

TESTING REVISED LOW SELF-CONTROL THEORY: RESULTS FROM THE
NATIONAL LONGITUDINAL STUDY OF ADOLESCENT HEALTH, 1994.

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ABSTRACT

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This study constructs a cross-sectional empirical test of revised low self-control theory using data collected in the National Longitudinal Study of Adolescent Health, 1994. The primary focus of the redefinition of low self-control is on the role of social bonds in determining the level of self-control one exhibits. Furthermore, these concepts are hypothesized to measure the same underlying construct. After constructing measures of social bonding, and attitudinal self-control, multiple statistical techniques were used to measure the extent to which self-control and social bonding were related to one another and to a versatility index of delinquency. Both scales were generally predictive of the number of different offenses youth commit, however, the shared variation in the

independent variable indices was small, leading one to believe the two scales may not measure the same underlying construct. It is more likely that the measure posited by Hirschi (2004) is a measure of social bonding as opposed to self-control. Limitations and implications are discussed.

CHAPTER I

INTRODUCTION

Criminological theory and empirical research are essential to the operation of the criminal justice system. In general, criminological theory provides a framework for understanding crime. However, the purpose of framing crime in a manner that organizes causes of crime and criminality goes beyond understanding. Theories are very useful in explaining crime, generalizing findings, and in proposing solutions to crime in our everyday life. Therefore, theory exists not only in a realm of its own; indeed it has profound effects on policies, which have consequences in the real world. Likewise, the real world provides the basis for empirical research upon which criminological theories are tested. Thus, criminological theory and real world application are complimentary.

If we further divide the explanatory purpose of criminological theory, we are able to address two main inquiries (Akers & Sellers, 2009). First, why does deviance vary between groups, locations, and times? Secondly, why do some individuals commit deviant acts, and others do not? Akers and Sellers (2009) refer to the latter as a micro-perspective, or a processual explanation of crime, where the unit of analysis is an individual, and the explanation for crime is a force acting on the individual. In contrast, the former elicits the label of macro-perspective or a structural explanation of crime. These theories generally examine larger units of analysis, such as geographic areas

or nations, and variation in crime as a function of social structure or differences between societies or groups of society. The purpose of this thesis is to empirically test one such micro-level or processual criminological theory, low self-control theory.

Low self-control theory was constructed by Michael Gottfredson and Travis Hirschi in *The General Theory of Crime* (1990). This theory falls under the criminological category of control theory. The aim of control theory departs from other theoretical approaches—why individuals *do not* commit crimes is the root inquiry of control theories (Hirschi, 1969, p. 10). In other words, control theory answers the question of what factors prevent individuals from committing criminal and deviant acts (Akers & Sellers, 2009). Low self-control theory is built on the foundation of classicism and the rational choice perspective, in which the philosophers Beccaria and Bentham theorized that man's only true masters were pain and pleasure (Lily, Cullen & Ball, 2011). The "hedonistic calculus," where pleasure is universally sought to be maximized and pain minimized, was considered to be the rule that explained behaviors of actors exercising free will. These philosophers had a profound effect on numerous criminological theories and historical developments including deterrence theory, the passage of England's Penitentiary Act of 1779, and numerous others (Lily et al., 2011).

Modern rational choice theory originated in economics, and the premise can be explained in simple mathematic terms. The likelihood that a certain behavior will happen increases as the expected payoffs that certain behavior outweigh its expected costs (Akers & Sellers, 2009). Though it is still debated whether criminals truly reason and weigh costs and benefits in a rational manner, generally the notion of rational choice

elicits any form of calculation taken by the potential offender, however inaccurate or misinformed.

Preceding low self-control theory was the social bonding theory by Travis Hirschi in *Causes of Delinquency* (1969). The explanation for crime in social bonding theory is weak or broken bonds to society. The bonds to which Hirschi refers, when strong, prevent individuals from committing crimes (See Figure 1). These bonds are attachment to others, commitment, involvement, and belief. Generally, the most salient of the social bonds in predicting conformity is strong attachment to parents and school, as well as commitment to occupational goals (Akers, 2009). A longitudinal study by Agnew (1985) found the components social bonding, with the exception of commitment and peer attachment, were significantly related to delinquency, at time-one. However, when controlling for time-one delinquency, only grades, dating, and belief had significant negative effects on time-two delinquency. This is only one of many studies (See Kempf, 1993 for review)—in general, the effects of social bonds on offending have been low to moderate, and research has supported the theory overall.

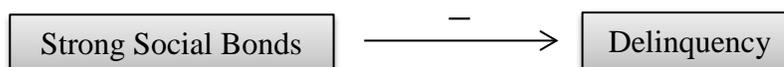


Figure 1: Social Bonding Causal Diagram

The dynamic nature of social bonds lead Hirschi to abandon social bonding theory in light of stable differences between individuals, which explain the tendency towards crime. What followed was the General Theory of Crime (Gottfredson & Hirschi, 1990).

Self-Control Theory

The General Theory of Crime (henceforth referred to as GTC) is a simple and parsimonious theory of deviance, crime, and delinquency (Gottfredson & Hirschi, 1990). The fundamental proposition of the theory is that individuals vary in the “extent to which they are vulnerable to the temptations of the moment” (Gottfredson & Hirschi, 1990, p. 87) rather than the extent to which they have a special tendency to commit crime. This is in contrast to the positivistic explanations of crime in which individual or social differences (e.g., intelligence, Socio-economic status etc.) between criminals and non-criminals explain the tendency to commit crime. Furthermore, Gottfredson and Hirschi posit that regardless of individuals’ comprehension of sanctioning systems for crime, the tendency to avoid criminal acts is stable (1990, p. 87). The authors conclude the cause of crime is independent of the state’s definitions of criminal acts: “[C]riminals do not require or need crime... criminal acts require no special capabilities, needs, or motivation; they are, in a sense, available to everyone” (Gottfredson & Hirschi, 1990, p. 88). The stable difference between individuals is low self-control, and is the cause of crime, along with criminal opportunities. Given the opportunity to offend, an individual with low self-control is more likely to commit crime. Furthermore, individuals who develop high self-control, are less likely to commit crimes (1990, p. 89).

The operational definition of self-control is explicated in the “Elements of Self-Control” Gottfredson and Hirschi explain in the GTC (1990, p. 89-91). These elements result from the nature of crime itself, as the authors note, “We thus infer from the nature of crime what people who refrain from criminal acts are like” (1990, p. 88). The elements of low self-control include impulsivity, a preference for simple tasks, risk

seeking, a preference for physical tasks; rather than mental tasks, self-centeredness, and temper. These elements make up a single trait, low self-control. Selection into deviant peer groups, low academic performance, unemployment and other factors used historically to measure the tendency of individuals to be deviant are defined by the authors as *effects* of low self-control. For example, they state that the association between deviant peer association and deviance is spurious because individuals lacking self-control tend to end up in peer groups with people with low self-control.

According to the theory, the development of self-control takes place in early childhood. Self-control is developed through Gottfredson and Hirschi's "child-rearing model," in which parental supervision of the child, recognition of deviant acts, and punishment of deviant acts are required to properly socialize the child (1990, p. 98-99). The authors further postulate that socialization is likely irreversible- once self-control has been developed, it is highly unlikely that individuals regress to patterns of anti-social behavior (Gottfredson & Hirschi, 1990, p. 107).

Gottfredson and Hirschi also borrow generally from the opportunity perspective of victimization (Cohen & Felson, 1979), in which predatory crimes require three components. Predatory crimes are committed in the absence of a capable guardian, when the spatial and temporal paths of a motivated offender and a suitable target cross. The GTC contends that opportunity for crime is not a sole predictor of offending. The authors propose that as individuals have increasing levels of self-control, crime will result from opportunities at a lower rate. Therefore, as opportunity and low self-control increase, the proportion of opportunities that become completed crimes increases (See Figure 2).



Figure 2: Low Self-Control Theory Causal Diagram, given opportunity

This theory explicitly departs from prior theories' definitions of crime. In the first chapter of their work they derive the definition of crime from the classical tradition, stating that crimes are any act of force or fraud carried out in the pursuit of self-interest (Gottfredson & Hirschi, 1990, p. 15). The authors go on to examine crimes in the empirical literature, defining what typical crimes are like, and from there, defining the cause of crime in the classical tradition. They posit that ordinary crimes are "trivial and mundane affairs that result in little loss and less gain," and furthermore "require little preparation, leave few lasting consequences, and often do not produce the result intended by the offender" (Gottfredson & Hirschi, 1990, p. 16). Therefore, the effects of low self-control need not be behaviors that are defined as illegal by law, but rather any act with long-term negative consequences, carried out in the pursuit of self-interest: because crime is not an automatic consequence of low self-control, individuals lacking self-control will engage in acts that tend to provide immediate gratification. Behaviors, such as smoking cigarettes and illicit sex, though defined by the state as legal, stem from low self-control.

Another proposition of the GTC is that offenders are versatile in the acts they commit (Gottfredson & Hirschi, 1990). The authors state that criminal and analogous behaviors are sought in the pursuit of self-interest, at the expense of long term costs. These acts are immediately gratifying, and the lack of self-control will cause individuals, given the opportunity, to participate in these acts. Furthermore, the benefits that drive

individuals to commit these acts are independent of legal sanctions. Division of the legally sanctioned acts into expressive or instrumental crimes, *mala in se* or *mala prohibita* crimes, according to the authors, is essentially useless (Gottfredson & Hirschi, 1990, p. 22). Therefore, the theory precludes the possibility that specialization is a function of low self-control. The only specialization that occurs does so because the spatial and temporal correlates of criminal opportunity are repetitive, and will be continually taken advantage of by individuals with low self-control (Gottfredson & Hirschi, 1990, p. 92).

Low self-control theory elicited a furor of empirical tests. As of 2000 over eighty-two tests of the theory had been conducted and published, and a meta-analysis conducted (Pratt & Cullen, 2000). Generally, low self-control theory had been supported and had considerable effect sizes, and yet, in the year 2004, Hirschi changed his position on control once again.

Hirschi (2004) argues that the control exerted through social bonds cannot account for the stable differences between individuals, but that social bonds control individuals through self-control. He states that “the source and strength of ‘bonds’ is almost exclusively within the person reporting or displaying them” (Hirschi, 2004, p. 544). He rejects the notion that society controls individuals, but rather the “principle source of control in social control theory is the concern for the opinion of others” (Hirschi, 2004, p. 545), and low self-control causes an individual to fail to consider societal controls, such as maternal attachment. Therefore, the strength of reported social bonds is, in effect, an indicator of self-control—individuals who have high self-control

will care for the opinion of others. In contrast, individuals who do not care for the opinion of others lack self-control.

