

## ABSTRACT

Title of Document:                   TURNING POINTS IN LATE  
  ADOLESCENCE: A STUDY OF HIGH  
  SCHOOL GRADUATION AND ADULT  
  OFFENDING IN A LIFE COURSE  
  FRAMEWORK

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Guided by the general theoretical paradigm of life course criminology, this study investigates the relationship between high school graduation and adult offending. This dissertation builds upon the idea of turning points in reducing offending behavior and extends this idea from adulthood to late adolescence/early adulthood, and considers high school graduation as a turning point in reducing adult offending behavior.

This dissertation identifies the research gap on the high school graduation/dropout-delinquency relationship, that is, most previous studies could not reject the alternative hypothesis, i.e. not graduating from high school and adult offending can both be explained by prior processes. This dissertation investigates the causal relationship between high school graduation, as a turning

point that opens up future opportunities, and early adult offending. After establishing a causal relationship between graduation and adult offending, this study further explores the mechanisms of the graduation effect. In particular, this study investigates whether and to what extent turning points in adulthood, i.e. employment and intimate relationships, mediate such a causal relationship.

The sample used in this dissertation consists of 460 males from the data collected by Johns Hopkins Prevention Intervention Research Center (JHU PIRC). The analytical methods used in this study include propensity score matching, sensitivity analysis (to address selection bias due to possible omitted covariates), and mediation analysis.

In terms of the causal relationship between graduation and offending, it was found that high school graduates are 93% less likely to have an adult offending record than dropouts similar on early processes. Such a finding is robust to selection bias due to possible omitted covariates. It was concluded that for those who are at great risk for dropping out, staying in school and finishing their education provides a turning point in reducing adult offending. In terms of the mechanisms of the graduation effect, it was found that post graduation experiences, employment in particular, help explain the graduate-dropout differences in offending during early adulthood. For dropouts, employment may be another turning point. Implications for life course criminology and policy are discussed.

TURNING POINTS IN LATE ADOLESCENCE: A STUDY OF HIGH SCHOOL  
GRADUATION AND ADULT OFFENDING IN A LIFE COURSE  
FRAMEWORK

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## Dedication

I would like to dedicate this dissertation to my wonderful parents, Li Liu and Wenjuan Yin, for all the support and sacrifices they have made for me to realize my dream.

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Getting a Ph.D. in criminology from the best program in the country has provided me the most important turning point in my academic career. I would like to extend my heartfelt gratitude to the following individuals who have made this turning point possible. First, I thank my advisor, Dr. Hanno Petras, for his continuous support throughout the Ph.D. program. When I first started the Ph.D. program in 2005, I experienced some financial strain (I did not have funding support for the first semester) and I experienced the change of environment (I got my M.A. from a much smaller department) as challenging. Despite that getting a Ph.D. in criminology from the University of Maryland has always been my dream, I was thinking about dropping out of the program. Hanno convinced me to stay and taught me to never give up my dreams. Throughout the Ph.D. program, he has always been there to listen to me and to give advice. He taught me how important it is to be detail-oriented when conducting empirical research. He introduced me to a new world of statistical analysis with latent variables, a concept that I was not aware of before. He taught me how to write academic papers and how to present my work with a clear structure. He introduced me to the field of prevention research. He gave me advice on everything related to my Ph.D. studies, from what classes to take to job searching. Under his guidance, I have grown from a Ph.D. student to an independent researcher. Thanks, Hanno!

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## CHAPTER I: INTRODUCTION

Guided by the general theoretical paradigm of life course criminology, this dissertation investigates the causal relationship between high school graduation and offending behavior in early adulthood. The study considers the role of turning points in reducing offending behavior, and extends this idea from adulthood to late adolescence/early adulthood. In this study, I investigate whether high school graduation is a turning point that opens up future opportunities and its causal effect on early adult offending. After establishing a causal relationship between graduation and adult offending, this study further examines whether and to what extent turning points in adulthood, i.e. employment and intimate relationships mediate such a causal relationship<sup>1</sup>.

Life course criminology has been one of the most popular criminological paradigms since the late twentieth century. It provides the most comprehensive explanations for the paradox of continuity and change in individual offending behavior. For example, adult offending virtually requires childhood antisocial behavior, while antisocial behavior in childhood does not necessarily lead to adult offending (Laub and Sampson 2003; Sampson and Laub 1993). One compelling reason that life course paradigm became popular in the field of criminology is that it provides the flexibility to understand the influences occurring during adulthood. A central theme of life course criminology is that, above and beyond childhood experiences and individual differences, salient life events in adulthood can counteract risk accumulation in childhood and adolescence, thus redirecting a

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<sup>1</sup> This study was approved by the IRB office at the University of Maryland on March 19<sup>th</sup>, 2009 (application number 09-0177).

risky trajectory to a more adaptive pathway. Examples of these life events are marriage, stable employment, and military service.

Sampson and Laub (2005, 13) called these events “turning points.” The idea of turning points has been useful in explaining the malleability of individual offending behavior, and in particular, the desistance from crime in adulthood. However, the general idea of turning points has not been applied to late adolescence and early adulthood, despite the evidence that desistance usually occurs earlier than the traditionally identified turning points in adulthood (Thornberry 2005). In other words, I argue in this study that the turning points identified by Sampson and Laub (Sampson and Laub 1993; Laub and Sampson 2003) are not as applicable to the offending process in late adolescence/early adulthood. This study attempts to draw attention to late adolescence/early adulthood in identifying potential turning points, and, more importantly, studying the mechanisms through which these turning points redirect adult offending behavior.

Application of the general idea of turning points requires the understanding of the different types of turning points. Pickles and Rutter (1991) describe two types of turning points. One type involves “a radical long lasting change in life circumstances,” including changes in social relationship patterns, social network, and way of living (Pickles and Rutter 1991, 133). This type of turning point is the current focus of life course criminology. The other type opens up or shuts down opportunities, i.e., getting access to other social institutions (e.g., college), an increase in human capital (e.g., higher income), and so on.



Although events of this type have been empirically studied, this type of turning point has not been discussed in the general framework of life course criminology to the same extent as the first type.

This dissertation will focus on high school graduation as an example of the second type of turning point in late adolescence/early adulthood, empirically studying the casual relationship between graduation and adult offending. The objective of this dissertation is to reinvestigate the causal relationship between high school graduation and adult offending and the mechanisms of such a relationship. In doing so, the study will re-incorporate early turning points into the paradigm of life course criminology and contribute to the prevention of offending behavior during early adulthood.

There has been a considerable amount of empirical research on the high school graduation/dropout-adult offending relationship. However, these studies have yielded inconsistent results. Some studies have found that dropping out decreases delinquency (Elliott and Voss 1974); other studies have found that dropping out increases delinquency (Farrington et al. 1986; Thornberry et al. 1985); and yet other studies found no relationship between the two (Bachman et al. 1971; Sweeten 2006). An important limitation of past studies (with the exception of recent studies such as Sweeten 2006; Sweeten et al. 2009) is that most did not adequately control for selection bias, i.e., not graduating from high school and adult offending can both be explained by prior processes. Most studies were not equipped to study the *causal* relationship between graduation and offending. Another limitation is that although some attempts have been made

(Farrington et al. 1986; Thornberry et al. 1985), most of these studies have not adequately examined the mechanisms of the effect of high school graduation on crime. This study will address the above mentioned limitations in studying the causal effect of high school graduation and adult offending, and, more importantly, the mechanisms of such an effect.

In order to study high school graduation as a turning point, I explore two specific research questions in this dissertation. In my first research question, I investigate whether high school graduation has a causal effect on early adult offending after taking into consideration an array of risk factors in five domains (individual, family, peer, school, and neighborhood). In my second research question, I investigate the mechanisms through which graduation influences adult offending behavior. In particular, I assess whether, and to what extent, employment and intimate relationships (as potential opportunities that are opened up by high school graduation) mediate the causal relationship between graduation and adult offending.

The sample used in this dissertation consists of 460 males from the first generation of the Johns Hopkins Prevention Intervention Research Center (JHU PIRC)'s intervention trials funded by the National Institute of Mental Health (NIMH) (Kellam and Rebok 1992). In order to study the causal relationship between high school graduation and adult offending, this study uses propensity score analysis. This method creates a quasi-experimental situation where graduates and dropouts are matched on an array of prior predictors, and consequently, the causal effect of graduation on adult offending can be estimated

among matched individuals. The prior predictors used for propensity score estimation include risk factors of dropout from five major domains including individual, family, peer, school and neighborhood domains.

In order to address a common criticism of propensity score matching, selection bias (the causal effect observed is subject to selection bias caused by an omitted covariate in the propensity score estimation), sensitivity analysis is used to assess how the observed causal effect of graduation changes when including a hypothetical omitted covariate with various effects on graduation and adult offending.

In order to study the mechanisms of graduation effect – that is, whether and, to what extent, employment and intimate relationships in early adulthood mediate the relationship between high school graduation and adult offending – mediation analysis is used. Beyond the simple relationship between graduation, being employed and being involved in an intimate relationship, and offending, I also assess the mediation effect of different aspects of employment and intimate relationships, such as the number of hours worked per week and negative interaction with one's partner.

The most important finding of this dissertation is that those who graduated from high school displayed a significantly lower likelihood of having an adult record during early adulthood compared to dropouts. High school graduates are about 93% less likely to have an adult offending record than high school dropouts. Such a causal effect of high school graduation is robust to selection bias due to omitted covariates. Another finding is that employment mediates

about 23% of the total effect of graduation on offending. However, employment only benefits high school dropouts, not graduates.

These findings contribute to criminology by reintegrating the period of late adolescence/early adulthood into the paradigm of life course criminology. In particular, the study applies the idea of turning points to the high school graduation-adult offending relationship. The answer to the question of whether high school graduation is a turning point is two-fold: for youth who are at risk for dropping out, staying at school and finishing their degree is a turning point; for youth who are not likely to drop out of high school, graduation is a continuation of their past behavior. Employment mediation of the relationship between high school graduation and adult offending contributes to life course criminology by 1) empirically studying the mechanisms of turning points and 2) investigating the interrelationship between turning points in late adolescence/early adulthood and the traditionally identified turning points in adulthood.

Apart from the contributions to life course criminology, the findings in this dissertation also provide strong support for President Obama's emphasis on the importance of high school graduation, especially for at-risk students (speech made on March 10<sup>th</sup>, 2009). Beyond the turning point effect of high school graduation on adult offending, it was also found that for high school dropouts, employment can be another turning point in reducing adult offending. Programs can be tailored to reduce the likelihood of adult offending by providing job training opportunities for dropouts to secure steady employment and reconnect to society.

In the next chapter, I will review both the theoretical and empirical literature related to this study. I will first discuss the theoretical background of life course criminology by focusing on the idea of turning points. I will further review empirical studies on the dropout-delinquency relationship and pinpoint their limitations. I will also review past studies on the predictors of high school dropout. This review will identify which predictors need to be used in the propensity score matching to study the causal relationship between graduation and adult offending. In the last part of this chapter, I will discuss the conceptual understanding of high school graduation as a turning point that opens up opportunities in late adolescence/early adulthood, mechanisms of graduation effect, and theoretical explanations of such mechanisms.

In the third chapter, I will present the two main research questions of this dissertation, i.e., the causal relationship between high school graduation and adult offending, and the mechanisms of high school graduation effect. I will conclude the third chapter with a presentation of the limitations and off-setting strengths of this study. In the fourth chapter, I will present the data and methods used in this study. I will discuss in detail the criteria used to select the sample of the study, the measures used, and the two analytical methods: propensity score matching (including sensitivity analysis) and mediation analysis. I will end this chapter with a discussion of other possible methods used to study turning points and the reasons that they were not chosen for this study. In the fifth chapter, I will present the empirical results of this study. In the last chapter, I will discuss and interpret in detail the main findings, the contributions of this study to both life

course criminology and the prevention of offending, as well as the limitations of this study. I will end this chapter with a discussion of possible directions for future research.

