.0677088	0.0213076	[0.0401714, 0.2231753]
Gangs	The ratio of county population to number of observed gangs	332	0.0001059	0.0001366	[0, 0.0011486]
Employability	The ratio of county population to number of facilities qualified to aid in employability	900	0.0001335	0.0001191	[9.94e-06, 0.0007238]
Gamble	The ratio of county population to survey respondents who gamble	92	2.56e-06	1.99e-06	[3.14e-07, 0.0000159]
Psychologists	The ratio of county population to number of practicing psychologists	900	0.0001029	0.0002011	[0, 0.0016379]
Drug deaths	The ratio of county population to number of deaths caused by drug usage	900	0.0001292	0.0000917	[0, 0.0008579]

FIGURE 2

## REPLICATION REGRESSION RESULTS: VIOLENT CRIME

<i>Economic Variables</i>	<i>Coefficient</i>	<i>Std Err</i>	<i>p Value</i>
P <sub>a</sub>	-4.50e-06	6.86e-07	0.000
P <sub>c/a</sub>	0.0146	0.0175	0.406
P <sub>p/c</sub>	0.0013	0.0135	0.922
S <sub>LIFE</sub>	0.0818	0.2797	0.770
S <sub>DEATH</sub>	2.4846	2.2978	0.261
Poverty	-0.0218	0.0082	0.008
<i>Social Variables</i>			
Minority	0.0009	0.0004	0.027
Unemployment	0.0064	0.0023	0.005
Education expenditure	0.0021	0.0007	0.002
Median income	-0.0005	0.0001	0.000
<i>Demographic Variables</i>			
Density	-1.35e-06	2.04e-07	0.000
Western	-0.0002	0.0001	0.056
Central	-0.0004	0.0000	0.000
Urban	-0.0002	0.0001	0.011
Young male	0.0025	0.0106	0.155

FIGURE 3

## REPLICATION REGRESSION RESULTS: PROPERTY CRIME

<i>Economic Variables</i>	<i>Coefficient</i>	<i>Std Err</i>	<i>p Value</i>
P <sub>a</sub>	-0.0001	8.28e-06	0.000
P <sub>c/a</sub>	-0.0921	0.1423	0.518
P <sub>p/c</sub>	-0.1459	0.1111	0.190
V <sub>recovered</sub>	0.0000	0.0000	0.370
Poverty	-0.7085	0.0556	0.203
<i>Social Variables</i>			
Minority	0.0042	0.0024	0.080
Unemployment	0.0565	0.0142	0.000
Education expenditure	0.0081	0.0031	0.008
Median income	-0.0026	0.0007	0.000
<i>Demographic Variables</i>			
Density	-0.0000	1.82e-06	0.000
Western	-0.0011	0.0009	0.212
Central	-0.0012	0.0008	0.118
Urban	-0.0029	0.0007	0.000
Young male	0.1220	0.0874	0.164

FIGURE 4

## INTEGRATED REGRESSION RESULTS: VIOLENT CRIME

<i>Economic Variables</i>	<i>Integrated Model (Replication)</i> <i>[Coefficient, p value]</i>	<i>Integrated Model (New)</i> <i>[Coefficient, p value]</i>
P <sub>a</sub>	<b>-.16, .06</b>	<b>-4.42e-06, .000</b>
P <sub>c/a</sub>	.14, .14	-.002, .923
P <sub>p/c</sub>	<b>-.18, .06</b>	.001, .963
S <sub>LIFE</sub>	-1.66, 1.27	2.094, .177
S <sub>DEATH</sub>	-2.20, 3.52	-19.52, .134
Poverty	-.00, .01	-.002, .880
Gangs	-	-.830, .231
Employability	-	3.920, .671
Gamble	-	-64.961, .610
<i>Social Variables</i>		
Minority	.08, .25	<b>.002, .098</b>
Unemployment	.18, 1.11	-.001, .770
Education expenditure	-.01, .00	.020, .767
Median income	-.00, .01	.002, .845
Psychologists	-	<b>-1.307, .000</b>
Drug deaths	-	2.028, .106
<i>Demographic Variables</i>		
Density	<b>-.00007, .00</b>	1.94e-08, .979
Western	.01, .09	<b>.0007, .028</b>
Central	-.06, .06	-.00007, .732
Urban	<b>-.22, .05</b>	-.0002, .374
Young male	-2.69, 3.78	.0006, .136