This is reflected in a change in the definition of self-control, and new measures. Hirschi redefined self-control in 2004 as “the tendency to consider the full range of potential costs of a particular act” (p. 543). In doing this, he asserts that individuals with high self-control will report being strongly bonded, and therefore, social bonding will indicate what level of self-control a person possesses.

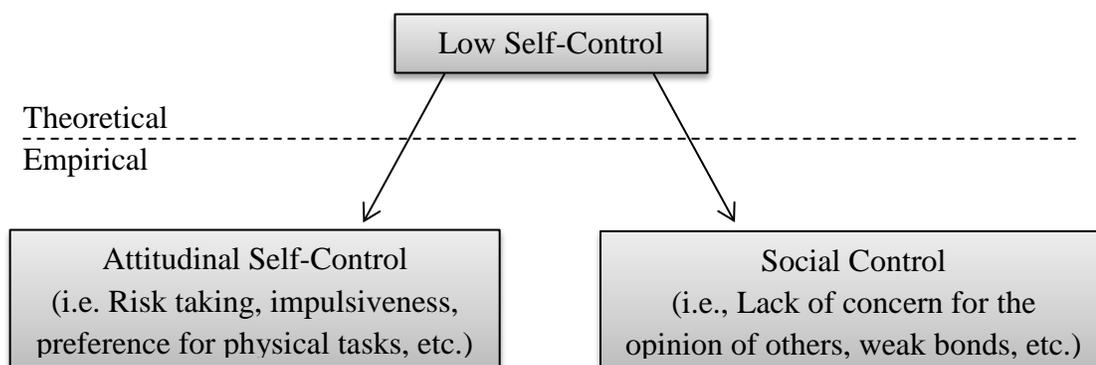


Figure 3: Low Self-Control & Social Bonding Measurement Model

Though the operational definition of self-control has changed markedly since the publication of *The General Theory of Crime*, the crux of the theory remains the same; a single stable measure accounts for all crime. The following chapters of this thesis will be used to review the literature and empirical tests of the theory, as well as those of revisions to the original explication and construct a test of the theory using secondary data.

CHAPTER II

LITERATURE REVIEW

Empirical tests of low self-control theory

Original tests of low self-control theory can be divided into two main categories; studies employing attitudinal scales derived from the elements of low self-control (Gottfredson & Hirschi, 1990), and studies employing behavioral indicators. A number of important studies will be reviewed.

Attitudinal Scales. Grasmick, Tittle, Bursik & Arneklev (1993) constructed a measure of self-control around the elements of low-control from the GTC. They explicitly construct their index around the GTC's assertion that these elements comprise a stable construct (1990, p. 91). The scale items that make up the attitudinal measure of low self-control were self-reported. These items reflected preferences for the elements defined by Gottfredson and Hirschi, the index of which is interpreted by Grasmick et al. as stable factor or personality trait (1993, p. 13). In fact, Grasmick et al. concluded from factor analysis that the six elements "appear to coalesce into a single personality trait" (1993, p. 17). Furthermore, the reliability of the scale employed by Grasmick et al. and later revisions to the attitudinal scale (Longshore, 1998; Arneklev, Elis & Medlicott, 2006; Morris, Gerber & Mernard, 2011) is high ($\alpha \geq .80$).

The Grasmick et al. scale was used to test two main propositions: the opportunity-low self-control interaction and the effect of low self-control on force and fraud perpetration on a simple random sample of adults in Oklahoma City ($n = 395$). Their definition of offending is based on the definition of crime in the GTC, which is independent of legal sanction. A self-reported count of incidences of fraud and force in the last 5 years was obtained as the measure of offending ($\bar{x}_{\text{fraud}} = 1.44$, $\bar{x}_{\text{force}} = .64$, both distributions were positively skewed). The authors also measured opportunity by asking for a count of opportunities for fraud and force which would have been “gratifying at the moment” or “possible to do easily” in the last five years (Grasmick et al., 1993). The interaction term for the crime opportunity-low self-control interaction was the multiplicative function of both variables.

The effects estimated in the analysis of fraud offending were significant for low self-control, crime opportunity and the low self-control-crime opportunity interaction while controlling for gender, race, and age. However, for force offending, the effect of low self-control was not significant, while the effect of crime opportunity, and crime opportunity-low self-control interaction were significant. The authors suggest the test of the theory is generally supportive of its empirical assertions.

One study involving delinquent boys used 5 binary items in an index which approximated low self-control, as opposed to 25 items on an ordinal scale used in the Grasmick et al. scale (Paternoster & Brame, 1998). The authors specifically measured attitudes that were not directly related to criminal and analogous behaviors in order to indicate low self-control; these included whether or not the respondents were (a) prone to act out, (b) lazy, (c) had difficulty concentrating, (d) had poor discipline, (e) a risk

taker. The summation of the items yielded an index with possible values from 0 to 5, with a median score of 1. All items in the scale were significantly correlated (Phi correlation coefficients). The outcomes tested in the analysis were ever committing a number of criminal behaviors, which included aggravated assault, motor vehicle theft, burglary, and larceny, and ever committing a number of analogous behaviors, including having several motor vehicle accidents, frequently loitering, gambling heavily, drinking heavily, smoking heavily, having multiple sex partners, and going out frequently at night. The effect of low self-control on criminal acts, and analogous behaviors was significant. Furthermore their findings support Gottfredson and Hirschi's assertion that self-control is a general cause of crime; however, self-control is not the sole cause (Paternoster & Brame, 1998, p. 654). This type of reduced Grasmick scale measuring low self-control has yielded significant effects on criminal and analogous behaviors (Wiebe, 2006; Holtfreter, Beaver, Reisig & Pratt, 2010; Forrest & Hay, 2011; Gunter & Bakkan, 2012). The most popular approximation of low self-control arises from the risk seeking element, based on the GTC's assumption that crime is thrilling and exciting.

Behavioral Indicators. The authors repeatedly state that the most powerful predictor of criminal behavior is prior criminal behavior (Gottfredson & Hirschi, 1990; Hirschi & Gottfredson, 1993). Furthermore, they claim "crime is not an automatic... consequence of low self-control... many non-criminal acts analogous to crime (such as accidents, smoking, and alcohol use) are also manifestations of low self-control" (Gottfredson & Hirschi, 1990, p. 91). The logical conclusion from these assumptions is that analogous non-criminal acts are among the best indicators of low self-control.

Keane, Maxim & Teevan tested the GTC with this type of indicator of low self-control (1993) with a random sample of Canadian nighttime drivers. Their study examines two elements of low self-control with behavioral indicators and their effect on the dependent variable of blood alcohol content, which was measured with a breathalyzer. Risk taking behavior was represented by whether the participants wore seatbelts, and their approximation of the certainty of being stopped by police while driving drunk. Impulsiveness was measured with the response to whether anyone tried to discourage the respondent from driving drunk.

The theoretical basis for the measures of the independent variable is equating the lack of “foresight of possible consequences” associated with not wearing a seatbelt to the failure to consider the full range of possible consequences the theory states is characteristic of individuals with low self-control. Furthermore, the authors measured risk taking with an estimate of how many drivers each participant believed would be stopped out of one-hundred by the police for drunk driving. The authors indicated that drivers who had high blood alcohol content, and estimated a high rate of DUI stoppage, were not deterred by legal sanctions, and thus were taking a greater risk. The same rationale was applied to whether or not the participants were dissuaded by friends telling them not to drink and drive. The authors found that their approximation of risk-taking behaviors were significant predictors of blood alcohol content.

It is not surprising, given the methodological issues¹ with the study by Keane et

¹ The limitations of secondary data analysis are acknowledged by Keane et al. (1993), in which the operational definitions of risk taking and impulsiveness may not be valid measures of elements of self-control (Gottfredson & Hirschi, 1990).

al. (1993) that behavioral measures were used in the operationalization of self-control subsequent to Hirschi and Gottfredson's remark on the initial tests of the GTC (1993). Researchers have used cheating (Gunter & Bakken, 2012), imprudent behavior (Arneklev, Grasmick, Tittle & Bursik, 1993) and drug, alcohol and tobacco use (Evans, Cullen, Burton, Dunaway & Benson, 1997) to approximate a behavioral measure. In fact, some studies compare behavioral and attitudinal scales (Evans et al., 1997; Arneklev et al., 2006).

Arneklev et al. measured imprudent behavior with a number of analogous behaviors which are "not illegal but do have distal consequences" (2006, p. 44). The researchers treated imprudent behavior as a dependent variable in one hypothesis, and as an independent variable in another. As expected, the low self-control measure was related to imprudent behaviors as a dependent variable. When imprudent behavior was added as an independent variable to the model, it also was a significant predictor of crime. Furthermore, the explanatory power of the models did not differ significantly.

The primary issue with behavioral scales as an approximation of low self-control remains the issue of tautology. Gottfredson and Hirschi state "both crime and analogous behaviors stem from low self-control (that is, both are manifestations of low self-control)" (1990, p. 91). As early critics of the theory point out, low self-control is the cause of both imprudent non-criminal acts and criminal acts, that is, analogous behaviors are the result of low self-control (Akers, 1991; Barlow, 1991). Therefore, it is tautological for the theory to be tested using an outcome of low self-control as a measure of low self-control.

Hirschi and Gottfredson (1993) responded to charges of tautology by addressing the order in which the conception of criminal was derived. They claim traditionally the cause of crime invokes the definition of the criminal act, where their definition of the criminal act precedes the conception of the cause of criminality. Such claims do not circumvent the fact that the behaviors explained by low self-control, which includes crime and imprudent behavior, have been used since the original tests of the theory, to explain crime; a behavior explained by self-control.

Other Scales. Gibbs and Giever (1995) used a measure of self-control that included protective factors *and* indicators of low self-control as represented in the elements of low self-control (Gottfredson & Hirschi, 1990). Their scale was a statistically significant predictor of class hours missed in the last week as well as alcoholic drinks consumed in the last week in college students. Brownfield & Sorenson also measured self-control as an index of parental attachments, school attachment, aptitude, time orientation, and egotism (1993). This measure specifically draws on the idea of control rather than lack of control.

Redefined Self-Control. Hirschi (2004) re-defined of self-control around the idea that controls made up a set of inhibitions individuals carry with them. These inhibitions to commit crimes or behaviors analogous to crime increase number of factors and the salience of each factor that one considers in making a decision to commit a given behavior (Hirschi, 2004, p. 545). The re-operationalized measure of self-control stressed the social bonding perspective (Hirschi, 1969). The revised scale is presented in Table 1. Furthermore, these measures circumvent the charge of tautology.