## **CHAPTER 2: LITERATURE REVIEW**

### **Section 2.1: Life Course Criminology and the Idea of Turning Points**

The paradox of continuity and change is characterized by two findings: 1) adult offending virtually requires childhood antisocial behavior, which is a better predictor than family background or social class and 2) most antisocial children do not engage in antisocial behavior as adults. Among theories that aim to explain the paradox of continuity and change in individual offending behavior, the paradigm of life course criminology provides the most comprehensive explanation (Laub and Sampson 2003; Sampson and Laub 1993).

One of the central concepts in life course criminology is the idea of turning points. In one of the most well known life course theories, age-graded informal social control theory, Sampson and Laub (e.g., Laub and Sampson 2003; Sampson and Laub 1993) apply the idea of turning points to explain changes in offending behavior and desistence from crime. A turning point is defined as “an alteration or deflection in a long-term pathway or trajectory that was initiated at an earlier point in time” (Sampson and Laub 2005, 16). In this section, I will discuss the theoretical background of this dissertation. I will first discuss how past theories and empirical studies explain the paradox of continuity and change in offending behavior. I will then focus on life course criminology in explaining such a paradox. In particular, I will introduce the theory of age graded informal social control, with a focus on the idea of turning points.

### **2.1.1 Continuity and change in individuals' offending behavior**

There has been good evidence for both continuity and change in antisocial and offending behavior. Many longitudinal studies have documented the continuity of antisocial behavior between adolescence and adulthood. For example, McCord (1979) found that 47% of juvenile offenders are convicted in adulthood, while only 18% of non-juvenile offenders are convicted in adulthood. On a similar note, Sampson and Laub (1993) reported that boys who committed delinquent acts in childhood are three to four times more likely to be criminals in adulthood than those who did not commit crime in childhood.

Despite the evidence for continuity in offending behavior, there is also plenty of evidence for change over the life course. Most adult criminals had no history of juvenile delinquency (McCord 1980). More importantly, most antisocial children do not commit crime as adults (Robins 1978; Sampson and Laub 1993). The process of reduction from active offending to a zero or near zero stable rate of offending is generally referred to as "desistance" (Bushway et al. 2001, 2003). A large body of theory and research explains continuity and change in offending behavior. Literature has contrasted "population heterogeneity" and "state dependence" (Nagin and Paternoster 1991) in explaining continuity, and "ontogenetic approach" and "sociogenetic approach" (Thornberry 2005) in explaining change or desistance.

Different theories have explicitly or implicitly provided explanations for the continuity of antisocial behavior. On one hand, self-control theory (Gottfredson and Hirschi 1990) argues that the propensity for criminal behavior is established



early in life and remains relatively stable over the life course. This explanation is normally referred to as “population heterogeneity” (Nagin and Paternoster 1991, 2000). A substantial amount of empirical evidence supports such an argument. For example, Paternoster et al. (2001) found that upon conditioning on offending behavior in adolescence, offending patterns in adulthood are random processes. Piquero et al. (2005) replicated this finding with a different data set and found similar results.

On the other hand, age graded informal social control theory (Sampson and Laub 1993) argues that a stable propensity for criminal behavior and the impact of prior antisocial behavior together explain the continuity of antisocial behavior. The impact of prior antisocial behavior on future antisocial behavior is normally referred as “state dependence” (Nagin and Paternoster 1991, 2000). Nagin and Paternoster (1991) found empirical support for the state dependence argument; prior participation in criminal behavior had a positive and significant association with future participation, controlling for the possibility of unobserved heterogeneity. In sum, the empirical evidence indicates that both aspects of population heterogeneity and state dependence are required to explain continuity in offending behavior (Horney et al. 1995; Laub et al. 1998; McCord 1990; Nagin and Farrington 1992; Paternoster and Brame 1997; Paternoster et al. 1997; Sampson and Laub 1993).

Two approaches have been taken in trying to understand desistance process: the ontogenetic approach and the sociogenetic approach. The ontogenetic approach argues that the shape of offending trajectories is universal

across individuals and that individual differences in offending are stable (Moffitt 1993; Glueck and Glueck 1940; Gottfredson and Hirschi 1990; Wilson and Hernstein 1985). Graphically, this approach expresses individual offending trajectories as a set of parallel curves. According to this approach, desistance from crime can be perfectly predicted by the aging process and changing opportunities. Everybody eventually desists from crime regardless of life events, and early processes can predict desistance perfectly. As empirical support for this argument, Broidy et al. (2003) found little heterogeneity in the shape of offending trajectories. However, they only focused on early offending behavior through age 13.

The sociogenetic approach, on the other hand, allows the intersection of offending trajectories (Laub and Sampson 2003; Sampson and Laub 1993). In other words, individual differences in offending are not stable over time. According to this approach, early processes are limited in predicting adult offending and desistance, and social factors in adulthood are more predictive. Empirical studies have found support for such an argument as well (e.g., Chung et al. 2002; Farrington and Hawkins 1991; Laub and Sampson 2003; Laub et al. 1998; Nagin et al. 1995; Wright et al. 1999; White et al. 2001; Wiesner and Capaldi 2003). For example, after analyzing the Dunedin cohort data, Wright et al. (1999) found that both low self-control in childhood and social bonds in adulthood are predictive of adult offending. Social bonds in adulthood have a net direct effect on adult offending, while self-control has both a direct and an indirect effect (by influencing social bonds) on adult offending.

Life course criminology provides the best paradigm for understanding continuity and change in individuals' offending behavior (Laub and Sampson 2003; Sampson and Laub 1993). On one hand, Sampson and Laub argue that population heterogeneity and state dependence together explain the continuity in offending behavior. On the other hand, they use the idea of turning points in adulthood to explain desistance from crime. They argue that adult turning points, such as marriage and employment, can counteract risk accumulation during childhood and adolescence, redirect individual offending trajectories, and ultimately facilitate desistance from crime. An overarching theme of life course criminology is the malleability of individual offending behavior, i.e., what happens later on in life can offset early risk and change individuals' offending behavior. Given the importance of the life course criminology paradigm for explaining continuity and change in offending behavior, I will now turn to a more focused discussion of the central ideas of life course criminology.

### **2.1.2 Age graded informal social control theory and the idea of turning points**

A life course is generally conceptualized as “pathways through the age-differentiated life span” (Elder 1985, 17). Theories and research in the life course framework focus on trajectories and transitions. Trajectories refer to long-term development lines or pathways, such as work life or patterns of criminal behavior. Transitions refer to short-term events embedded in trajectories, such as getting married or getting a new job. The interlocking nature of these long-term

trajectories and short-term transitions may generate turning points or a change in the life course (Elder 1985, 32).

A well-known theory in life course criminology paradigm is the age-graded informal social control theory developed by Sampson and Laub (Sampson and Laub 1993). The theory bridges informal social control theory (Hirschi 1969) and concepts from life course studies, in order to explain continuity and change in individual criminal behavior. Like classic informal social control theory, the age-graded version makes the assumption that human nature is self interested and hypothesizes that the fundamental cause of crime is weakened social control. There are three themes in age-graded informal social control theory. First, structural background variables (such as family disruption and poverty) influence adolescent delinquency through family processing variables (such as parental supervision). Second, there is continuity between antisocial behavior in childhood and criminal behavior in adulthood. It is argued that both population heterogeneity (i.e., the idea that individuals possess a certain propensity to engage in antisocial or criminal behavior) and state dependence (i.e., the idea that prior offending has a criminogenic effect on future offending) together explain such continuity. To explain continuity of offending behavior, Sampson and Laub (1997, 2) emphasize the notion of “cumulative disadvantage,” which describes how serious delinquency and its inevitable consequences (such as being labeled by parents, peer rejection, and criminal justice intervention) undermine bonds to conventional society, which, in turn, increase the likelihood of continued offending. The third theme of their theory, however, is most

important: Above and beyond childhood experiences and individual differences, salient life events and changes in social control during adulthood can counteract delinquency in childhood and adolescence and redirect individual trajectories.

Sampson and Laub (Laub and Sampson 1993; Sampson and Laub 1993) refer to these salient life events in adulthood as “turning points” and argue that they are crucial in understanding changes in individual offending behavior. The authors focus on turning points that result in involvement in social institutions and “changing roles and environments” (Laub and Sampson 1993, 310). Through interviews with men from the Gluecks’ study, Sampson and Laub (1993) retrospectively identified major turning points in adulthood, such as military service, marriage, and employment. In their in-depth discussion of turning points, Laub and Sampson argue that the idea of turning points goes beyond simple changes in roles and environments (e.g., from being single to being married or from being unemployed to being employed) and should capture the notion of “embeddedness” (Laub and Sampson 1993, 311) or “connectedness” (Laub and Sampson 1993, 310). They argue that what reduces offending is not marriage or employment per se, but the social ties or “embeddedness” associated with marriage and employment, such as marital attachment and job stability.

According to Laub and Sampson (1993), these adult social ties reduce offending through strengthening social control and increasing the costs of committing crime. Most importantly, they argue that strong social ties in adulthood will inhibit individuals from committing crime regardless of their past delinquent behavior. In contrast, weak social ties in adulthood will give individuals

freedom to commit crime even if they were non-delinquents in adolescence (Laub and Sampson 1993; Sampson and Laub 1993). Empirical research provided evidence for the effects of these adult turning points. After analyzing data from the Gluecks' study, Sampson and Laub found that, for both delinquent and non-delinquent men, marital attachment and job stability in adulthood were significantly associated with adult offending behavior, i.e., these social ties reduced the likelihood of offending and facilitated desistance (Sampson and Laub 1993).

A number of other empirical studies have also examined the effects of turning points proposed in the age graded informal social control theory. The most well studied turning point is marriage. Three findings are relevant to the present study. First, there has been much support for the effect of being married on adult criminal offending. Together, studies (Bersani et al. 2009; Capaldi et al. 2008; Farrington and West 1995; Horney et al. 1995; King et al. 2007; Laub and Sampson 2003; Sampson and Laub 1993; Sampson et al. 2006; War 1998) found that being married is significantly associated with a lower likelihood of criminal offending. Recent literature has indicated that the effect of marriage on the desistance from crime is causal (Sampson et al. 2006). Other than the effect of marriage, some studies also examined the relationship between being involved in a romantic relationship and offending. For example, using a sample of young adults who were involved in committed romantic relationships (with a mean age of 22), Simons et al. (2002) found that warm and caring romantic relationships lead to less crime.

Second, research has indicated the effect of marriage may depend on the type of marriage and living arrangement. For example, common law marriage by non-whites was found to be positively related to crime (Piquero et al. 2002). Living together could have a different effect compared to marriage. Horney et al. (1995) found that living together without marriage could actually increase criminal behavior. Duncan et al. (2003) found that although both living together and being married reduce criminal behavior, the effect of marriage is stronger.

Third, in addition to the finding that being married reduces the likelihood of offending, some studies have also assessed the effects of certain aspects of marriage on desistance, such as quality of marriage and criminal behavior of the spouse. For example, Sampson and Laub (1990, 1993; Laub et al. 1998; Laub and Sampson 2003) found that merely being married is not enough to reduce offending, and only men who are attached to their spouses benefit from the crime reducing effect of marriage. Simons et al. (2002) found that interaction with the spouse is significantly related to one's criminal involvement, with warm and caring relationships leading to less criminal behavior. Capaldi et al. (2008) found that female romantic partners' antisocial behavior is predictive of men's onset and persistence of offending, and that a relationship's stability is negatively associated with men's persistence in offending. However, other studies (Sampson et al. 2006) found that being married inhibits crime, regardless of quality of marriage and criminal behavior of the spouse.