FIGURE 5

## INTEGRATED REGRESSION RESULTS: PROPERTY CRIME

<i>Economic Variables</i>	<i>Integrated Model (Replication)</i> [Coefficient, p value]	<i>Integrated Model (New)</i> [Coefficient, p value]
P <sub>a</sub>	<b>-.19, .05</b>	<b>-.0004, .000</b>
P <sub>c/a</sub>	.15, .15	-.04, .583
P <sub>p/c</sub>	-.12, .07	-.056, .317
V <sub>recovered</sub>	.005, .03	.00002, .117
Poverty	<b>.02, .01</b>	.021, .709
Gangs	-	-8.28, .442
Employability	-	57.03, .333
Gamble	-	445.14, .442
<i>Social Variables</i>		
Minority	.10, .25	<b>.022, .039</b>
Unemployment	-.06, 1.10	.024, .193
Education expenditure	-.00, .00	-.122, .336
Median income	.00, .01	<b>.051, .044</b>
Psychologists	-	<b>-9.74, .000</b>
Drug deaths	-	6.73, .311
<i>Demographic Variables</i>		
Density	<b>-.0008, .00</b>	4.40e-06, .535
Western	.03, .08	<b>.007, .048</b>
Central	-.05, .06	.0005, .800
Urban	<b>-.22, .05</b>	-.002, .486
Young male	-3.78, 3.77	<b>.089, .002</b>

FIGURE 6



# FEDERAL SENTENCING TABLE

## SENTENCING TABLE (in months of imprisonment)

	Offense Level	Criminal History Category (Criminal History Points)					
		I (0 or 1)	II (2 or 3)	III (4, 5, 6)	IV (7, 8, 9)	V (10, 11, 12)	VI (13 or more)
Zone A	1	0-6	0-6	0-6	0-6	0-6	0-6
	2	0-6	0-6	0-6	0-6	0-6	1-7
	3	0-6	0-6	0-6	0-6	2-8	3-9
	4	0-6	0-6	0-6	2-8	4-10	6-12
	5	0-6	0-6	1-7	4-10	6-12	9-15
	6	0-6	1-7	2-8	6-12	9-15	12-18
Zone B	7	0-6	2-8	4-10	8-14	12-18	15-21
	8	0-6	4-10	6-12	10-16	15-21	18-24
	9	4-10	6-12	8-14	12-18	18-24	21-27
	10	6-12	8-14	10-16	15-21	21-27	24-30
Zone C	11	8-14	10-16	12-18	18-24	24-30	27-33
	12	10-16	12-18	15-21	21-27	27-33	30-37
	13	12-18	15-21	18-24	24-30	30-37	33-41
	14	15-21	18-24	21-27	27-33	33-41	37-46
Zone D	15	18-24	21-27	24-30	30-37	37-46	41-51
	16	21-27	24-30	27-33	33-41	41-51	46-57
	17	24-30	27-33	30-37	37-46	46-57	51-63
	18	27-33	30-37	33-41	41-51	51-63	57-71
	19	30-37	33-41	37-46	46-57	57-71	63-78
	20	33-41	37-46	41-51	51-63	63-78	70-87
	21	37-46	41-51	46-57	57-71	70-87	77-96
	22	41-51	46-57	51-63	63-78	77-96	84-105
	23	46-57	51-63	57-71	70-87	84-105	92-115
	24	51-63	57-71	63-78	77-96	92-115	100-125
	25	57-71	63-78	70-87	84-105	100-125	110-137
	26	63-78	70-87	78-97	92-115	110-137	120-150
	27	70-87	78-97	87-108	100-125	120-150	130-162
	28	78-97	87-108	97-121	110-137	130-162	140-175
	29	87-108	97-121	108-135	121-151	140-175	151-188
	30	97-121	108-135	121-151	135-168	151-188	168-210
	31	108-135	121-151	135-168	151-188	168-210	188-235
	32	121-151	135-168	151-188	168-210	188-235	210-262
	33	135-168	151-188	168-210	188-235	210-262	235-293
	34	151-188	168-210	188-235	210-262	235-293	262-327
	35	168-210	188-235	210-262	235-293	262-327	292-365
	36	188-235	210-262	235-293	262-327	292-365	324-405
	37	210-262	235-293	262-327	292-365	324-405	360-life
	38	235-293	262-327	292-365	324-405	360-life	360-life
	39	262-327	292-365	324-405	360-life	360-life	360-life
	40	292-365	324-405	360-life	360-life	360-life	360-life
	41	324-405	360-life	360-life	360-life	360-life	360-life
	42	360-life	360-life	360-life	360-life	360-life	360-life
	43	life	life	life	life	life	life

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