(Item) Stem	Self-control response
Do you like or dislike school?	Like it
How important is getting good grades to you personally?	Very important
Do you finish your homework?	Always
Do you care what teachers think of you?	I care a lot
It is none of the school's business if a student wants to smoke outside of the class-room	Strongly disagree
Does your mother know where you are when you are away from home?	Usually
Does your mother know who you are with when you are away from home?	Usually
Do you share your thoughts and feelings with your mother?	Often
Would you like to be the kind of person your mother is?	In every way/ In most ways

When Hirschi measured self-control in the context of the social bond, he selected the most significant social bonds to approximate the construct of self-control; attachment to school, commitment to school, and parental attachment. The literature suggests that the items that approximate parental attachment may approximate the extent to which self-control was developed in the respondent. For example, the parental attachment variables closely resemble the parenting style Gottfredson and Hirschi suggest is the key to developing self-control (1990, also see Glueck & Glueck, 1950). In theory, the tendency to consider the full range of consequences, including consequences related to parental and school punishments, is certainly impacted by the attachment to their sources. A student who does not care about education, is unlikely to consider suspension or expulsion to be a serious consequence; he/she would likely benefit by the immediate gratification of removal of negative stimuli through suspension or expulsion. Furthermore, parental attachment is likely to impact the assessment of the seriousness of parental punishment for deviant behavior. However, these measures only approximate the frequency and salience of considerations of consequences from parents and school.

Hirschi based his test score on an additive model, counting the responses that best identified the self-control response (coding all other responses 0). In his research, as the number of controls increased, the proportion of youth reporting two or more delinquent acts significantly decreased. This suggests a negative relationship between inhibiting factors and offending (Hirschi, 2004).

Empirically, the new definition of self-control has been tested using hypothetical situations. Piquero and Bouffard (2007) interpreted Hirschi's redefinition at the decisional level, as opposed to measuring self-control as an attitudinal measure. The researchers asked participants to list up to seven negative consequences for drunk driving and sexual coercion (male participants only), which was the number of costs term. Furthermore, they computed the salience term by asking the participants to rate, on a scale from zero to one hundred, the importance of each consequence while weighing their decision. The resulting scale was the multiplicative term of both variables and had values ranging from thirteen to seven-hundred, where a score of seven-hundred indicated that the participant listed seven consequences of absolute importance to their decision making. The dependent variable was the self-reported percent likelihood that the participant would drive drunk and use sexual coercion as a means to achieve intercourse. The theory hypothesizes that as the number-of-costs times salience term increases, the lower the likelihood of drunk driving, and use of sexual coercion.

The results of the multivariate regression model indicated that the redefined measures of self-control had a significant effect on the logged percent likelihood of drunk driving ($B=-.003$, $SE=.001$), while controlling for prior behavior, sex, and age ($\beta = .229$, $R^2_{\text{model}}=.217$). For a one unit increase in the number-of-costs times salience term,

the self-reported percent likelihood of drunk driving decreased by .3%. The effect was also significant for sexual coercion ($\beta = .276$, $R^2_{\text{model}} = .101$), though the explanatory power of the model was weaker.

In an alternative model, the authors compared the effects of the Grasmick et al. scale, social bonding measures, and the number-of-costs times salience term. They found the effect of the number-of-costs times salience term was significant, and the attitudinal measure and social bonding measures were not significant. Furthermore, the explained variance in the full model, was only slightly larger than the explained variance in the number-of-costs time salience-only model (Costs model $R^2 = 0.217$, Full Model $R^2 = 0.227$).

The authors also tested the effect of the number of long term costs times their salience to approximate the “tendency to consider long term costs,” which Hirschi predicts will affect crime. They found that when the costs were limited to legal costs to the respondent (such as jail, lawyer’s fees etc.) the number-of-costs time salience term was not a significant predictor of percent likelihood of offending, while the Grasmick et al. scale was significant. These findings suggest that not *only* consideration of long term costs has an effect on hypothetically abstaining from drunk driving and using sexual coercion. They also support the utility of the redefinition of self-control as the tendency to consider a broader and more contemporaneous range of consequences for one’s actions (Hirschi, 2004).

Bouffard & Rice (2011) used a similar research strategy to test the effect of social bonding on the decisional self-control measure. The researchers found that mean

salience of costs was significantly correlated with a social bonding scale. Furthermore, a path analysis indicated that a model where the direct effect of social bonding on hypothetical drunk driving was eliminated was a better fit. They concluded that the social bond likely influences hypothetical drunk driving through its effect on the decisional self-control measure. Given the evidence in the literature, the most salient social bonding measures may be good approximations of the tendency to consider a broad range of consequences for one's actions. In theory, the increasing level of social bonding impacts decision making by increasing the *perceived* number or seriousness of consequences; weak social bonds lead to fewer or less serious *perceived* consequences.

Gunter and Bakken (2012) tested the number-of-costs times salience term against self-reported percent likelihood of DUI and cheating in a sample of college students. Using a similar methodology, the authors failed to find the significant effect of the number-of-costs times salience term on percent likelihood of cheating and DUI in models which only the number-of-costs times salience term was used for prediction of each offense, and in full models using both the number-of-costs times salience term and the Grasmick et al. Scale.

The theoretical basis for low self-control, itself, is derived from the nature of crime. The elements defined by Gottfredson and Hirschi (1990) include impulsivity, a preference for simple tasks, risk seeking, a preference for physical tasks, self-centeredness, and temper. These measures reflect the extent to which an individual is likely to commit in behaviors which are immediately gratifying. Indeed, Hirschi (2004) included questions which tapped some of these dimensions of self-control, such as preference for mental and challenging tasks, and conscientiousness. These dimensions

are embedded in the redefinition of self-control as “*the tendency to consider the full range of costs of a particular act*” (2004, p. 543, emphasis in original). Individuals who are conscientious consider people beyond themselves in their decisions. Individuals who are diligent and risk averse, by definition, consider the full range of costs of particular acts. Therefore, an attitudinal indicator will be an adequate approximation of self-control to compare the effect of the social bonding/ self-control measure.

CHAPTER III

METHODOLOGY

The method of analysis herein is secondary data analysis. The data analyzed come from the Longitudinal Study of Adolescent Health 1994-2008 (Harris & Udry, 2008). This is a multi-wave study using interviews to obtain information about youth in the United States. Data from only the first wave of data collection will be analyzed in this thesis².

Adolescent Health Study Design

Sampling. The sampling method employed by the Adolescent Health Study was a cluster sampling technique. Using a database compiled by Quality Education Data Inc. as a sampling frame, a systematic sampling method and stratification was utilized to obtain a sample of 80 communities in which there were eligible high schools. The strata employed in approximating a representative group of schools were region of country, urban city, size, type, and ethnicity. The second stage of sampling was selecting schools from each community stratum. This process resulted in a sample of 132 schools. The unit of analysis in the study, however, was individual students. All students listed on any

² This research was conducted under IRB Exemption Category 4, under request EXP2012S4861 which was approved September 4, 2012

of the 132 participating schools' rosters were eligible for participation in the study. The rosters were stratified by grade and sex, and students were randomly selected from each stratum in each school. This yielded a sample 12,105 students who were interviewed at Wave I of data collection.

Data Collection. The data were collected using in-home interviews that were recorded on laptop computers. For less sensitive questions the respondents were read the question by the interviewer who then recorded the response on the laptop computer. For sensitive topics, the respondents were assisted by the computer software through headphones, and the respondents recorded their own answers. These interviews generally took 1 to 2 hours, and addressed a myriad of issues, ranging from health and nutrition to sexual experiences and offending behaviors.

Study Sample

The sample examined herein is a subset of the students sampled in the entire Adolescent Health Study. The Adolescent Health Study specifically oversampled several special groups. Members of these groups were distinguished from the core sample in the data and were excluded from this analysis. Furthermore, the sample size in the public access dataset was limited. The sample in the public access dataset, not including any oversampled groups, contained 6,072 participants. Descriptive statistics of the sample are included in Table 2.

The sample was comprised of 51.5% females, and 48.5% males. The sample was somewhat heterogeneous with regards to race; however, it was mainly white (68.9%). Students were only eligible to participate if they were enrolled in 7th through 12th grade

at or had been enrolled in the previous school year at the time of the Wave I interview. Furthermore, the sample was stratified such that the proportion of students in each grade was similar. Finally, the mean age of the sample was 16.53 years of age. Respondents ranged from 12 years of age to 22 years of age at the time of the Wave I interview. The standard deviation of age was 1.75 years.

Characteristic		n= 5,749	% of sample ^a
Gender	Male	2,787	48.5
	Female	2,962	51.5
Race/ <i>Ethnicity</i> ^b	Caucasian	3,967	68.9
	African American	1,093	19.0
	Other	797	12.1
	<i>Hispanic</i>	686	11.9
Grade level at time of Wave I interview ^c	7	870	15.1
	8	999	15.6
	9	981	17.1
	10	1,015	17.7
	11	1,002	17.4
	12	867	15.1
	Not in School	104	1.8
Age	Min. 12 Max. 22	Mean 16.53	Std. Dev. 1.75
^a Values may not sum to 100 due to rounding			
^b Missing cases n = 22			
^c Missing cases n = 11			

Study Measures

Independent Variables. There were two measures of self-control employed in this analysis: an attitudinal self-control scale, and a self-control/ social bonding scale similar to the instrument used by Hirschi (2004).

The attitudinal index used was an additive scale, and approximated low self-control using five questions from the Personality and Family section of the Adolescent Health Interview. The questions included in the index are listed in Table 3. The

respondents were asked to respond on a Likert scale that ranged from strongly agree (1) to strongly disagree (5). First, cross-classification tables were examined to assess the relationship between the question response categories and whether the person had committed an individual offense. The direction of each item was verified, and one item was reverse coded (ATT1). As values of the individual items indicated greater self-control, the proportion of respondents who reported committing a certain act decreased. In the majority of tests, the chi-square tests were significant, indicating there was a relationship between the attitudinal item and whether or not the respondent had committed the offense. Secondly, to check that the items would all positively contribute to the index, the inter-item correlations were computed (see Appendix 1). The responses to each question were positively correlated with one another. The values of each of the five items were then summed. With the exception of reverse coding and exclusion of missing values, the data were otherwise not transformed.

Table 3: Attitudinal Self-Control Measures.
Add Health Personality & Family Questions 8, 16, and 18-20

(Variable) Stem	Response Categories
(ATT1) When making decisions, you usually go with your “gut feeling” without thinking too much about the consequences of each alternative.	Strongly agree to Strongly disagree
(ATT2) When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible.	Strongly agree to Strongly disagree
(ATT3) When you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible.	Strongly agree to Strongly disagree
(ATT4) When making decisions, you generally use a systematic method for judging and comparing alternatives.	Strongly agree to Strongly disagree
(ATT5) When you get what you want, it's usually because you worked hard for it.	Strongly agree to Strongly disagree
<i>ATT1 was reverse coded.</i>	

The resulting index had potential values ranging from five to twenty-five, where greater numbers approximate *low* self-control. The mean value of the attitudinal index is 11.66, and the standard deviation is 2.71. The index approximates a normal distribution, though the distribution of scores is slightly peaked. The descriptive statistics for the items and the summative scale are reported in Table 4. See Appendix 2 for a histogram of the resulting scale.