A slightly less well-studied turning point in adulthood is employment. Three findings are relevant to the present study. First, past research (Bushway

and Reuter 1997; Paternoster et al. 2003; Uggen 1999, 2000; Wright and Cullen 2004) has consistently found that being employed is negatively related to the likelihood of offending. For example, after analyzing data collected from a large scale experimental employment program, Uggen (2000) found that having a job is negatively associated with recidivism for offenders aged 27 or older.

Second, it has been found that the effect of work opportunities depends on age. For example, Uggen (2000) found that age interacts with employment to affect the rate of self-reported recidivism; employment is effective in reducing recidivism only for older offenders but not for younger offenders. While those aged 27 or older are less likely to recidivate when provided with employment opportunities, the experimental job treatment had little effect on recidivism for young offenders in their teens and early twenties. After conducting a literature review, Uggen and Staff (2001) also concluded that employment is more effective for adult offenders than for adolescent or young adult offenders.

Third, in addition to findings on the employment status-offending relationship, studies have also examined the relationship between certain aspects of employment and offending. For example, Sampson and Laub (1993) found that quality of employment – measured by a scale composed of employment status, stability of employment, and work habits – significantly reduces offending. Uggen (1999) found that job quality reduces both economic and non-economic related criminal behavior. He attributes the effect on economic criminal behavior to a Mertonian view of offenders as frustrated strivers, and the effect on non-economic criminal behavior to a social control perspective.



## **Section 2.2: The Remaining Issues and the Conceptual Understanding of turning Points**

While Sampson and Laub's age graded informal social control theory is informative in understanding how turning points can redirect individuals' offending trajectories and facilitate the desistance process, some research gaps remain to be addressed. Moreover, some critical issues regarding the understanding of turning points remain, and these critical issues provide the potential to expand life course criminology.

When the theory of age-graded informal social control was first developed, it put great emphasis on the importance of informal social control. Sampson and Laub (1993) argue that it is not marriage or employment per se, but the increased informal social control and social ties resulting from marriage and employment that reduce adult offending. Laub and Sampson (2003) further developed their ideas by incorporating new mechanisms through which turning points, such as marriage and employment, reduce adult offending. For example, building on routine activity theory, they argue that marriage and employment restructure individuals' routine activities and, in turn, reduce their likelihood of committing crime. Another mechanism through which marriage and employment reduce adult offending is through monitoring and direct supervision. It is also argued that although possible, cognitive change is not necessary for the change in behavior. (For a more detailed discussion of the mechanisms, please see section 2.6).

As a result of this extension, the concept of turning points in age-graded informal social control theory has made the empirical testing of these mechanisms rather difficult because the same measures can be used to support different mechanisms. For example, if it is found that having a job reduces adult offending, this could be explained using different theories. Having a job increases informal social control to conventional institutions, restructures individuals' routine activity, and provides direct supervision and monitoring. More importantly, such an extension of the age graded informal social control theory has pushed the theory further from its tradition of informal social control theory and has turned the theory into a research agenda. When I discuss this theory, I mainly refer to the informal social control interpretation of the theory and compare my understanding of turning points to Sampson and Laub's social control understanding of turning points. The reason for this is that age-graded informal social control theory was originally developed from a social control tradition, and most of Sampson and Laub's discussion and studies have focused on the social control explanation. I will attend to this topic in more detail in section 2.6 when I discuss the mechanisms of turning points.

In summary, to understand the idea of turning point, three issues remain. The first issue is that the definitions of turning points, and especially the criteria of what can be qualified as a turning point, have not been clearly laid out. Sampson and Laub's identification of turning points is mostly post hoc instead of prospective. The second issue is that most of the research on turning points in criminology has focused on turning points in adulthood. We lack knowledge

about turning points in late adolescence and early adulthood. The third issue is that most research has focused on involvement in social institutions and changes in roles and environment, such as marriage, employment, and military service. While such changes constitute one type of turning point, there are other types (Pickles and Rutter 1991) as well. I will address these issues by discussing the literature on turning points in criminology and related fields. Addressing these critical issues will shed some light on the conceptual understanding of turning points and will form the basis for this study.

### **2.2.1 Critical Issue I: Definition, identification, and criteria of turning points**

The term “turning point” has been broadly employed in recent criminological literature to refer to life transitions that change offending behavior (e.g., Laub and Sampson 1993; Pickles and Rutter 1991; Rutter 1996; Sampson and Laub 1993, 2005). For example, Rutter (1996) refers to turning points as the transitions embedded in trajectories that change the direction of the trajectories. According to Sampson and Laub (2005, 16), a turning point is “an alteration or deflection in a long-term pathway or trajectory that was initiated at an earlier point in time.” A critical issue in any broadly employed terms in social sciences is that the definition of the term becomes fuzzy over time. In addition, Sampson and Laub’s identification of turning points is mostly post hoc instead of prospective. For example, Sampson and Laub identified adult turning points such as marriage and employment only after interviewing the men from Gluecks’ study.

Efforts have been made to clarify the definition of a turning point and, particularly, the criteria for qualifying which life events are turning points. Pickles and Rutter (1991) specified two criteria that need to be met in order for a life event to be qualified as a turning point. First, a turning point must be identified independently of the individual. This criterion excludes those rare and dramatic internal and external events experienced by a specific individual – such as religious conversions, earthquake, or being taken hostage – and chronological age-defined transitions such as the hypothesized “mid-life crisis” (Levinson 1978). In other words, turning points should be normative and characterized by universal changes in opportunities, social networks, and social relationships, such as entering school, marriage, beginning a career, graduating from high school or dropping out of school, joining the military, or going to college.

Second, a turning point must bring about long lasting changes in individuals’ lives that involve movement away from a well-established behavior pattern and long-term adoption of a new behavioral pattern. Only long lasting changes can be qualified as turning points. Sampson and Laub (2005, 34) call this “knifing off the past from the present.” This criterion excludes short-term stressful life events, which are usually only temporally connected to the onset of depression and antisocial or criminal behavior (Rutter 1996).

### **2.2.2 Critical Issue II: Focusing only on adulthood**

Life course criminology was developed in reaction to developmental theories’ heavy focus on early risk and protective factors during childhood and

adolescence (Farrington 1995) and the idea that offenders can be classified into different stable groups (Moffitt 1993; Patterson et al. 1989). For example, Moffitt (1993) argues that two groups of offenders (life course-persistent offenders and adolescence-limited offenders) can be prospectively defined by the presence and absence of childhood risk factors, such as neurological deficits and antisocial behavior in early childhood. These two groups differ in motivation, crime types, and developmental course of their offending behavior. In reaction to this focus on forming processes during childhood and adolescence, life course criminology has put more weight on adulthood. The idea of turning points that facilitate desistance from crime has been developed exclusively in adulthood. While we know a lot about risk factors and protective factors in childhood and adolescence, the general idea of turning points during childhood and adolescence has not been explored to the same extent as in adulthood.

I argue that it is important to focus on turning points in late adolescence/early adulthood because there has been good evidence that the desistance process occurs earlier than the traditionally identified adult turning points (Thornberry 2005). There are two groups of desistors: low level desistors and intermittent offenders (Figure 2.1). In both cases, there is no sharp drop in offending but a more gradual decline from the peak to a near-zero rate. Thornberry (2005) argues that desistance involves two developmental processes, the gradual decline from the peak to near zero and the maintenance of non-offending. For example, low-level desistors exhibit a gradual drop from age 14.5 to 19.5 and then maintain a persistent near-zero offending from age 20

to 23. Noticeably, desistance can occur at different ages. Desistance appears to begin at age 15 for the low level desistors, 16 for the intermittent offenders, 17.5 for the mid adolescent chronics, and 19 for the transitional offenders (see Thornberry 2005). All of these declines occur before the occurrence of marriage, work, and family in a typical case. Thornberry suggests that the traditional explanations of desistance might focus more on maintenance rather than initiation of desistance.

In addition, there are other reasons to focus on turning points in late adolescence/early adulthood. For example, the age-crime curve indicates that offending behavior peaks during late adolescence/early adulthood. Therefore, preventing offending during this time period might be the most cost effective way to reduce crime. More importantly, early turning points in adolescence, such as education related transitions, may be more applicable for preventive interventions than marriage and employment, which typically occur later in adulthood.

Desistance occurs before the traditionally identified turning points in adulthood, therefore it is important to identify turning points in late adolescence/early adulthood. We know little about whether there are potential turning points in late adolescence/early adulthood, and, if so, whether the same mechanisms that we discovered for adult turning points can be applied to late adolescence/early adulthood. This study attempts to search late adolescence/early adulthood for potential turning points, and, more importantly, the mechanisms through which these turning points redirect adult offending behavior.

### **2.2.3 Critical Issue III: Other types of turning points**

The last critical issue is that research in criminology has predominately focused on only one type of turning point. There has been some discussion about different types of turning points in other relevant fields. For example, Pickles and Rutter (1991) noted that discussions of “turning points” in recent literature have mainly focused on two types of universal and normative events that bring about potential long-term changes in individuals’ behavior. One type of event involves “a radical long lasting change in life circumstances” (Pickles and Rutter 1991, 133), which could include changes in social relationship patterns, social network, and way of living. This classification is very much in line with Sampson and Laub (Laub and Sampson 1993; Sampson and Laub 1993). Sampson and Laub are most interested in “deep” change, e.g., a high rate offender suddenly desists from crime, and “modified” change, e.g., a high rate offender commits fewer crimes than expected. In Sampson and Laub’s view, both “deep” change and “modified” change are “enhanced when changing roles and environments lead to social investment or social capital in institutional relationships” (Laub and Sampson 1993, 310). They mainly focus on marriage and employment as examples of “institutional relationships.” According to Pickles and Rutter (1991), there are a few subtypes of turning points that belong to this category. The first subtype is important “additions” or “subtractions” from a person’s closest family relationships, such as marriage or divorce. The second subtype is alterations in patterns of living, such as having a first child. The third

subtype is major change resulting from a geographical move, such as migration or immigration.

Apart from the above-discussed turning points that change life circumstances, Pickles and Rutter also noted another type of turning point that opens up or shuts down opportunities, such as going to university and getting a Ph.D. Such opportunities may include getting access to other social institutions, changes in social network, association with conventional peers, increases in human capital and self worth, and changes in routine activities and life styles. For example, going to college could provide training that will increase one's human capital and opportunities for a better career. Compared to those who do not go to college, college students have more opportunities to associate with conventional peers and engage in pro-social activities. Although events of the second type of turning point have been empirically studied (Andrews and Bonta 2003; Bernburg and Krohn 2003), they have not been conceptually discussed in the life course framework or fully applied to understand continuity and change in offending behavior.

While there are two distinct types of turning points, i.e., one type changes life circumstances and the other opens up or closes down opportunities, these two types are not mutually exclusive. Some turning points can have both effects. For example, while Sampson and Laub focus on "institutional relationships" that change roles and environment, they argue that military service, as an adult turning point, opens up opportunities for education and job training (Sampson and Laub 1993). The typology of turning points can be viewed as a continuum,



with some turning points typically focusing on only one type of change and other turning points having both effects. For example, although it is possible that marriage opens up opportunities (e.g., changing social networks bring about new employment opportunities), it is more likely to be seen as a turning point that brings about changes in roles and environments. Similarly, although graduating from college can bring about some changes in roles and environments (I will demonstrate this in more detail in section 2.6 when I discuss the mechanisms of turning points), it is more likely to be seen as a turning point that opens up opportunities, such as employment and higher level education.