The attitudinal measure only approximates low self-control, as the items themselves are theoretically highly correlated to low self-control. For example, making decisions based on “gut feelings” approximates the extent to which an individual is impulsive, a quality which is theoretically highly correlated with low self-control. The other items approximate the extent to which the individual is diligent, thoughtful, conscientious and thorough. All items are correlated with one another, and the correlations are significant; however, the reliability of the index is weak (Chronbach’s Alpha $\alpha = .555$). This indicates that though the items are significantly correlated, they may not measure the same underlying construct.

Table 4: Attitudinal Self-Control Index- Descriptive Statistics

Variable	Mean	Median	Mode	Range	Variance	Std. Deviation
ATT1	2.99	3	2	4	1.28	1.13
ATT2	2.18	2	2	4	.72	.85
ATT3	2.03	2	2	4	.57	.75
ATT4	2.37	2	2	4	.77	.88
ATT5	2.10	2	2	4	.75	.87
Total	11.66	12	12	20	7.36	2.71
<i>N= 5,749 for all variables</i>		Alpha = .555				

The self-control/ social bonding index was also a summative index. This index approximates self-control using eleven items from various sections of the Adolescent

Health Study. The questions included in the index are listed in Table 5. The respondents were asked to respond on various Likert scales depending on the question. For example, the responses to the question “How close do you feel to your mother?” were arranged on a Likert scale ranging from “Not at all” (1) to “Very Much” (5).

Table 5: Self-Control/ Social Bonding Measures. Add Health Relations with Parents Questions 9-10, Personality & Family Questions 1, 3-5 Expectations, Employment & Income Question 1, Academics & Education Questions 17, 22-23, and Protective Factors Question 2.	
(Variable) Stem	Response Categories
(SCSB1) How close do you feel to your mother?	Very much to Not at all
(SCSB2) How much do you think your mom cares about you?	Very much to Not at all
(SCSB3) Most of the time, your mother is warm and loving toward you.	Strongly agree to Strongly disagree
(SCSB4) When you do something wrong that is important, your mother talks about it with you and helps you understand why it is wrong.	Strongly agree to Strongly disagree
(SCSB5) You are satisfied with the way your mother and you communicate with each other.	Strongly agree to Strongly disagree
(SCSB6) Overall, you are satisfied with your relationship with your mother.	Strongly agree to Strongly disagree
(SCSB7) How much do you want to go to college?	High through Low
(SCSB8) You are happy to be at your school.	Strongly agree to Strongly disagree
(SCSB9) The teachers at your school treat students fairly.	Strongly agree to Strongly disagree
(SCSB10) How much do you feel that your teachers care about you?	Very Much to Not at all
(SCSB11) Since school started this year, how often have you had trouble getting your homework done?	Every day (1), Almost every day, About once a week, Just a few times, Never (5).
<i>Respondents who indicated they had no mother figure or had not attended school in the last year were assigned a value of 1 in the respective category.</i>	
SCSB11 was recoded to reflect having difficulty completing homework as an indicator of low self-control.	

Cross-classification tables also were examined first in this case, and the majority of offenses were significantly related to the response on each item. To check that the

items would all positively contribute to the index the inter-item correlations were examined (See Appendix 1). The responses to each question were positively correlated with one another. The values to each of the 11 items were then summed. The resulting index had potential values ranging from eleven to fifty-five, where greater numbers approximate *high* self-control/ social bonding. The mean value of the self-control/ social bonding index is 44.29, and the standard deviation is 7.05. The index scores are skewed to the left, and the distribution is also peaked. The descriptive statistics for the items and the summative index are reported in Table 6. A histogram for the resulting index is reported in Appendix 2. With the exception of transforming missing data attributed to the respondents' not being either enrolled in school, or not having a mother figure, and the exclusion of missing data, the data were otherwise not transformed.

Table 6: Self-Control/ Social Bonding Index- Descriptive Statistics

Variable	Mean	Median	Mode	Range	Variance	Std. Deviation
SCSB1	4.41	5	5	4	1.05	1.03
SCSB2	4.71	5	5	4	0.77	0.88
SCSB3	4.24	4	5	4	1.03	1.02
SCSB4	3.99	4	4	4	1.13	1.06
SCSB5	3.94	4	4	4	1.34	1.16
SCSB6	4.17	4	5	4	1.15	1.07
SCSB7	4.44	5	5	4	1.03	1.02
SCSB8	3.64	4	4	4	1.39	1.18
SCSB9	3.44	4	4	4	1.27	1.13
SCSB10	3.55	4	4	4	0.99	0.99
SCSB11	3.78	4	4	4	1.27	1.13
Total	44.30	46	47	44	49.67	7.05
<i>N= 5,749 for all variables</i>		Alpha = .825				

According to Hirschi (2004), the self-control/ social bonding index approximates the stable latent trait of self-control. Hirschi claims that conventional bonds are the

source of concern for the opinion of others, and this concern is the principle source of self-control (2004, p. 545). Therefore, as the strength of these bonds increases, the concern for the opinion of others increases, as does self-control. The inter-item correlations indicate that these items measure two distinct concepts. The items referring to maternal attachment are highly correlated to one another, but weakly correlated with the items referring to school attachment and aspirations. In general the school attachment and aspirations items are weakly correlated with one another. Nonetheless, the reliability of the scale is quite strong (Cronbach's Alpha $\alpha = .840$).

A measure of opportunity was also approximated using self-reported items from the Add Health study. The questions that were used are presented in Table 7.

Table 7: Opportunity Measures. Add Health Relations with Parents Questions 1, 2, 6, Resident Father Question 12 and Resident Mother Question 12.	
(Variable) Stem	Response Categories
(OPP1) Do your parents let you make your own decisions about the time you must be home on weekend nights?	Dichotomous Yes/ No
(OPP2) Do your parents let you make your own decisions about the people you hang around with?	Dichotomous Yes/ No
(OPP3) Do your parents let you make your own decisions about what time you go to bed on week nights?	Dichotomous Yes/ No
(OPP4) How often is your father at home when you return from school?	Never through Always
(OPP5) How often is your mother at home when you return from school?	Never through Always
<i>OPP1, OPP2 & OPP3 were reverse coded to reflect greater supervision at higher values.</i>	
<i>OPP4 and OPP5 were recoded; if respondents reported their mother/ father being home "most of the time" or a more frequent response category they were assigned a 1. Respondents who indicated they had no mother or father figure 0 in the respective category.</i>	

A number of items were examined in cross-classification tables to determine which questions were most predictive of delinquent acts. Generally, among respondents who had committed any offense, there was a high probability that they were not normally supervised. The resulting five items were dichotomized, and coded such that a “1” indicated greater levels of supervision. For example, one would hypothesize that if parents do not set a weeknight curfew there would be less supervision on weekday nights. The opportunity items were then summed, resulting in an index which ranged in values from zero to five, where greater values approximate less opportunity. The descriptive statistics are presented in Table 8. The index approximates a normal distribution.

Variable ^a	Mean ^b	Mode	Variance ^c			
OPP1	.6644	1	.2225			
OPP2	.1433	0	.1253			
OPP3	.3417	0	.2259			
OPP4	.1931	0	.1524			
OPP5	.4982	0	.2499			
Total	2.5424	3	3	5	1.13	1.06

N = 5,749 for all variables Alpha = .290

^a Dummy coded variables where 1 equals less opportunity

^b Proportion of sample that recorded a value of 1.

^c Computed as $p(1 - p)$ where p equals the mean of the variable.

Dependent Variable. Low self-control theory posits a broad measure of offending which includes any act of force or fraud carried out in the pursuit of self-interest. This definition is independent of the legality of the act. Gottfredson and Hirschi also state that low self-control is the cause of a number of acts that are legal but carry long-term negative consequences and deliver immediate gratification (e.g., cigarette

smoking, cheating in school, illicit sex etc.). Therefore, individuals with low self-control may commit number of acts that may or may not be legal. Furthermore, the authors state that individuals are versatile in the acts that result from low self-control. These assumptions guide the measure of delinquency used in the study.

There were a number of delinquent behaviors in the Add Health Study about the frequency of delinquency, ranging from less serious legal behaviors to more serious illegal behaviors. The scale employed herein, for example, contains behaviors which are less serious, such as lying to parents, and more serious behaviors, such as burglary; however, the number of very serious offenses is limited for three reasons. First, very serious offenses, such as assault with a deadly weapon are very rare in this sample of juveniles. Secondly, the inclusion of a number of very serious offenses would have caused the distribution of the delinquency measure to be very positively skewed. Finally, the inclusion of several various offenses reduces the effect of a respondent not having the opportunity to commit a given offense. Specifically, if a respondent has never had access to marijuana they are not distinguishable from a person who has had access to drugs and has not used drugs. Including multiple offenses, as opposed to a few offenses only, reduces this effect. The list of offenses used in the Delinquency Scale is listed in Table 9.

The responses in the Add Health Study were recorded on an ordinal scale with response categories of “never,” “once or twice,” and “three or more times.” These response categories were collapsed and recoded into dichotomous categories: “never” (0) and “ever” (1), for several reasons. Primarily, simply adding the items in their original form would make interpretation of the scale difficult. One would be unable to

distinguish between a respondent who committed burglary 3 or more times, and a respondent who used drugs 3 or more times. Also, according to Gottfredson & Hirschi, (1990, p. 92), specialization is not a function of low self-control, therefore, the most

Table 9: Delinquency Measures.	
Add Health Delinquency Scale Questions 1, 3, 4, 6, 7, 10, 12, 13 & 15, Tobacco, Alcohol & Drugs Questions 18 & 31, and Academics & Education Questions 2 & 7.	
(Variable) Stem	Response (Code)
<i>In the past 12 months how often did you...</i>	
(Graffiti) ...paint graffiti or signs on someone else's property or in a public place?	1 or more times (1) Never (0)
(Lie) ...lie to your parents or guardians about where you had been or whom you were with?	1 or more times (1) Never (0)
(Shoplift) ... take something from a store without paying for it?	1 or more times (1) Never (0)
(Assault) ...hurt someone badly enough to need bandages or care from a doctor or nurse?	1 or more times (1) Never (0)
(RunAway) ...run away from home?	1 or more times (1) Never (0)
(Burglary) ...go into a house or building to steal something?	1 or more times (1) Never (0)
(SellDrugs) ...sell marijuana or other drugs?	1 or more times (1) Never (0)
(Stealt50) ...steal something worth less than \$50?	1 or more times (1) Never (0)
(ActLoud) ...act loud, rowdy, or unruly in a public place?	1 or more times (1) Never (0)
(BeenDrunk) Over the past 12 months, on how many days have you gotten drunk or "very, very high" on alcohol?	1 or more times (1) Never (0)
(UsedMari) During your life, how many times have you used marijuana?	1 or more times (1) Never (0)
(SkipSchool) During this school year how many times did you skip school for a full day without an excuse?	1 or more times (1) Never (0)
(Suspended) Have you received an out-of-school suspension since you entered the 6 th grade?	Yes (1) No (0)
<i>Each question was collapsed from ordinal response categories to dichotomous response categories.</i>	

useful piece of information relating to the relationship between delinquency and self-control, is the distinction between never committing and committing an offense:

“Indeed, it appears that the best available operational measure of the propensity to offend is a count of the number of distinct problem behaviors engaged in by a youth” (Hirschi & Gottfredson, 1995, p. 134). Thirdly, the error introduced into self-report scales can increase as the number of offenses estimated by the respondent increases. For example, a respondent who has used drugs or painted graffiti hundreds of times is unlikely to respond with the same accuracy as a respondent who committed an act only once. The interpretation of this “ever” index is more straightforward than a simple addition of the original data. The inter-item correlation matrix for the 13 offenses is reported in Appendix 4.