While most of the research in life course criminology has mainly focused on turning points that bring about long lasting changes in life circumstances<sup>2</sup>, one of the main goals of this dissertation is to draw attention to the less well studied second type, turning points that open up or close down opportunities. This dissertation will focus on education, as a particularly important aspect in adolescents' lives, and high school graduation, as a crucial milestone on the pathway to educational success. In the next few sections, I will discuss the conceptual understanding of high school graduation as a turning point in adolescence. The goal for the next few sections is to link the literature on the education-crime relationship with concepts from life course criminology (particularly the idea of turning points), and to provide a conceptual

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<sup>2</sup> Sampson and Laub also discuss opportunities. They argue that turning points provide "opportunities for investment in new relationships that offer social support, growth and new social networks" (Sampson and Laub 2005, 34) and "an opportunity for identity transformation" (Laub and Sampson 2003, 149). However, according to my reading of the theory, opportunity has not played a primary role in their theory.

understanding of high school graduation as a turning point in reducing adult offending within the life course theoretical framework.

### **Section 2.3: Revisiting the High School Graduation/Dropout-Delinquency relationship**

High school education is one of the most important milestones for adolescents on the road to educational and occupational success (Englund et al. 2008). There is good evidence for a strong and negative association between education and crime in general (e.g., Andrews and Bonta 2003; Lochner and Moretti 2004) and between high school graduation and adult offending in particular (e.g., Jarjoura 1993, 1996; Thornberry et al. 1985; Voelkl et al. 1999). Apart from offending, research has also found that graduating from high school opens up employment opportunities; high school completers are more likely to be employed and earn higher wage rates than high school dropouts (e.g., U.S. Department of Education 2006; U.S. Department of Labor 2004). The literature has indicated that high school graduation as a turning point may open up opportunities and eventually lead to desistance in late adolescence/early adulthood. However, most studies on the topic have focused on high school dropout (as the other side of the same coin) and its relationship to delinquent behavior. In this section, I will first review past studies on the education-crime relationship in general. Although most research indicates a strong association between education and crime, the education-crime relationship is rather complex.

Notably, education may be indirectly related to offending through employment and marriage. I will then review and assess in detail the body of research on the high school dropout-delinquency relationship.

### **2.3.1 The relationship between education and crime**

The general benefits of education have been convincingly documented in different fields. Dropping out of high school has negative consequences for both individuals and society (see Rumberger 1987). For individuals, dropping out of high school results in a low level of academic skills, which leads to difficulties in securing stable employment and adequate income. Economic research and government reports have specifically documented the detrimental effect of dropping out of high school on employment and income. According to a report by the U.S. Department of Education (2006), high school completers are more likely to be employed and earn higher wage rates than high school dropouts. Day and Newburger (2002) reported that the disparity between the wages of high school dropouts and that of high school graduates has increased in the last 30 years. According to the U.S. Census Bureau statistics (2005), individuals with a high school diploma earn on average 1.5 times more than those without it, and individuals with a college degree earn 2.7 times more than high school dropouts. An increased dropout rate also reduces tax revenues and political participation and results in a poorer level of public health (Rumberger 1987).

While the negative consequences related to the lack of education in economics, political participation, and health are worrisome, the consequences in

terms of increased levels of crime and delinquency can be even more harmful, given the high costs associated with crime. Relevant to the present study, research in criminology has long identified a strong association between education and crime at both an individual level and an aggregate level. At an individual level, research has shown that education decreases delinquency. Lochner (2004) found that high school graduation is negatively associated with crime even after controlling for race, family background, and local conditions. Andrews and Bonta (2003) found that educational success is highly correlated with decreased risk of engagement in delinquent behavior and involvement in the juvenile justice system. Kasen et al. (1998) showed that academic achievement is related to decreasing deviant behavior, after controlling for the effects of low SES, low intelligence, childhood conduct behavior problems, and association with delinquent peers during adolescence. Studies using prison populations also found supporting results. For example, a recent review of evidence-based practices for crime prevention conducted by the Washington State Institute for Public Policy (2006) found that vocational education implemented in prison resulted in the largest changes in crime (a reduction of 9%). Other studies using official data (Tauchen et al. 1994) or self-report data (Lochner and Moretti 2004) have also documented a negative association between success in school and delinquent behavior. Conversely, research has shown that school failure and dropping out are associated with increased levels of delinquent and criminal behavior. Bridgeland et al. (2006) reported that dropouts are eight times more likely to be incarcerated than graduates. Other research on risk factors for

delinquency also found school failure as a primary risk factor (e.g., Siegel and Senna 1988). Maguin and Loeber (1996) conducted a meta-analysis on the relationship between education and delinquency, and they found that children with poor academic performance offend more frequently and commit more serious offenses.

Compared to research at an individual level, less research has been done at an aggregate level but the relationship between education and crime has been documented. Lochner and Moretti (2004) found a negative relationship between schooling and criminal activity at a state level. However, they suggest that this relationship could be spurious, since increases in state spending for crime prevention and prison construction reduce funding for education.

The relationship between education and crime, however, is far from straightforward. There has been strong evidence for reciprocal effects between education and crime. Studies have found that delinquency during high school has long-term detrimental effects on educational attainment and occupational outcomes (Monk-Turner 1989; Siennick and Staff 2008). For example, Siennick and Staff (2008) found that delinquent youths complete less education than their conventional peers. Other studies show that the association between education and delinquency is spurious (Bachman et al. 1971; Drapela 2005; Fagan and Pabon 1990; Felson and Staff 2006; Grogger 1998; Krohn et al. 1995; Sweeten et al. 2009; Witte 1997; Yamaguchi and Kandel 1984). For example, Drapela (2005) found that dropout and drug use are weakly associated with each other. Post-dropout drug use is better predicted by antecedents to dropout, such as

school discipline problems and previous drug use than by dropout status. Felson and Staff (2006) found that the relationship between academic performance and delinquency can be explained by individual differences in self control. Based on empirical studies by Tauchen et al. (1994) and Witte and Tauchen (1994), Witte (1997) concluded that neither years of schooling nor graduation from high school has a significant impact on individual level criminal behavior. The complex relationship, i.e., the reciprocal nature of the education-crime relationship and the possible spurious relationship between the two, warrants further research.

Moreover, despite the evidence for an association between education and adult offending, it is unclear whether the effect is direct or indirect. Literature has suggested both. On one hand, as discussed above, studies on the education-crime relationship have found that education is directly related to offending (e.g., Andrews and Bonta 2003; Bridgeland et al. 2006). On the other hand, evidence suggests that education (high school graduation, in particular) increases employment opportunities and income (e.g., U.S. Department of Education 2006) and the likelihood of getting married (e.g., Lloyd and South 1995), which, in turn, reduce the likelihood of offending behavior (Farrington and West 1995; Horney et al. 1995; Sampson et al. 2006; Uggen 2000; Uggen 1999; Warr 1998; Wright and Cullen 2004). These studies indicate that the link between education and crime may be mediated through marriage and employment.

### **2.3.2 Past research on the high school dropout-delinquency relationship**

Beyond the general relationship between education and crime, there is also a good amount of literature on the specific relationship between high school graduation and subsequent offending, given that high school graduation is an important milestone on the pathway to educational success. High school graduation plays a particularly important role in influencing both employment opportunities (e.g., U.S. Department of Education 2006) and adult offending behavior (e.g., Bridgeland et al. 2006). Although the literature has indicated that high school graduation may redirect individuals' offending trajectories, most studies on the topic have focused on high school dropout instead and its relationship to delinquent behavior.

Table 2.1 presents a list of previous empirical studies on the dropout-delinquency relationship in terms of samples, measures, methods, and main findings. The list was arrived at using Gottfredson's (2001) book *School and Delinquency* as a point of departure, and also includes more recent studies on the dropout-delinquency relationship. So far, no clear conclusion can be drawn from the literature on this relationship. Some studies found that dropping out of high school reduces delinquency (e.g., Elliott and Voss 1974); other studies found that dropping out of high school increases delinquency (e.g., Thornberry et al. 1985); yet other studies found a spurious relationship between the two (e.g., Bachman et al. 1971).

Three criminological theories have been utilized to explain the effect of dropping out on subsequent delinquent behavior, and there has been empirical

support for each theory. First, strain theory (Cohen 1955; Cloward and Ohlin 1960) argues that lower class youths are gauged with middle class standards at school and experience problems of adjustment. While delinquent behavior serves as a “solution” to this problem, dropping out of school is an alternative. As a result, dropping out may reduce delinquency. Early empirical studies have found that dropping out indeed reduces delinquency (Elliott 1966; Elliott and Voss 1974; Mukherjee 1971), especially when followed by successful employment or marriage (Pronovost and LeBlanc 1980). For example, Elliott and Voss (1974) found that the dropouts with the highest official crime rates after leaving school are those who are unmarried and unemployed during the three years after dropping out.

Second, social control theory (Hirschi 1969) argues that lack of attachment to school and commitment to schoolwork increases the likelihood of delinquent behavior and dropout. Since dropping out reduces control from conventional institutions, it increases delinquent behavior. However, when followed by successful employment and marriage, it may actually decrease delinquency. Some studies have found empirical support for this theory that high school dropout increases delinquency (Farrington et al. 1986; Thornberry et al. 1985) and that the effect might be due to unemployment after dropping out (Farrington et al. 1986; Thornberry et al. 1985). Other studies (Jarjoura 1993, 1996; Sweeten 2004) found that the effect of dropping out on delinquency depends on the reasons for dropping out, e.g., disliking school leads to higher delinquency.



Third, the general theory of crime (Gottfredson and Hirschi 1990) argues that the relationship between dropping out and subsequent delinquency may be spurious because both dropping out and delinquency occur due to low self control, and thus reflect a common set of problems. This line of thinking has also received some empirical support (Bachman et al. 1971; Drapela 2005; Krohn et al. 1995; Sweeten 2006; Sweeten et al. 2009). For example, using data from the Youth in Transition Study, Bachman et al. (1971) tested whether high school is a *symptom* of past problem behavior or a *problem* that leads to future problem behavior. They found that while those with low self-concept, poor academic performance, and involvement in delinquency at school are more likely to drop out, dropping out of school does not necessarily lead to more delinquency. A more recent study by Krohn et al. (1995) also found similar results. When controlling for school related problems, dropping out of school is not related to subsequent delinquent behavior or drug use. They used this finding as support for the general theory argument and suggested that dropout and drug use may both be consequences of school-related problems.

### **2.3.3 Assessing the past literature on the high school dropout-delinquency relationship**

The majority of studies on the high school dropout-delinquency relationship show some significant limitations regarding sample design, model specification, and methods. First, most studies did not include early risk factors

from elementary school, which have been found to be predictive of high school dropout when controlling for measures during middle school and high school (e.g., Alexander et al. 2001).

Second, as noted by Thornberry et al. (1985), early studies (Elliott 1966; Elliott and Voss 1974; Mukherjee 1971) did not control for the effect of age. Although it appears that high school dropout decreases subsequent offending, the effect may be largely driven by age. Most early studies (Elliott 1966; Elliott and Voss 1974; Farrington et al. 1986; Thornberry et al. 1985) did not control for delinquent behavior before dropout and other risk factors that distinguish high school dropouts from graduates. Failing to control for these pre-existing differences has resulted in selection bias and has raised questions about the validity of causal inferences drawn from these studies. Although more recent studies did control for some early processes such as school experiences (Drapela 2005; Jarjoura 1993, 1996; Krohn et al. 1995; Sweeten 2004), most did not adequately account for selection bias with the exception of the most recent studies (e.g., Sweeten 2006; Sweeten et al. 2009).