Table 10: Delinquency Index- Descriptive Statistics

Variable ^a	N	Mean ^b	Mode	Variance ^c			
Burglary	5,758	0.0504	0	0.0478			
SellDrugs	5,754	0.0707	0	0.0674			
RunAway	5,758	0.0846	0	0.0794			
Graffiti	5,755	0.0874	0	0.0793			
Assault	5,750	0.1791	0	0.1476			
Steallt50	5,755	0.1891	0	0.1527			
Shoplift	5,751	0.2295	0	0.1763			
UsedMari	5,605	0.2500	0	0.1924			
Suspended	5,740	0.2570	0	0.1930			
BeenDrunk	5,746	0.2800	0	0.2059			
SkipSchool	5,648	0.2813	0	0.2039			
ActLoud	5,754	0.4743	0	0.2493			
Lie	5,750	0.5268	1	0.2495			
	N	Mean	Median	Mode	Range	Variance	Std. Dev.
Total	5,749	2.70	2	1	12	5.58	2.36

^a Dummy coded variables where 1 equals doing the behavior.
^b Proportion of sample who recorded a value of 1.
^c Computed as $p(1 - p)$ where p equals the mean of the variable.

The responses to each item were then summed resulting in a scale ranging from zero to thirteen. The delinquency index was generated so long as nine of the thirteen

items had valid responses. In this “ever” scale, larger numbers indicate committing more different types of offenses. However, this scale does not use all available information from the items in the study, and cannot differentiate between respondent who has committed an act once and a different respondent who has committed the same act three or more times. Therefore, this index is a versatility index.

The creation of the scale resulted in an index that ranged in possible values from zero to thirteen, with a mean of 2.71, and a standard deviation of 2.36. The distribution is positively skewed and slightly peaked. The modal value of the delinquency index is 1. On average, individuals in the study have committed 2.71 different offenses listed in Table 9; however, more respondents reported committing only one offense than any other possible category. The descriptive statistics for each offense and the resulting index are reported in Table 10. A frequency distribution for the resulting index is presented in Appendix 4.

Control Variables. There were three control variables employed in this study. The first was age. Both the date of the interview and the birthdates of the respondents were available. The age of the respondent was obtained by computing the age at the time of the interview from the date of birth of the respondent.

The final two control variables were race, and sex. Both pieces of information were self-reported during the interview. Race and ethnicity were both recorded by the interviewer. For simplicity, a variable named “White” was created. If a respondent reported being Caucasian, he/she was assigned a value of 1, and if the respondent did not

report being Caucasian he/she was assigned a value of 0. The sex variable was also dummy coded, 1 for male and a value of 0 for female.

Cases missing valid data on any variable were omitted from the analysis. This resulted in dropping 323 cases, or 5.3 percent. The final sample size was 5,749 respondents.

Analytic Strategy

There are three main hypotheses that will be tested. The first concerns the effects of social bonding and self-control on delinquency. The theory predicts that increased self-control/ social bonding will result in decreased crime. The second hypothesis concerns the relationship between the two independent variables in this study. Hirschi (2004, p. 543) claims the two constructs of social control, and self-control are the same. Therefore, the measures should be highly correlated. The third hypothesis concerns the effects of self-control/ social bonding, while controlling for the attitudinal measure of self-control. According to the theory, the scales measure the same construct—self-control; therefore, the effect of one while controlling for the other should be insignificant.

With regards to the first hypothesis, a multivariate ordinary least squares regression model will be fit to the data to quantify and test for significance of the slope, or effect of the self-control/ social bonding index on the delinquency index. The effect of self-control/ social bonding should be negative and significant. The model will control for opportunity, age, gender, and race.

A Pearson's product moment correlation coefficient will be computed to test the relationship between the attitudinal self-control measure and the self-control/ social bonding measure. The second hypothesis predicts there will be a negative significant correlation.

Finally, the third hypothesis will be tested using a multivariate linear regression model, which models the effects of the attitudinal self-control measure and the self-control/ social bonding measure on the delinquency index. Examination of the model will determine whether or not the independent variables are collinear. In theory, the scales approximate the same construct, and the amount of variation in the delinquency index explained by both variables should be high. Therefore, the slopes of the independent variables should be insignificant when both self-control indices are in the model.

CHAPTER IV

FINDINGS

Results

Scatterplots and correlation matrices were generated in order to summarize the relationship among the variables in the analysis. The correlation matrix for the variables used in the study is shown in Table 11. There was a weak positive relationship between the attitudinal self-control index and the delinquency index, as well as a moderate negative relationship between the self-control/ social bonding index and the delinquency index. Keeping in mind the attitudinal index represents low self-control with increasing values, and the self-control/ social bonding scale represents greater maternal attachment and school commitment with greater values, the two indices themselves were moderately negatively related, as expected.

Variable	1	2	3	4	5	6	7
Attitudinal Index	-	-.263**	.213**	-.059**	-.100**	.024	.036*
SC/SB Index		-	-.375**	.042**	-.144**	-.018	-.011
Delinquency Index			-	-.005	.131**	.136**	-.022
Opportunity Index				-	.237**	.019	.034*
Age					-	.043**	-.022
Male						-	.013
White							-

N = 5,749 for all variables * $p < .05$ ** $p < .01$

The correlation between opportunity and delinquency was weak, and insignificant. Furthermore, the correlation between age and delinquency was positive and significant. This correlation is consistent with age and crime research (See Hirschi & Gottfredson, 1983 for discussion) as the sample is comprised of respondents aged 12 to 22, where the steepest ascent on the age-crime curve is present. As expected the correlation between gender and delinquency was positive, indicating that on average males had a higher score on the delinquency measure. Finally, delinquency was unrelated to the respondent being white.

Interestingly, both scales were significantly and negatively related to age. The attitudinal scale, in which greater values indicate *low self-control*, was negatively related, meaning older respondents had greater levels of self-control, on average. Furthermore, the self-control/ social bonding scale, in which greater values indicated greater maternal attachment and commitment to school was also negatively related, meaning older respondents on average were less bonded.

One assumption of ordinary least squares estimation is a linear relationship between the dependent variable and the independent variables. The relationship between the causal variable self-control and delinquency is assumed to be linear, in theory. The scatterplots did not indicate a curvilinear relationship between the independent variables and the dependent variables. Therefore, the analysis will proceed using ordinary least squares estimation.

Ordinary least squares multivariate regression models were initially estimated for both regression models in this analysis. In both models there were violated assumptions

of the error variance being both identically normally distributed. For example, a scatterplot of the predicted values of the regression equation and the residuals was created and is presented in Figure 4.

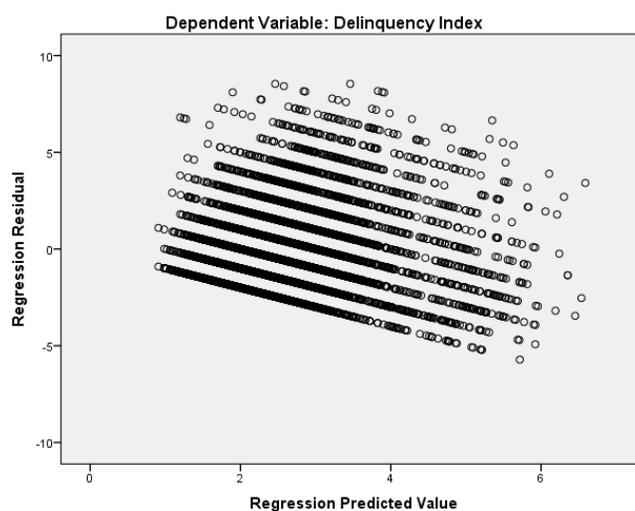


Figure 4: Scatterplot for Regression Residuals with SC/SB Index as a predictor

The errors are patterned in a fan shape indicating that the error variance is small at low predicted values and increases as the predicted values increase. This finding is generally consistent with an important variable being omitted, a variable which explains the increasing error variance as predicted values increase. Furthermore, the data analyzed herein are clustered, that is, there are multiple units of analysis within this data because of the sampling method employed. The respondents are the first unit of analysis and are of concern in the analysis. However, students were not randomly sampled, they were selected within schools, therefore, schools are the second unit of analysis³.

According to Goldstein (1999, p. 1), respondents clustered within schools and

³ The author recognizes this is an oversimplification of clustering effects. Generally, in datasets collected in schools there will be many clusters, clustering in individuals, individuals clustering into small friendship groups, friendship groups clustered within classrooms, and so on.

classrooms behave in a similar manner and will provide “less information” as compared to a sample where each respondent came from a different school. That is to say, the data are predictable from the cluster in which each student is nested, and the errors in the regression model are autocorrelated. In the case of autocorrelation and heteroscedasticity, the coefficients estimated remain unbiased, but no longer have the smallest standard errors.

Long and Ervin (2000) suggest correcting for the violated assumptions and inefficient estimates by estimating a heteroscedasticity consistent standard error. This “loosens” the assumption of constant and normally distributed error variance (Long & Ervin, 2000). Robust standard errors (Huber-White SE) were estimated in the models presented, to account for the problems with autocorrelation and heteroscedasticity. The sample size (5,749 respondents) allows for the robust standard error to be applied as the size of the bias of the estimator will be negligible as sample size increases.