Third, most of the previous studies did not use propensity score matching or instrumental variables to study the causal effect of high school graduation/dropout, with some exceptions (Chavez et al. 1989; Sweeten 2006). Early studies (Bachman et al. 1971; Elliott 1966; Elliott and Voss 1974; Farrington et al. 1986; Mukherjee 1971; Pronovost and LeBlanc 1980) only compared delinquency rates between dropouts and graduates. Later studies (Drapela 2005; Jarjoura 1993, 1996; Krohn et al. 1995; Sweeten 2004; Sweeten

et al. 2009; Thornberry et al. 1985; Voelkl et al. 1999) used various regression analyses to explore the effect of high school dropout on subsequent offending. None of these methods is appropriate for detecting causal effects. (For more detailed comparison between regression methods and matching methods, please refer to the method chapter.)

In a recent dissertation, Sweeten (2006) explored the effect of high school dropout as a turning point in offending trajectories. In order to determine whether high school dropout has a causal effect on subsequent offending above and beyond the early processes that lead to dropping out, the author analyzed the National Longitudinal Survey of Youth 1997. The sample consists of 2990 youths, ranging from age 12 to 17 during the first wave of the interview. Interviews were conducted every year for seven years, and the first five waves of data were used in the analysis. Delinquency was measured with a self-report scale, and dropout was measured with self-reported educational attainment supplemented with official transcripts. Two matching methods (based on trajectory membership and propensity score matching) were used to answer the research questions. First, Sweeten found that matching based on trajectory models was unable to achieve balance between dropouts and non-dropouts. Second, although propensities score matching achieved balance, the effect of dropping out was not significantly different from zero. Based on these findings, it was concluded that dropout is not a turning point in individuals' offending trajectories. I speculate that the reason that the author did not find a significant effect might be due to the population based sample used in the study. As

Sweeten suggests, it may be fruitful to apply the matching methods to a sample dominated by inner city minorities with higher dropout rates, as the effect of life events may vary with social context. The present study makes an attempt to address Sweeten's suggestion and apply the matching method to a sample of predominately poor, urban, African-American youth from inner city Baltimore, Maryland, a city with higher than national average dropout rate (Annie E. Casey Foundation 1997; Alexander et al. 2001).

Sweeten's study is superior to previous studies because the matching methods allowed the author to take into account the process of disengagement from school before dropout, and it allowed a direct assessment of the comparability of dropouts and their matched counterparts (Sweeten 2006). This study has contributed greatly to the methodological advancement of the current topic. The analyses employed serve as a template to examine any negative outcomes to which dropout may lead, such as decreased employment opportunities and substance abuse. Despite the advances in methodology, this study did not focus on theoretical explanations of the high school graduation-delinquency relationship. Whether high school dropout is a turning point is as much of a theoretical question as it is an empirical one.

Last and most importantly, beyond simply assessing the dropout-delinquency relationship, most of these studies have not adequately examined the mechanisms of the effect of high school graduation on crime (Bachman et al. 1972; Elliott 1966; Elliott and Voss 1974; Drapela 2005; Krohn et al. 1995). That said, some attempts have been made to study whether employment and

marriage explain the effect of school dropout (Farrington et al. 1986; Thornberry et al. 1985). For example, Thornberry et al. (1985) tested the effects of both high school dropout and post-school experiences on subsequent offending by including dropout vs. non-dropout, employed vs. unemployed, and married vs. not married as independent variables in an OLS regression model. They found that both dropping out and employment have significant effects on offending at age 21-23, employment (but not dropout) has a significant effect on offending at age 24, and marriage does not have any significant impact at any age. Based on these findings, the authors concluded that school dropout has a significant and positive effect on subsequent offending, even controlling for post school experiences, and offending behavior for dropouts and graduates converges by mid-twenties. Other studies (Elliott and Voss 1974; Jarjoura 1993, 1996) controlled for post school experiences, although they did not particularly focus on those variables.

Methodologically, these studies tested the effect of post school experiences, either by including them as covariates in the regression models (Jarjoura 1993, 1996; Thornberry et al. 1985) or by simply comparing offending rates during periods of employment and unemployment (Elliott and Voss 1974; Farrington et al. 1986). It has been documented that regression procedures are not suitable for mediation analysis. (See the method chapter for more details.) Moreover, studies that include employment and marriage lack theoretical explanations for why these variables may account for the observed association between school dropout and delinquency. Finally, most of the past studies used

binary variables to measure employment. For example, Thornberry et al. (1985) included a variable “unemployed” (measured as the proportion of time during the year the respondent was unemployed) as the only measure of employment. Other studies (e.g., Jarjoura 1993) included similar dichotomous measures of employment and marriage. Using such measures, they were not able to provide in-depth theoretical explanations for what it is about employment and marriage that affects later offending.

In summary, past criminological research on the dropout-delinquency relationship has yielded inconsistent findings. While some studies found dropping out increases delinquency, other studies found dropping out decreases delinquency. Yet other studies found a spurious relationship between the two. In addition, past studies are characterized by several significant limitations in terms of sample design, model specification, and methods, which have limited their ability to investigate and explain the causal effect of graduation on adult offending.

#### **Section 2.4: High School Graduation as a Second Type of Turning Point**

Having discussed the empirical literature on the dropout-delinquency relationship, this section will focus on the conceptual understanding of high school graduation as a second type of turning point, i.e., a turning point that opens up opportunities. I will first discuss the reasons that high school graduation is a better focus than high school dropout, followed by a discussion of the conceptual differences between high school graduation and adult turning points. I

conclude that high school graduation, as a turning point that opens up opportunities, is conceptually different from adult turning points and therefore deserves a separate consideration. Last, I will discuss the heterogeneity of high school graduates and the importance of distinguishing different groups of graduates when studying graduation as a turning point.

#### **2.4.1 High school graduation vs. dropout**

Most of the studies discussed in the last section focus on dropout instead of graduation in studying the effect of high school education on subsequent offending. The lack of research focusing on high school graduation reflects the general trend of most longitudinal studies in delinquency, i.e., most studies focus on predictors and correlates of negative behaviors and risk factors. Less attention has been paid to positive experiences or behaviors, such as age appropriate developmental tasks (Stouthamer-Loeber et al. 2004). Although graduation is simply the flip side of dropout in a binary variable, I argue that focusing on graduation instead of dropout may be more in line with prevention research. In this study, I will focus on high school graduation for the following reasons:

First, there are good reasons to consider the completion of high school as a turning point. Educational attainment is known to open up future opportunities for positive turning points in adulthood. In addition, a diploma may send a message that the student has the ability to overcome difficult times and adversity, and, in turn, may provide psychological benefits (Natsuaki et al. 2008).

Second, qualitative research in developmental psychology, focusing on protective factors, provides reasons why a positive high school experience can serve as a positive turning point. For example, focusing on resilience, Werner and Smith (1992, 2001) have identified possible predictors of positive transitions (i.e., “second-chance opportunities”), including school experiences. They argue that education can increase one’s self esteem and restructure individuals to develop in a more adaptive direction. When discussing protective mechanisms, Rutter (1987) used the example of school based studies – the decision to stay in school enables at-risk youths to improve their qualifications and open up future occupational opportunities, which, in turn, may redirect a risky trajectory to a more adaptive pathway. Another possible mechanism through which positive school experiences may work, according Rutter, is to increase youths’ self esteem and self-efficacy, which can be useful qualities for future success.

Third, some studies on the high school education-crime relationship in criminology and related fields have focused on the positive consequences of high school graduation. For example, developmental psychologists Andrews and Bonta (2003) found that success in school and completion of high school are highly predictive of decreased risk of delinquent involvement. Economist Lochner (2004) found that high school graduation (above and beyond years of schooling) is negatively associated with crime after controlling for race, family background, and local conditions. Bernburg and Krohn (2003) found that high school graduation is indirectly associated with offending through employment.



High school graduation is a normative and universal change that is usually experienced by a large number of people. In addition, the effect of high school graduation on employment opportunities, income, and offending behavior is likely to be long lasting. In conclusion, high school graduation can be conceptually viewed as a turning point in redirecting individuals' offending behavior. In line with prevention research, high school graduation, compared to dropout, may be a better research focus.

#### **2.4.2 The conceptual differences between high school graduation and adult turning points**

While Sweeten's (2006) study informed us about the dropout-delinquency relationship using a strong methodology, it did not focus on the conceptual understanding of high school dropout/graduation as a turning point in adolescence. We lack knowledge of how the two types of turning points (i.e., turning points that open up or close down opportunities and turning points that change life circumstances) differ conceptually, and whether these differences warrant different theoretical explanations. In the following few sections, I will make an attempt to provide some conceptual understanding of high school graduation as a turning point.

High school graduation is different from adult turning points that change life circumstances, such as marriage, employment, and military service. First, marriage, employment, and military service are all conventional institutions and

can be understood as social institutions in which the individual is embedded. In contrast, high school graduation is more of a discrete event or an individual achievement that cannot be understood as a social institution by itself (although education itself is a social institution).

Second, marriage, employment, and military service mark the starting point of a change. Although high school graduation can lead to other changes, such as social network and routine activities, it is not a starting point of a change itself. In fact, rather than a starting point, high school graduation is more likely to be seen as the successful completion and end point of high school education as a process.

Third, the benefits of marriage, employment, and military service can be understood within these social institutions. However, the benefits of high school education are often linked to other social institutions such as employment, and, to a lesser extent, marriage and family life. In other words, the most important benefit of high school graduation is to open up opportunities for other positive changes in individuals' lives. There has been strong evidence that the link between high school education and offending at least partly goes through employment. For example, Thornberry et al. (1985) suggest that the increase in offending after dropping out of high school may be due to unemployment after dropout rather than dropping out of high school per se. Conversely, the decrease in offending after high school graduation may be due to employment after graduation rather than graduating from high school per se.

Fourth, finishing high school education has a ceremonial effect that marks the start of a new life, especially for disadvantaged youths (Natsuaki et al. 2008). While one can argue that marriage includes a ceremonial effect as well, the effect of marriage is more likely to come from the institution of marriage instead of the wedding ceremony.

Last, while the effect of adult turning points can be reversible, the effect of high school graduation cannot be reversed. For example, getting married could reduce the level of offending, but this change may last only as long as one remains married. Getting separated or divorced could reverse the effect of marriage and increase the level of offending. In their age graded informal social control theory, Sampson and Laub (1993) have suggested that separation or divorce may increase offending behavior. After analyzing the Cambridge study, Farrington and West (1995) found that for the men in their study, separation from their wives is associated with an increase in offending behavior. In contrast, the effect of high school graduation is not reversible for an obvious reason; that is, once someone graduates from high school, they cannot drop out of school anymore.

In sum, high school graduation is conceptually different from adult turning points (such as marriage, employment, and military service). Akin to the typology idea from the last section, although it can lead to changes in life circumstances, high school graduation is similar to going to college and getting a Ph.D. and can be seen as a second type of turning point that opens up opportunities.

### **2.4.3 Heterogeneity of high school graduates**

As discussed above, literature has suggested that students drop out of high school for different reasons (Jarjoura 1993, 1996; Sweeten 2004). Likewise, there has been evidence that high school graduates are not a homogeneous group. Some studies have distinguished groups of graduates with characteristics both similar and dissimilar to dropouts. These studies have found a group of graduates who resemble dropouts and are prime candidates for dropping out. For example, in their Youth in Transition study, Bachman et al. (1971) made a distinction between graduates not pursuing additional education and graduates who attend college. When studying the predictors of high school graduation/dropout, they found that it is difficult to distinguish dropouts and non-college-bound graduates. While most predictors in their model can distinguish college-bound graduates and dropouts, the only predictor that makes a distinction between non-college-bound graduates and dropouts is in-school delinquency.