The results from the multivariate regression model explaining the number of different types of offenses an individual has reported committing as a function of the self-control/ social bonding index and opportunity index, while controlling for age, sex, and race, are reported in Table 12. The F-ratio is 173.85 ($p > .0001$) which lies in the critical region. Therefore, one would reject the null hypothesis, and conclude that at least one slope in the regression model is not equal to zero in the population, and the individual t-statistics are worth examining.

The squared multiple correlation coefficient, or R^2 value, is 0.163, meaning the proportion of variation in the dependent variable explained by all variables in the model

is 16.3%. In other words, as opposed to using the mean value of the delinquency index to predict values on the delinquency index, this regression model improves prediction errors by 16.3%. However, the predictions are not perfect—on average the regression model estimates the number of different types of offenses an individual has reported committing with prediction error of 2.161 offenses.

Table 12: Multivariate Regression Equation Explaining Delinquency Index Using the Self-Control/ Social Bonding Index as a predictor

Variable	Coefficient	Robust SE	Std. Coefficient	t
SC/SB Index	-.121*	.004	-.362	-24.77
Opportunity	-.020	.028	-.009	-0.71
Age	.100*	.016	.074	6.23
Male	.601*	.057	^a	10.49
White	-.130*	.062	^a	-2.10
Intercept	6.255*	.381		16.43
n =5,749	RMSE=2.161	$R^2 =.163$	F =173.85	* p < .05

^a Standardized coefficients not reported for dummy coded variables.

The partial slope value, for the effect of self-control/ social bonding on the delinquency index was -0.121. This means for every one unit increase on the self-control/social bonding scale, the number of different types of offenses an individual will commit decreases by about .1 offenses, on average. This effect holds constant the potentially confounding effects of opportunity, age, sex, and race. This effect corresponds to a t statistic of -24.77, which lies in the critical region, and has a probability of occurring less than one time in a thousand. Therefore, one would reject the null hypothesis and conclude, at the .05 level of statistical significance, that the effect of self-control/ social bonding on delinquency is not zero.

In order to summarize the relationship between the attitudinal self-control measure and the self-control/social bonding measure, a scatter plot explaining the relationship between the attitudinal index and the social bonding index was generated (See Figure 5). This particular scatterplot indicates the density of observations by the number of “petals” or black spokes on each orange or yellow hexagon. Single observations are indicated by blue circles. This scatterplot clearly indicates the clustering of observation around the means of the independent variables (indicated by intersecting lines superimposed on the plot), and a very slight negative relationship.

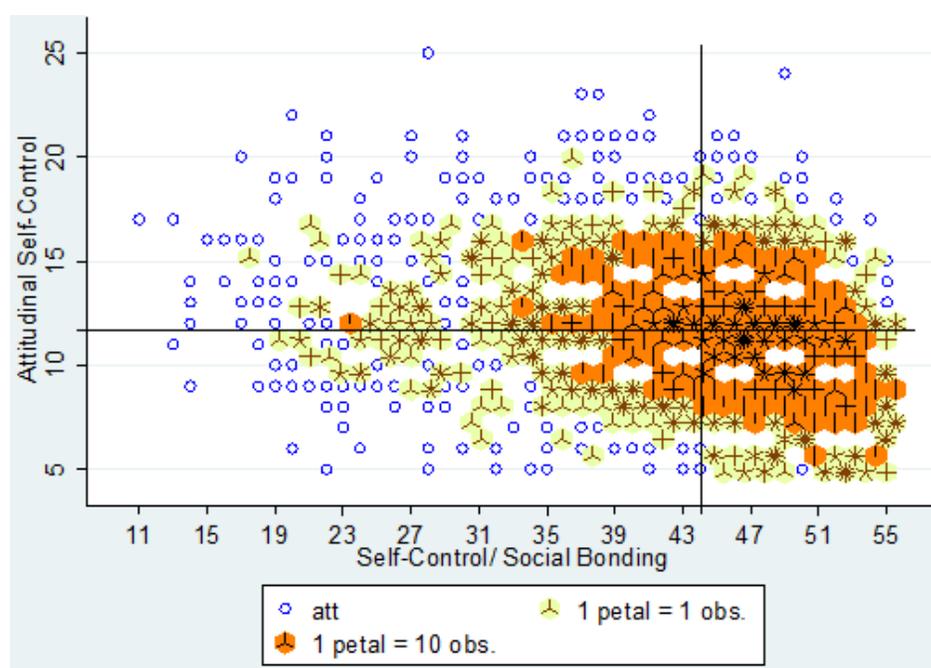


Figure 5: Sunflower Plot

Additionally, a Pearson’s product moment correlation was computed. The correlation between the attitudinal self-control index and the self-control/ social bonding index was $-.263$, indicating the relationship was moderately negative and statistically significant. In order to investigate the relationship between the scales further, a

correlation matrix was computed between the items in both indices. The matrix is shown in Table 13. The correlations between the items in the scales are weak, and at times insignificant. The largest correlation is between diligence in problem solving and the respondents' having discussions about right and wrong with their mother. The weakest correlation is between relying on gut feelings, and desire to go to college.

Table 13: Inter-item Correlation Matrix for Attitudinal and Self-Control/ Social Bond Measures

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
A1	-.040*	-.049*	-.053*	-.007	-.021	-.025	-.129*	-.069*	-.071*	-.094*	-.099*
A2	-.119*	-.075*	-.148*	-.222*	-.188*	-.187*	-.099*	-.126*	-.098*	-.151*	-.119*
A3	-.094*	-.078*	-.149*	-.175*	-.153*	-.162*	-.096*	-.111*	-.091*	-.132*	-.090*
A4	-.087*	-.055*	-.137*	-.174*	-.146*	-.131*	-.089*	-.111*	-.099*	-.136*	-.100*
A5	-.090*	-.059*	-.169*	-.190*	-.182*	-.172*	-.110*	-.127*	-.129*	-.127*	-.160*
A- Attitudinal Self-Control Measure (Followed by item number from index)											
B- Self-Control/ Social Bonding Measure (Followed by item number from index)											
* p < .01											

The correlations between the items in the two scales suggest that the items are weakly related. One would expect these items to have strong correlations if they measures similar constructs. However, the correlations here suggest that one's self-control measured on an attitudinal scale is not equivalent to the extent to which they have strong bonds to their mother and school.

In order to further investigate the effect of both scales on delinquency, a multiple regression model was estimated, and the results presented in Table 14. The F test indicates that the model is a good fit to the data and that the individual slopes and t-tests for significance of the slopes are worth examining. Furthermore, the R^2 value is .180, a slight improvement over the model which only included the self-control/social bonding index.

The multiple regression model estimates the unique effect of the independent variables on the dependent variable with a partial slope value. The effect of the self-control/social bonding index on the delinquency index, while controlling for attitudinal self-control, opportunity, age, sex, and race, was $-.108$. For a one unit increase in the self-control/ social bonding scale individuals would commit about $.1$ fewer types of crimes on average. A partial slope of $-.108$ corresponds to a t-statistic of -21.84 , which lies in the critical region. Therefore, one would reject the null hypothesis, and conclude that the population partial slope is not equal to zero and self-control/ social bonding has a negative and statistically significant effect on delinquency.

Table 14: Multivariate Regression Equation Explaining Delinquency Index Using the Attitudinal Self-Control Index and the Self-Control/ Social Bonding index as predictors

Variable	Coefficient	Robust SE	Std. Coefficient	t
SC/SB Index	$-.108^*$	.005	$-.323$	-21.84
Attitudinal Index	$.117^*$	.011	$.135$	10.39
Opportunity	$-.015$	.028	$-.007$	-0.54
Age	$.126^*$	.016	$.093$	7.77
Male	$.585^*$	.057	-	10.30
White	$-.151^*$	.062	-	-2.45
Intercept	3.308^*	.439		8.91
n =5,749	RMSE=2.139	$R^2 =.180$	F =173.41	* p < .05

The effect of the attitudinal index was estimated with a partial slope of $.117$, meaning for every one unit increase on the attitudinal index, respondents commit $.117$ greater different types of crimes, on average. This effect holds constant the potentially confounding effects of the self-control/social bonding index, opportunity, age, sex, and race. The partial slope value of $.117$ corresponds to a t- statistic of 10.39 which lies in the critical region. Therefore, one would reject the null hypothesis, and conclude, at the

.05 level of statistical significance, that the population partial slope is not equal to zero and low self-control has a positive effect on delinquency⁴.

The zero-order and part correlation coefficients in the full model were compared to investigate the shared variation in delinquency of the two indices. The correlations are reported in Table 15. The reduced value of the part correlation compared to the zero-order correlation would indicate that there is shared variation in delinquency among the variables in the model, that is to say that two or more variables explain the same portion of variation in the number of offenses committed. If the two indices perfectly measured the same construct, one would expect the part correlations to be zero, because the variation in both indices would explain the same portion of variance in the delinquency scale. The part correlations hold constant the confounding effects of opportunity and the control variables. The variation in delinquency the self-control/ social bonding index explains uniquely is roughly 9.3%, compared to 14.1% explained with no control variables. The variation in delinquency the attitudinal index explains uniquely is 1.7%, compared to 4.5% with no control variables.

Table 15: Zero-order and Part Correlation Coefficients.
Model Explaining Delinquency Index

Independent Variable	Zero-order	Part
SC/SB Index	-.375	-.306**
Attitudinal Index	.213	.129**
Opportunity	-.005	-.007
Age	.131	.089**
Male	.136	.124**
White	-.022	-.030*
* p < .05 ** p < .001		

⁴ The VIF was examined to quantify the effect, if any, of multicollinearity. The VIF for all independent variables was less than 1.12, suggesting multicollinearity does not affect the estimates.

According to Hirschi (2004) one would expect a large amount of overlap in the variation in the delinquency index explained by both self-control indices. In this case, both predictors are significant, indicating that the overlap in explained variation was not enough to reduce the effect of each predictor to insignificance. However, when the self-control/social bonding measure is eliminated as a predictor from the regression equation, the t-statistic for the effect of attitudinal self-control increases from 10.39 in the full model, to 17.08. When comparing the t-statistic for the self-control/ social bonding index in the first model to the t-statistic for the full model, the t-statistic of the self-control/social bonding index is smaller in the full model (-24.77 in the first model to -22.84 in the full model). However, in no model is the effect of either scale insignificant.

CHAPTER V

DISCUSSION

Conclusions

The results from the first regression model indicated that the self-control/ social bonding measure posited by Hirschi (2004) is a significant predictor of delinquency. This model held constant the potentially confounding effects of opportunity and other control variables. The first hypothesis was supported in this analysis.

Secondly, examination of the inter-item correlation matrices of the independent variables, and the correlation between the independent variable indices indicated the relationship between the two measures of self-control was significant. This correlation indicates that individuals with low self-control, on average, had weaker maternal attachment and commitment to school. However, the extent to which they were related was less than one would expect to find if two indices measured the same construct.