Using a different data set (the High School and Beyond study 1980 cohort), Wehlage and Rutter (1986) also found a group of graduates similar to the non-college-bound graduates in Bachman et al.'s sample and called them "stay-ins." These "stay-ins" share many similar characteristics and academic experiences with dropouts. What distinguished them was that, in general, "stay-ins" felt more positive about their academic experiences, were more interested in school, and had fewer disciplinary problems than dropouts did.

Although it is difficult to distinguish non-college-bound stay-ins and dropouts in terms of early processes, it is possible that the differences start emerging after graduation. For example, non-college-bound stay-ins may be less likely to offend as adults compared to dropouts. If this is true, we can conclude that for non-college-bound graduates, graduation serves as a turning point because it brings about changes in individuals' behavior patterns. However, for college bound graduates, graduation may not be a turning point since the differences between them and dropouts existed long before graduation. In this case, graduation marks the continuation of strong academic performance and conventional behavior. For these reasons, it is important to distinguish these two different groups of graduates when studying high school graduation as a potential turning point. In this study, I will explore whether these two groups can be distinguished in a sample of predominately poor urban minority youth.

### **Section 2.5: The Issue of Selection Bias in Turning Point Research**

Having conceptually established high school graduation as a turning point, I hereby turn to the empirical testing of such a turning point. According to Sampson and Laub (2005), a potential threat to any empirical study of turning points is that turning points could be a result of selection bias (also called omitted variable bias, hidden bias, or confounding or unobserved heterogeneity). Changes in offending behavior could be due to unobserved characteristics of the person rather than due to the occurrence of turning points. Sampson and Laub argue that the biggest challenge to study the effect of any social state is to

account for the nonrandom selection of individuals into that state. Selection bias is the main source of doubt about the argument that events in adulthood influence offending (e.g., Gottfredson and Hirschi 1990). Using the example of marriage as an adult turning point, Sampson and Laub (2005) argue that given that marriage is self-selected, any marriage-crime relationship discovered may be potentially spurious. According to Sampson and Laub, the most often used research approach, i.e., controlling for a variety of confounding factors, is not appropriate in dealing with the issue of selection bias. (For details, see Sampson and Laub (2005) and the method chapter of this dissertation).

To address the issue of selection bias in studying marriage effect, Sampson et al. (2006) employed a method for identifying causal effects with observational data, commonly called the “counterfactual” model of causality. In order to estimate the causal effect of marriage on adult offending, they used the inverse proportional treatment weighting (IPTW) method rather than the traditional regression adjustment procedures, i.e., controlling for other variables that may influence offending behavior when estimating the effect of marriage. They first estimated the propensity of being married using observed covariates, and then weighted each observation using the inverse propensity of being married. Married men with high propensity of being married were given less weight and married men with low propensity of being married were given more weight. As a result, individuals who self-selected into the state of marriage contribute less to the estimation of the causal effect of being married on crime.

Using this method, Sampson et al. found that married men are 35% less likely to engage in offending behavior, compared to their non-married counterparts.

On a similar note, in their discussion of the criteria of turning points, Rutter and colleagues (Pickles and Rutter 1991; Quinton and Rutter 1988) also conveyed the idea that some life events may not necessarily change opportunities or life circumstances. For example, marriage may not involve a major change in life circumstances (Pickles and Rutter 1991), or it may simply mark the changes that are already taking place before marriage (Quinton and Rutter 1988).

Similar to the idea of marriage, since high school graduation is not a random process, it is possible that graduating from high school is simply a continuation of the process that starts as early as the first grade in terms of student attachment to school and commitment to school work<sup>3</sup> (Alexander et al. 2001). Through this process, individuals self select into the state of graduation/dropout. The observed effect of high school graduation, as a turning point in adolescence, on adult offending could be due to unobserved characteristics of the person rather than high school graduation itself. In such a case, rather than leading to changes in offending behavior, high school graduation may simply mark the continuation of individual differences in offending behavior. In order to address the issue of selection bias and to draw causal inferences on the effect of high school graduation on adult offending, early

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<sup>3</sup> As discussed earlier in this section, it is also possible that for some high school graduates, graduating from high school is a continuation, while for others it is a turning point.

processes that lead to both high school graduation and adult offending must be taken into account.

### **2.5.1 Research on predictors of high school graduation**

There has been a large body of research focusing on the predictors or precursors of high school dropout; the same predictors also predict high school graduation (although in the opposite directions). Most research examining the precursors to high school dropout (Alexander et al. 2001; Batin-Pearson et al. 2000; Entwisle et al. 2005; Ensminger and Slusarcick 1992; Finn 1989; Temple et al. 2000) uses a risk factor approach. A risk factor approach focuses on identifying factors that increase an individual's vulnerability to negative developmental outcomes (Small and Luster 1994). Many studies have shown that since problem behaviors tend to co-occur, the same risk factors usually predict several problem behaviors (such as serious delinquency, substance abuse, and dropping out of school) (Hawkins et al. 2000; Howell 2003; Huizinga and JaKob-Chien 1998). Taken together, these studies have provided strong evidence that multiple risk factors in major domains (individual, peer, family, school, and neighborhood) predict high school dropout. In this section, I will introduce the most important risk factors in each domain by reviewing recent literature on predictors of dropout. In this discussion, I will take into account the timing of the risk factors and introduce a life course perspective of looking at the dropout process.



## 2.5.2 Risk factors in major domains

**Individual domain:** In the individual domain, studies have suggested that a number of individual factors put youth at risk for dropping out of high school. Some of these factors include race/ethnicity (Battin-Pearson et al. 2000; Rumberger 2001), gender (Battin-Pearson et al. 200; Rumberger 2001), immigration status (Rumberger 1995), limited English proficiency (Schargel 2004), and physical or mental disabilities (Kaufman et al. 1992; Lehr et al. 2004; Schargel 2004). While these factors are beyond individuals' control, other factors are alterable. For example, early antisocial behavior, such as aggression, delinquency, and substance abuse, has been linked to dropping out of school by numerous studies (Alexander et al. 1997; Bachman et al. 1971; Battin-Pearson et al. 2000; Ekstrom et al. 1986; Monk-Turner 1989; Siennick and Staff 2008; Wehlage and Rutter 1986). Low self-esteem and self-confidence (Ekstrom et al. 1986; Rumberger 1983; Wehlage and Rutter 1986) also contribute to the increased risk of dropout.

**Peer domain:** There has been a good amount of research on the predictors of dropout in the peer domain. It has been consistently found that dropouts tend to have more delinquent friends who also display great potential for dropping out (Battin-Pearson et al. 2000; Catalano and Hawkins 1995; Elliott and Voss 1974; Ekstrom et al. 1986; Fagan and Pabon 1990). In addition, some studies have made an attempt to investigate the mechanism of the deviant peers influence on dropout. For example, Battin-Pearson et al. (2000) hypothesized that low academic achievement mediates the relationship between deviant peer

bonding and dropout. Apart from the indirect effect, bonding to deviant peers is also directly related to dropping out, over and above the mediated influence of low academic achievement.

**School domain:** In the school domain, numerous studies have found that risk factors measured at all school levels (elementary, middle, and high) are predictive of high school dropout. These risk factors include poor school performance/low academic achievement, grade retention, disengagement from school, and misbehavior at school. Among these factors, poor school performance/low academic achievement is one of the most consistent predictors of dropout (Alexander et al. 2001; Battin-Pearson et al. 2000; Ensminger and Slusarcick 1992; Rumberger 2001). “Poor grades” and “failing in school” were reported as the most important reasons for dropping out of school (Bridgeland et al. 2006; Ekstrom et al. 1986).

Grade retention is another important risk factor predicting school dropout (Alexander et al. 2001; Rumberger 2001). Since the impact of grade retention is cumulative, retention at any grade level has been found to increase the likelihood of dropping out (Alexander et al. 2001). Related to school performance, disengagement from school is another important predictor. Students disengaged from school are much more likely to drop out (Alexander et al. 1997; Rumberger 2001). An indicator often used to measure disengagement from school is truancy. According to Bridgeland et al. (2006), missing too many days of class is the second most important reason students reported for dropping out of school. Empirical evidence suggests that non-attendance, starting as early as the first

grade, increases the chance of dropping out, and it continues to be an important factor throughout a student's schooling (Wagner et al. 1993).

Another important individual factor is misbehavior at school (Alexander et al. 2001; Ekstrom et al. 1996). Disciplinary problems measured in elementary, middle, and high school are also significantly associated with risk of dropping out, particularly when the behavior results in suspension from school (Alexander et al. 2001; Ekstrom et al. 1986; Kaufman et al. 1992; Rumberger et al. 2001; Wehlage and Rutter 1986).

Apart from the above school related risk factors, studies have also explored the role the school plays in the dropout process. Studies have consistently found that private schools have lower dropout rates than public schools (Goldschmidt and Wang 1999; Ingels et al. 2002; Rumberger 2001). Studies at a school level (Bryk and Thum 1989; Rumberger 1995; Rumberger and Thomas 2000; Wehlage and Rutter 1986) have also found that certain school level variables, such as student composition, school structure, school resources, and school processes all predict high school dropout. For example, Rumberger (1995) reported that students attending schools with a high percentage of minorities are more likely to drop out, and students attending religious schools are less likely to drop out.

***Family domain:*** In the family domain, the strongest risk factor found to be significantly associated with the risk of dropping out is low socioeconomic status (SES). Family SES level has been repeatedly found to influence educational outcomes at all stages of a student's educational career (Alexander et al. 2001;

Bachman et al. 1971; Battin-Pearson et al. 2000; Lehr et al. 2004; Rumberger 1983, 2001; Schargel 2004; Wehlage and Rutter 1986). Another important risk factor in the family domain is low parental monitoring. Students from families with a low level of parental monitoring and school involvement were found to be more likely to leave school before graduation (Janosz et al. 1997; Jimerson et al. 2000; Rosenthal 1998; Rumberger et al. 1990). Frequent residential moves may be another risk factor. Residential moves are most likely to result in changing schools, which has been found to significantly increase the risk of dropping out (Rumberger 2001; Teachman et al. 1996).

***Neighborhood domain:*** Although a body of research and theories (e.g., Bowen and Bowen 1999; Dornbusch et al. 1991; Garner and Raudenbush 1991; Gottfredson 2001; Wilson 1987) has suggested that neighborhoods and communities influence students' academic achievement, risk factors in the community domain have not been studied to the same extent as factors in other domains. However, studies have found that neighborhood poverty and crime are related to students' school behavior. For example, it has been consistently documented that neighborhood poverty is predictive of dropouts: dropout rates are generally higher in poor communities than in well off communities (Entwisle et al. 2005; Rumberger 2001).

### **2.5.3 Comparison between the five domains**

Even though all of the above risk factors in different domains contribute to the prediction of dropout, it is important to note that not all of them have the same

predictive power. Studies comparing different domains of predictors (Bachman et al. 1971; Bridgeland et al. 2006; Ekstrom et al. 1986; Elliott and Voss 1974; Janosz et al 1997; Rumberger 1983; Wehlage and Rutter 1986) have yielded overwhelming evidence that school related factors are the most powerful predictors of high school dropout. For example, Janosz et al. (1997) conducted a study of risk factors in different domains to find the most powerful predictors of dropout, and they concluded that school experience variables (such as grade retention and school achievement) are the most powerful. Elliott and Voss (1974) also found that school achievement and commitment contribute most in predicting dropout; a model including only school variables was able to classify 74% of the sample correctly. They also found that family context variables did not contribute to the prediction of dropout above and beyond school variables. Other studies (Bachman et al. 1971; Bridgeland et al. 2006; Cairn et al. 1989; Ekstrom et al. 1986; Rumberger 1983) have also reported that school related reasons are the most important reasons given by students who dropped out.