While these measures are hypothesized to measure the same construct, these findings make a case for the inequity of social bonding and self-control. If the reported strength social bonds are solely based on the self-control of an individual reporting them, there is likely error in the self-reported bonding measures. That is, if individuals perceptions of social bonds are influenced by their self-control and the “true value” of

social bonding is independent of self-control, than individuals will make errors when responding to self-reported social bonding items. Under these assumptions, one would expect individuals with low self-control to report being weakly attached to their mothers, and weakly committed to school. As self-control increases, the strength of these reported bonds increases. The evidence does not support this view of the relationship between social bonds and self-control. One would expect indices that measure the same construct to explain more than 6.92% of the variation in one another. Though the scales were significantly related, one would tend to reject the notion that the two indices measured the same construct based on these findings. Furthermore, the correlations between the social bonding items are weakly related to attitudinal self-control items. In addition, the attitudinal items are weakly related to the social bonding index, and the social bonding items are weakly related to the attitudinal index.

The results of the final regression model indicate that both indicators of self-control are significant predictors of delinquency. That is to say, while controlling for self-control, social bonding is a significant predictor of delinquency, and vice versa. Certainly, one would expect to find a great deal of shared explained variation in the dependent variable if two measures measured the same construct, and the effect of one while controlling for the other would be insignificant. This further supports the conclusion from the second hypothesis.

Limitations

These results are potentially attributable to the context of the responses. For example, when social bonds are measured in the survey context, the true value of the

strength of social bonds is more likely to be recorded than if they were approximated in a hypothetical “weighing the costs” method, which has been applied in previous studies of the redefined self-control. That is to say, when researchers get to the point about respondents’ bonds, they are measuring social bonds with greater accuracy. It follows that, the true strength of social bonds is free to vary along values of self-control, and that, when measured in this general context, social bonds and self-control are not perfectly related. That is not to say that there is no relationship—the evidence clearly indicates a relationship between the two measures. However, the evidence indicates that each measure explains a significant amount of unique variation in delinquency.

Researchers may obtain a measure of self-control based on social bonding if they apply a method similar to Piquero & Bouffard (2007), and respondents indicate that loss of trust in their mother, or negative consequences at school, are serious considerations in weighing whether or not to commit a crime, without being directly asked about their bonds. However, the results of this study indicate that the measure posited by Hirschi (2004), is a social bonding measure, and not a self-control measure.

These findings are consistent with the existing evidence for the effect of social bonding on delinquency (Agnew, 1985). The findings with regard to the relationship between self-control and social bonding were not expected given the hypothesis and the revisions made to self-control theory (in Hirschi, 2004). There are, however, a number of limitations in this study. The main limitations in the study deal with the measures, clustering of the data, and testing effects.

The assumptions of the linear regression model require the independent variables in the model to be measured perfectly. There must be no error in the independent

variables; otherwise the estimates will be biased. The measures in this thesis are at a disadvantage because they are approximated from items in the Add Health survey, rather than fully operationalized as one would prefer. While the measures in the study are constructed from questions that were the best available in approximating the constructs, the limitations of secondary data analysis are present in the findings. The measures were able to predict delinquency based on the scores from the survey questions to a certain extent. However, there are a few differences between the self-control/ social bonding scale proposed by Hirschi (2004) and the one employed here. Primarily the weighting of each scale is different. In the Hirschi scale, maternal attachment accounts for four of nine total questions. In the scale employed in this study, maternal attachment accounts for six out of eleven items. Furthermore, the Hirschi (2004) scale is dichotomously coded, ranges from zero to nine, and has a smaller variance compared to the scale here which is scored on a composite scale of eleven Likert scales, ranging from eleven to fifty-five and has a greater variance. While the scale employed in this thesis allows one to make clearer distinctions between individuals than would a dichotomous coding system, it could increase the amount of error introduced into the statistical models, and affect the construct validity of the self-control/social bonding scale. The questions used to construct the self-control/ social bonding scale are good approximations of the questions used by Hirschi (2004), and should be highly correlated with the construct. On face value, the scale and questions seem to approximate the maternal attachment and school commitment dimensions of the social bonding scale.

The social bonding scale was negatively related to age, indicating greater maternal attachment and school attachment was reported in younger subjects on average.

This is consistent with previous findings. However, the low self-control scale was significantly and negatively related to age, indicating as subjects aged, they reported higher levels of self-control on average. According to self-control theory, one would not expect age to be significantly related to self-control in a sample older than 10 years old, as by that age self-control is fully developed (Gottfredson & Hirschi, 1990). This suggests a measurement issue in the attitudinal self-control scale.

Indeed, the attitudinal self-control scale also suffers from many of the problems discussed above. The attitudinal scale was constructed with the best available questions covering the domains of low self-control as explained in the first chapter. However, given the few number of items in this attitudinal scale (five), as compared to other attitudinal measures such as Grasmick et al. which contained twenty-four items (1993), the sensitivity of this scale to individual differences is weak. The Grasmick et al. scale was also the sum of the z-transformation of the items. The computation of the independent variable indices in this study was a simply additive function, meaning the variance of one or more items could have a disproportionate effect on the scale as a whole. Once z-transformations were performed on the items, models were estimated once again, and there were no meaningful differences in the t-statistics.

Another limitation of this study is the validity and reliability of the opportunity measure. Again, this measure was constructed with the best available items, which were individually significantly related to delinquency. However, when combined, the scale was weakly related to delinquency, and had poor reliability. This is likely attributable to the lack of a broader spectrum of items approximating opportunity. Indeed, the five-item scale pertained to restrictions at home in four of five items.

One would expect a correctly specified opportunity measure to be at least moderately related to delinquency. In fact, in four of five models that excluded the opportunity index, and included each opportunity item individually, the opportunity items were significant, however, no other conclusions were affected. A model which excluded the opportunity measure was estimated and there were no major changes in the t-statistics over the models presented. As opportunity is uncorrelated with the self-control variables, it is unlikely to contribute to a misspecification of the models—the shared explained variation between the control variables, opportunity and delinquency is small.

Furthermore, these models are technically misspecified because they exclude the possibility of a self-control-opportunity interaction for simplicity. This means the models don't allow for the effect of opportunity to vary at different levels of self-control, or vice versa. In Grasmick et al. (1993), the main effect of the attitudinal scale was significant for both fraud and force when respondents had zero opportunity to offend. Furthermore, as low self-control increased, the effect of opportunity on whether respondents had committed acts of force or fraud increased. In the models constructed in this thesis, opportunity is only controlled—the effect of low self-control is constant across all levels of opportunity.

Another source of error in the independent variable measures is the questions from the scales were clustered within a larger interview. That is, all questions dealing with maternal attachment were asked in one section of the survey, and all self-control questions were asked in another. The ordering of questions can contribute to multiple

answers being more like one another, and farther away from the true value. These deviations are errors, and can cause the estimates to be biased.

Another limitation of this study deals with the clustering of observations within schools. As it was noted above, this limitation concerns the amount of information provided by entirely unique observations as compared to respondents clustered within a larger level of measurement. This study attempted to address this issue by estimating robust standard errors in the model. Another way to use ordinary least squares to control for the effects of the clustering of subjects within schools, is to create dummy variables for each school in which the subjects were clustered. These dummy variables were then included in an alternative regression model, less one for the reference group, and the model estimated. Including the dummy variable allows for any shared variation between cluster and the dependent variable to be trimmed, and one would expect at times the dummy variable to have a significant effect on the dependent variable. The R-square value of the alternative model increased over the model excluding the cluster information, and there were otherwise, no major differences in the t-statistics of the important variables.

There remains the possibility that, as Grasmick et al (1993) point out, the measurement of low self-control is multidimensional. Indeed, the original attitudinal scales tapped six dimensions of self-control, and the original social bonding scale tapped four main dimensions. When the z-transformed items in both scales were combined to a single index ($\text{Alpha} = .814$), the model's improvement was marked. However, in this case the ordinary least squares technique may not be preferred to answer such a measurement question. There are superior methods to drawing conclusions on

measurement questions, such as the one posed herein. Structural equation modeling, multi-level modeling, and other techniques would be preferred to lend a greater degree of validity and reliability to these findings. One could use the items employed in this study in a confirmatory factor analysis to determine the extent that the items are measuring one or more latent variables.

Though the self-control and social/bonding scales used in this study were able to predict delinquency, the improvement of the model including both scales over the model including only the attitudinal self-control scale was minimal. One would prefer the simplest explanation, in which case there is little utility the social bonding items in predicting delinquency, and offending. Furthermore, the social bonding items used in this study are limited to youth aged 12 to 22, and generally have no predictive power in any other population. Certainly, school commitment is not a salient social bond for middle-age adults. However, the evidence supports the effect of the social bonding measure proposed by Hirschi (2004).

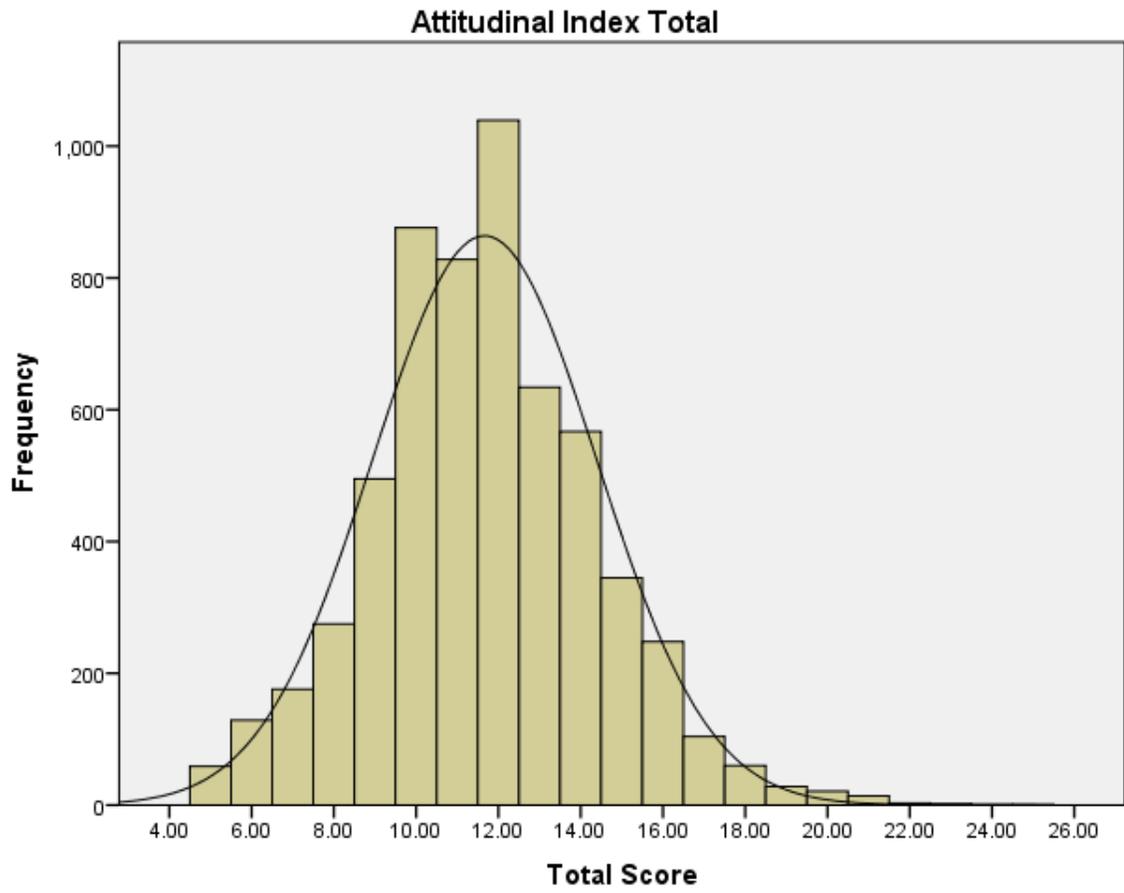
Consider a juvenile with low self-control, who is unlikely to contemplate what consequences will occur if they commit an offense. Does the strength of their maternal attachment, and school commitment have an effect on their decision making, if their decision making process is truncated to start? This question is beyond the scope of this study; however, it enlightens the need for the clarification of the roles of social bonding and self-control, such that modeling these effects goes beyond speculation. This study has provided evidence for the relationship between social bonds and low self-control, which may help clarify the theoretical relationship between the control society exerts on juveniles, and the internal controls they exhibit.