Although school related factors are powerful predictors of dropout, factors in other domains are also important. Studies (Cairns et al. 1989; Jimerson et al. 2000) have found that a model that includes a combination of factors in all major domains best predict dropout. For example, Jimerson et al. (2000) found that a model including risk factors in all major domains was able to predict 82 percent of dropouts and 77 percent of graduates.

#### **2.5.4 Timing of risk factors**

Dropping out is often viewed as a cumulative process of disengagement from academics that starts as early as the first grade (Alexander et al. 2001; Entwisle et al. 2005; Jimerson et al. 2000). Research suggests that risk factors measured at all stages of the educational career are important in predicting high school dropout (Alexander et al. 1997, 2001; Ensminger and Slusarcick 1992; Entwisle et al. 1997, 2005; Stroup and Robins 1972; Temple et al. 2000).

Although risk factors measured in middle and high school are important in predicting dropout, risk factors measured as early as first grade are by no means less important. For example, an early study by Stroup and Robins (1972) found that elementary school events, such as school retardation, truancy, and early drinking, predict high school dropout. After examining a cohort of 1,242 black first graders from Woodlawn in Chicago, Ensminger and Slusarcick (1992) concluded that poor academic performance and aggressive behavior during the first grade predict high school dropout. In another study, Jimerson et al. (2000) followed an at-risk sample of youth from birth up to age 19 to assess the impact of different risk factors on dropout. They found that the process of dropping out seemed to be set by third grade, and that both early and later events are important in predicting dropout. The significant predictors found in their study include early parenting, problem behaviors and low academic achievement in the first grade, low parent involvement in the sixth grade, and poor peer relationships, problem behaviors, and low achievement at age 16.

Using a sample of Baltimore public school children, Alexander et al. (2001) examined the effects of multiple risk factors measured at the first grade, the rest of elementary school years (second-fifth grades), middle school years (sixth-eighth grades), and the ninth grade on dropout. Findings suggested that sociodemographic factors, family context measures (stressful family changes, parents' attitudes, and parents' socialization practices), children's behaviors and attitudes, and school experiences (test scores, grades, and track placements) measured in first are as predictive of high school dropout as those factors measured later in children's schooling. After controlling for measures from the remaining years of schooling, school performance and retention measured in first grade still remain significant. From these findings, Alexander et al. concluded that data on risk factors from the first grade are needed to better predict dropout. Data from the ninth grade is not sufficient.

Using the same sample as Alexander et al., Entwisle et al. (2005) also found that first graders' social contexts and personal resources explain educational attainment in early adulthood as well as those measured in adolescence. In order to answer the question of whether models estimated in first grade have the same predictive power as those estimated in high school, Entwisle and colleagues compared their model for first graders to the Exploration in Equality of Opportunity (EEO) model estimated by Alexander and Eckland (1975) for high school students. They found that the first grade model explains roughly the same amount of variance as the high school model (42% vs. 44%).

One of the reasons that early predictors have such a powerful impact on high school dropout is the consistency in behaviors during childhood and adolescence. As early as elementary school, behaviors such as temper tantrums significantly predict antisocial behavior in adolescence and adulthood (Loeber 1982; Olweus 1979; Patterson et al. 1989; Petras et al. 2008). In addition to patterns of antisocial behavior, patterns of academic performance are also established early and remain consistent in the long term (Entwisle and Hayduk 1988). There is also evidence that behavioral measures are more stable than attitudinal measures. Alexander et al. (2001) found that while school engagement behaviors measured at grade 1 and grade 9 correlate .34, school engagement attitudes measured at grade 1 and grade 9 correlate only .06.

Consistent with the above empirical findings, theories of high school dropout suggest a life course view (Alexander et al. 2001; Engsminger and Slusarcick 1992; Finn 1989). For example, as suggested by Engsminger and Slusarcick (1992), the processes leading to success or failure in school are established early in children's school experiences. Experiences in early school years, set the stage for later development and, to a large extent, determine future educational attainment. Alexander et al. (2001) also suggested a life course view of the dropout process. They argue that before the decision to drop out is made, many students fade out through chronic truancy and disengagement from academics. In particular, they argue that first grade is of particular interest when studying the dropout process since it can be viewed as a developmental milestone that defines the transition to full time formal schooling. Similarly,



Entwisle et al. (2005) also argue that a good reason for focusing on the first grade when studying dropout is that the temporal order is less ambiguous at the first point of school entry.

In conclusion, research on precursors of high school dropout has suggested that various risk factors in multiple domains are predictive. Risk factors measured as early as the first grade are as important as those measured in the later educational career. In order to study the causal effect of high school dropout on later negative outcomes, we must take into account these risk factors measured at all school levels.

## **Section 2.6: The Mechanisms of High School Graduation**

While studying the protective effects of turning points on offending is important, as Rutter (1987) has pointed out, it is more important to study how these turning points operate for people at high risk of offending (i.e. mechanisms). Most of the discussion of mechanisms has been focusing on adult turning points. In an earlier section, I argue that high school graduation is another type of turning point; instead of changing life circumstances, high school graduation opens up opportunities. Some of these mechanisms discovered for adult turning points, however, can be applied to explain the effect of high school graduation as well. In this section, I will review the mechanisms that have been discussed in the literature, and apply these mechanisms to explain the effect of high school graduation on adult offending. More importantly, I will discuss a

unique mechanism of high school graduation effect as a second type of turning point, that is, the mechanism of opening up opportunities.

### **2.6.1 What we know about mechanisms of turning points**

Past literature has identified several mechanisms through which turning points may operate to influence offending. First, turning points may increase social investment and social capital. Sampson and Laub (1993) explained the mechanisms of turning points via the route of informal social control theory. They argue that the changing roles and environments embedded in turning points bring about new social investment and social capital. Second, turning points may structure routine activities or alter a person's social group. For example, marriage may structure one's routine activities and reduce unstructured time with peers (Farrington and West 1995; Horney et al. 1995; Laub and Sampson 2003; Simons et al. 2002; Warr 1998), and employment may increase association with pro-social coworkers (Wright and Cullen 2004). Third, turning points, such as marriage, may provide direct or indirect supervision and monitoring of behavior (Laub and Sampson 2003). Fourth, turning points may bring about cognitive restructuring and change of self identity and self esteem. There has been some debate over whether cognitive change is necessary for desistance from crime. While some scholars (e.g., Giordano et al. 2002; Maruna 2001) argue that cognitive shift is fundamental to the desistance process, others (e.g., Laub and Sampson 2003) suggest that desistance can occur in the absence of cognitive shift.

### **2.6.2 Mechanisms of high school graduation effect**

In section 2.2 of this chapter, I discussed two types of turning points, and argued that these two types are not mutually exclusive. Although graduation from high school is more likely to be seen as a turning point that opens up opportunities, it can also change life circumstances. In other words, the same mechanisms hypothesized for adult turning points may provide reasonable explanations for high school graduation effect as well. First, youths who graduated from high school have already invested a considerable amount of time and energy in education as a conventional institution. Graduation from high school signals the benefit of such commitment, and this may encourage youths to continue investing in other conventional social institutions (Hirschi 1969). Second, youths who graduated from high school are more likely to spend time on conventional activities such as work and education (Lochner and Moretti 2004), leaving little time for crime. Third, since youths who graduated from high school are more likely to find a job or go to college than dropouts (U.S. Department of Education 2006), they are subject to more direct and indirect supervision from these conventional institutions. Last, high school graduation, as a successful accomplishment, may increase one's self esteem and self-efficacy. In turn, this increases the ability to deal with challenges in life and control what happens, especially for those who are at high risk of offending (Rutter 1987; Werner and Smith 1992). Apart from these adult turning point mechanisms, a unique mechanism of high school graduation (as a second type of turning point) is opening up future opportunities. These opportunities may partly explain the

relationship between graduation and offending. Examples of these opportunities may include traditionally identified adult turning points, such as employment and intimate relationships.

As mentioned earlier, past studies indicate that employment explains at least part of the relationship between graduation/dropout and offending behavior (Bernburg and Krohn 2003; Farrington et al. 1986; Grogger 1998; Thornberry et al. 1985). For example, Grogger (1998) found a negative relationship between wage and crime, but no relationship between education and crime when controlling for wages. It was suggested that the effect of schooling on crime may be mediated by wages. A recent study by Bernburg and Krohn (2003) examined the long-term effects of police and juvenile justice interventions during adolescence on adult offending. They hypothesized that police and juvenile justice interventions have indirect effects on adult crime through reducing both educational attainment and employment. After analyzing the data collected from a sample of males living in Rochester, NY, findings provide support for this hypothesis. Relevant to this study, it was found that high school graduation is indirectly related to adult offending through employment, while employment is directly related to adult offending (Bernburg and Krohn 2003).

In addition to the above mentioned studies directly testing the relationship between education, work, and crime, literature on the education-work relationship and on the work-crime relationship also suggests that one of the avenues through which high school graduation influences offending is opening up employment opportunities. On one hand, as discussed in detail in section 2.3 of

this chapter, a good body of literature in a variety of fields has documented the positive relationship between education and employment opportunities and income (Lerner and Galambos 1998; Lochner and Moretti 2004; Monk-Turner 1989; Rutter 1987). On the other hand, as discussed in section 2.1 of this chapter, it has been established that employment, as an identified turning point in adulthood, reduces delinquency and may lead to eventual desistance from crime (Bushway and Reuter 1997; Uggen 1999, 2000; Uggen and Staff 2001; Uggen and Wakefield 2008; Wright and Cullen 2004).

Beyond employment opportunities, high school graduation can also open up opportunities for intimate relationships, especially with conventional partners. Literature on the association between education and romantic relationship and on the association between romantic relationships and crime suggests that marriage or romantic relationships may partly mediate the relationship between high school graduation and crime. On one hand, although less documented, it is possible that finishing high school may increase the likelihood of associating with non-delinquent friends and meeting conventional partners. Empirical research on marital behavior suggests that men's economic and educational circumstances, such as their job stability and educational attainment, affect both their own marital intentions and their attractiveness to potential partners (Mare and Winship 1991; Oppenheimer et al. 1993; Wilson 1987). Empirical research on women's marital behavior also suggests the importance of considering the "quality" of available mates. The employment and educational status of potential husbands

are of particular importance to women (Fossett and Kiecolt 1991; Lichter et al. 1992; South and Lloyd 1992b; Wilson 1987).

These two lines of research suggest the following conclusions. First, objectively, men with stable employment and high income are capable of providing an independent household for themselves and their potential partners, and therefore they make more attractive potential husbands (Lloyd and South 1995). Second, men with higher levels of educational attainment are also more likely to perceive themselves as being able to provide for their potential partners and, in turn, are more attractive to potential partners (Oppenheimer et al. 1993). Therefore, the substantial detrimental effect of lack of a high school diploma on future educational attainment, employment opportunities and income (U.S. Census Bureau 2005) would be expected to reduce men's attractiveness as romantic partners and increase the instability of their romantic relationships. Compared to high school dropouts, high school graduates are more attractive to potential partners and are more likely to be involved in stable romantic relationships. On the other hand, as discussed in the section 2.1 of this chapter, studies have found that marriage and romantic relationships reduce offending behavior and facilitate desistance from crime (Capaldi et al. 2008; Horney et al. 1995; Farrington and West 1995; Sampson et al. 2006; Sampson and Laub 1993; Simons et al. 2002; War 1998).