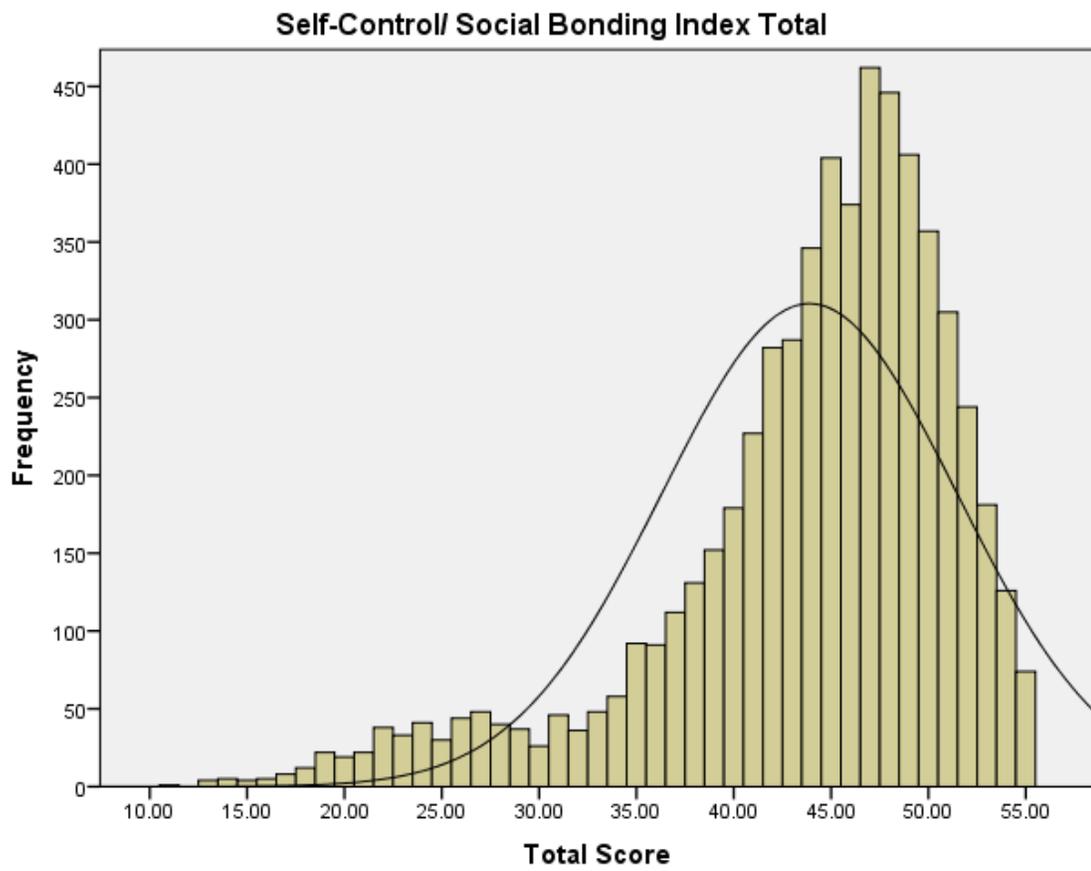
APPENDIX 1

Self-Control/ Social Bonding Index											
National Longitudinal Study of Adolescent Health- Wave 1											
Inter-item Spearman Correlation Matrix											
Variable	1	2	3	4	5	6	7	8	9	10	11
SCSB1	-	.571	.537	.462	.585	.604	.082	.155	.118	.172	.114
SCSB2		-	.466	.400	.440	.467	.095	.121	.101	.142	.090
SCSB3			-	.535	.609	.657	.134	.196	.163	.196	.113
SCSB4				-	.694	.586	.108	.174	.146	.180	.142
SCSB5					-	.805	.104	.194	.171	.188	.160
SCSB6						-	.119	.197	.158	.183	.142
SCSB7							-	.156	.112	.175	.141
SCSB8								-	.427	.305	.234
SCSB9									-	.355	.245
SCSB10										-	.184
SCSB11											-
<i>N= 5905 for all variables All correlations are significant p < .01</i>											

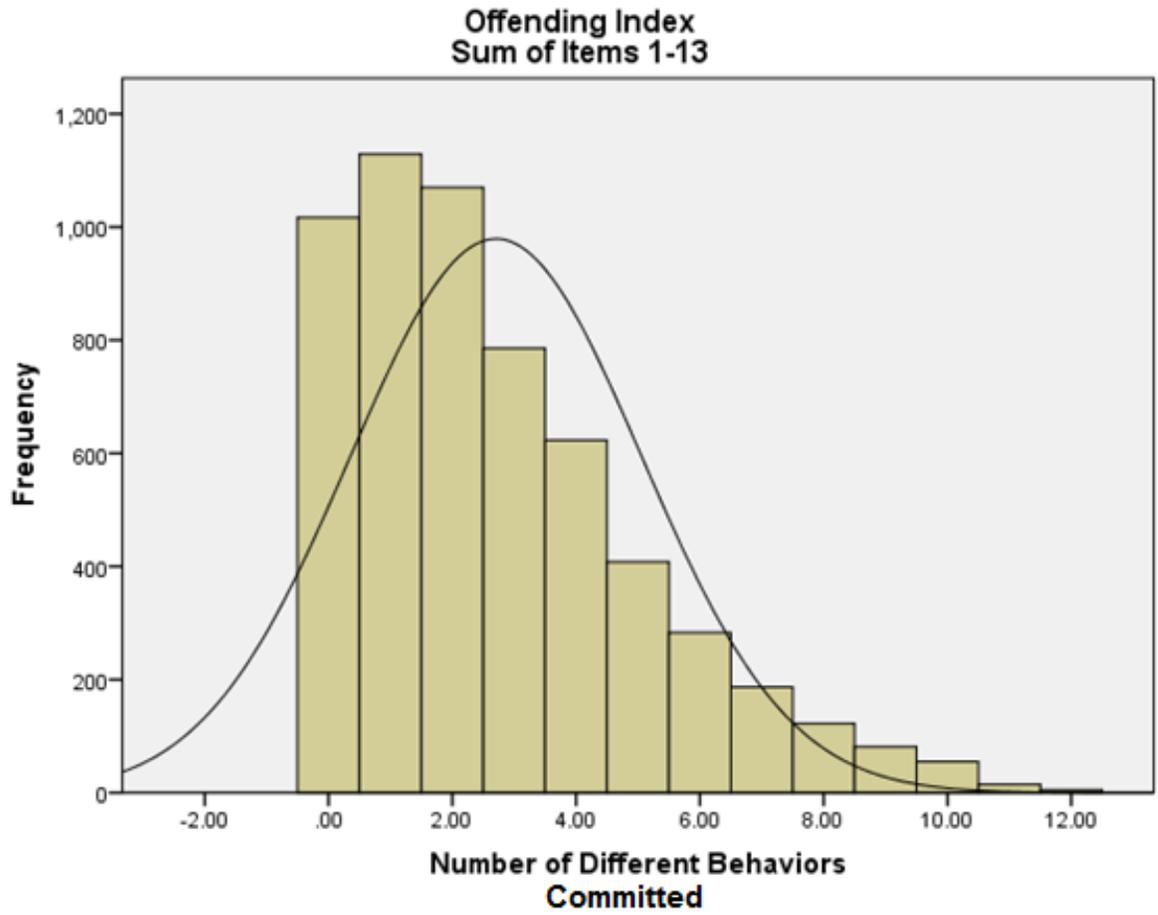
Attitudinal Self-Control Index					
National Longitudinal Study of Adolescent Health- Wave 1					
Inter-item Spearman Correlation Matrix					
Variable	1	2	3	4	5
ATT1	-	.075	.101	.071	.050
ATT2		-	.510	.424	.261
ATT3			-	.436	.239
ATT4				-	.221
ATT5					-
<i>N= 5905 for all variables All correlations are significant p < .01</i>					

APPENDIX 2





APPENDIX 3



APPENDIX 4

Delinquency Index													
National Longitudinal Study of Adolescent Health- Wave 1													
Inter-item Pearson Correlation Matrix													
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
Graffiti	-	.149	.238	.205	.156	.215	.227	.252	.194	.158	.180	.133	.145
Lie		-	.266	.121	.140	.139	.149	.241	.307	.251	.205	.147	.059
Shoplift			-	.225	.202	.313	.227	.694	.236	.219	.273	.144	.176
Assault				-	.175	.158	.190	.222	.187	.139	.168	.134	.254
RunAway					-	.186	.200	.171	.127	.168	.220	.157	.173
Burglary						-	.258	.355	.144	.152	.184	.123	.147
SellDrugs							-	.253	.174	.292	.371	.172	.216
Stealt50								-	.250	.213	.267	.122	.149
ActLoud									-	.216	.184	.097	.095
BeenDrunk										-	.499	.273	.199
UsedMari											-	.285	.243
SkipSchool												-	.223
Suspended													-
All correlations are significant $p < .01$													

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VITA

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