Taken together, the above findings suggest that although high school graduation can change life circumstances (that is, the same mechanisms discovered for adult turning points can also be applied to understand the effect of

high school graduation), a unique mechanism of high school graduation effect is opening up opportunities. In this dissertation, I mainly focus on the discussion of steady employment and intimate relationships as two of the potential opportunities that high school graduation opens up. Other opportunities may include pursuing a higher level of education and training, such as attending college. In addition, in line with the heterogeneity of graduation group discussed in section 2.4 of this chapter, it is important to note that for different individuals, the benefits of graduating from high school may be different. For example, for college-bound graduates, high school graduation provides an opportunity for college education; for non-college-bound graduates, it may open up an avenue for long term employment.

## **Section 2.7: Theoretical Frameworks in Testing the High School Graduation-Delinquency Relationship**

As demonstrated in the last section, a unique mechanism of the effect of high school graduation, as a second type of turning point, is opening up opportunities. Some opportunities include employment and establishing long-term intimate relationships with conventional partners. This section will apply two theories, human capital theory and informal social control theory, to explain how high school graduation opens up opportunities that, in turn, reduce adult offending. Human capital and informal social control theories provide the most promising theoretical explanations for the effect of high school graduation. On

one hand, most of the literature on high school graduation in economics uses a human capital theoretical framework; on the other hand, the discussion of turning points in life course criminology is based on informal social control theory.

Although I discussed the relationship between education, work/intimate relationship, and crime based on these two theories, it is possible that both theories provide complementary explanations for the observed relationships.

The same empirical findings can provide support for both theories. For example, if it is found that high school graduation increases the probability of having a job, which in turn reduces the likelihood of adult offending, such a finding can be used to support both informal social control and human capital theories. It is possible that high school graduation increases both informal social control and human capital, which can both be measured by having steady employment. Similarly, different aspects of employment can have an important impact on adult offending, which can be used to support both theories as well. For example, the finding that income decreases the likelihood of adult offending can be used to support human capital theory because income can be a measure of human capital. Such a finding can also support informal social control theory because income is closely related to the number of hours worked per week, which is frequently used as a measure of attachment and commitment to work. In sum, it is empirically possible for both theories to work together to explain the relationships between education, work/intimate relationships, and, crime. For conceptual purposes, I present these two theoretical explanations separately. It is also important to note that although the two theories presented can provide



reasonable explanations for the education, work/intimate relationships, and crime relationship, the purpose of this study is not to empirically test these two theories, but they are rather used to make the relationship between graduation, adult offending and the mediator variables plausible.

### **2.7.1 The human capital approach in understanding education, work, and crime**

Human capital is traditionally defined as skills and capabilities that enable individuals to act in certain ways (Becker 1964, 1975; Ben-Porath 1967; Coleman 1988). Economist Gary Becker (1975) specified education as a major form of human capital. After investigating the rate of return from education, he concluded that after controlling for individual capability, the investment in human capital through education increases individual earnings. A high school education plays an important role in creating human capital, and it is directly associated with more favorable economic outcomes, such as higher income and shorter periods of unemployment (Caspi et al. 1998; Day and Newburger 2002; U.S. Department of Education 2006; U.S. Census Bureau 2005).

Relevant to this study, there has been evidence that education raises the costs associated with committing crime and possible incarceration through increasing human capital (Ben-Porath 1967, Lochner and Moretti 2004; Lochner 2004). For example, Lochner and Moretti (2004) listed several reasons that education may affect subsequent delinquency. First, education increases the

return of legitimate work, and thus raises the opportunity costs of illicit behavior. Second, since incarceration implies time away from job, it is more costly for individuals with higher income. The stigma related to a criminal conviction is also likely to be higher for those with higher education. Therefore, punishment is likely to be more costly for more educated individuals. Third, education may alter individuals' time preference and perception of risk. Fourth, education may affect the financial or psychological rewards of crime. Empirically, it was found that high school graduation is negatively associated with offending even when controlling for race, family background, and local conditions (Lochner and Moretti 2004; Lochner 2004).

Using the evidence from other studies regarding elasticity of crime and imprisonment with wage rates, Lochner and Moretti (2004) suggest that a significant part of the effect of education on crime is through increases in wages. Lochner (2004) found that the empirical relationship between education and crime is different for white collar crime and street crime. Since white-collar crime requires more skills and is more likely to result in an increase in human capital, white-collar crime declines less as education increases. The mechanisms through which education may influence crime, however, have not been empirically investigated in this study.

Taken together, as presented in Figure 2.2, the human capital approach suggests that the effect of educational attainment on delinquency and crime is largely through employment and income. Educational attainment increases individuals' human capital, which is reflected in more favorable economic

outcomes, such as higher income and shorter periods of unemployment. The increased level of human capital increases the costs and decreases the benefits associated with criminal behavior and therefore reduces involvement.

### **2.7.2 The social control perspective in understanding education, work, and crime**

While the human capital approach emphasizes individual decision making, the social control perspective emphasizes social relationships and the interaction between individuals and conventional institutions. As discussed in detail in section 2.1 of this chapter, Hirschi (1969) argues that attachment and commitment to work reduces the likelihood of engaging in delinquent behavior. The concepts of attachment and commitment are closely related to the notion of social ties and “embeddedness” in the work by Sampson and Laub (1993). As Sampson and Laub (1993) suggest, it is not having a job per se, but the stability of the job and the commitment to the job that lead to a reduced level of delinquency. We can apply this idea to the relationship between education, employment, and crime. As presented in Figure 2.3, successful education, as a reflection of high social control, further increases the level of attachment and commitment to work, which is reflected in the increased likelihood of securing stable employment and perceiving the job as important. Attachment and commitment to work reduce the likelihood of adult offending.

### **2.7.3 The human capital perspective in understanding education, intimate relationships, and crime**

There have been two lines of research on human capital and marriage. One line of research tries to understand why some people are more likely to get married than others. For example, as discussed earlier in the last section, individuals with higher education are more likely to be involved in a stable intimate relationship (Lloyd and South 1995). Another line of research explores the benefits of marriage. For example, economist Gary Becker (1973) developed a theory of marriage from a human capital perspective. He argues that the gain from marriage compared to remaining single depends on the individual's income, human capital, and relative differences in wage rates. However, the human capital explanation of marriage has not particularly focused on the relationship between marriage and subsequent delinquency. Therefore, the human capital understanding of education, marriage, and adult offending will not be presented in the present study.

### **2.7.4 The social control perspective in understanding education, intimate relationships, and crime**

There has been strong evidence that on one hand, finishing high school increases the likelihood of establishing adult social bonds, including stable intimate relationships (Lloyd and South 1995), and, on the other hand, marriage (or romantic relationship) reduces the likelihood of adult offending (Horney et al. 1995; Sampson and Laub 1993; Sampson et al. 2006). According to Hirschi

(1969), a positive school experience increases attachment to conventional individuals and social institutions. According to Sampson and Laub (1993, 2003), one of the most important mechanisms through which marriage has an effect on later offending is attachment to one's spouse. As presented in Figure 2.4, the successful completion of high school should increase attachment to marriage or romantic relationships, which is reflected in the increased likelihood of having a stable romantic relationship and the quality of relationships. Attachment to marriage or romantic relationships reduces the likelihood of offending.

### **CHAPTER 3: PRESENT STUDY**

Building on the theoretical framework of life course criminology and past empirical studies on the education-crime relationship, this study will focus on the causal relationship between high school graduation and adult offending up to age 28 in a sample of predominately urban minority youth. As I have argued in the literature review chapter, most of the literature on turning points in criminological research has focused exclusively on turning points that change life circumstances, such as marriage and full time employment, which tend to occur in later adulthood. Pickles and Rutter (1991) discussed a less well-studied second type of turning point, that is, a turning point that opens up or closes down opportunities. This type of turning point typically occurs earlier than the traditionally identified turning points in adulthood and may be closely related to the well-known age-crime curve.

An example of the second type of turning point in late adolescence is high school graduation. There is consistent evidence that high school graduation facilitates employment opportunities, opportunities for higher education, as well as opportunities for meeting conventional partners. Focusing on high school graduation as an example of a turning point that opens up opportunities in late adolescence, this study will integrate theories and research findings from life course criminology and empirical studies on the high school graduation-delinquency relationship. Most importantly, this study will go beyond investigating the simple relationship between graduation and offending by exploring the mechanisms through which high school graduation influences adult

offending. This study will focus on two types of opportunities that high school graduation may open up, i.e., employment and intimate relationships (with a heavier focus on employment), and empirically test to what extent these two opportunities mediate the effect of high school graduation on adult offending.

### **Section 3.1: The Conceptual Model**

Building upon the empirical literature, Figure 3.1 presents the relationship of childhood and adolescent risk factors in major domains leading to high school graduation/dropout, employment, intimate relationships, and adult offending behavior in early adulthood. According to previous studies on predictors of high school dropout (Alexander et al. 2001; Entwisle et al. 2005; Finn 1989), multiple risk factors in all the major domains (i.e., individual, peer, family, school and neighborhood) are predictive of high school graduation/dropout. There has been strong evidence that official and self-reported risk factors measured in early elementary school are as important in predicting high school dropout as those measured in later school years (Alexander et al. 1997, 2001; Ensminger and Sluarcick 1992). It is proposed that high school graduation/dropout influences offending behavior during early adulthood, both directly and indirectly, through the effect of employment and intimate relationships during early adulthood.

## **Section 3.2: Research Question and Hypotheses**

Based on the conceptual model, this dissertation will primarily explore the following two empirical research questions.

### **3.2.1 Research Question 1**

The first research question is: Does high school graduation have a causal effect on early adult offending after taking into consideration early processes from the above mentioned five domains? In order to reject the alternative hypothesis that these early processes are predictive of both not graduating from high school and adult offending, appropriate methods are required to create a quasi-experimental design where the prior differences between graduates and dropouts are random. This is accomplished by the use of propensity score matching (Rosenbaum and Rubin 1983b; Stuart 2007). Early risk factors in the individual, peer, family, school, and neighborhood domains measured during elementary, middle, and high school will be used to estimate the propensity scores. I will refer to this part of the analysis as RQ1. The following two hypotheses will be tested against each other, where H0 represents the hypothesis generated by a general theory of crime.

*H0: The relationship between high school graduation and adult offending is spurious, once controlling for earlier processes.*



*HRQ1: High school graduation is negatively associated with adult offending, above and beyond early processes (direct effect hypothesis).*

### **3.2.2 Research Question 2**

The second research question is: Given that a causal relationship between graduation and adult offending is established, what are the mechanisms through which high school graduation influences adult offending? According to social control and human capital theory, high school graduation, as a second type of turning point, may open up employment opportunities as well opportunities for intimate relationships with conventional partners. In other words, at least part of the direct relationship between high school graduation and adult offending may be mediated through employment and intimate relationships. This study will empirically test such indirect effects using mediation analysis (MacKinnon 2008).

In testing the indirect effect of high school graduation through employment and intimate relationships, a two-study approach will be used. In the first study, I will test whether having a job and being involved in a relationship partially mediate the association between high school education and adult offending. This enables direct comparison of the results from this study with past studies to the extent that employment and marriage partly explain the relationship between high school graduation and adult offending. Thereafter, I will refer this part of the analysis as RQ2-Study I. The following hypotheses will be tested:

*HRQ2-Study I-Employment: Having a job (partially) mediates the effect of high school graduation on adult offending (indirect effect hypothesis I).*

*HRQ2-Study I-Relationship: Being involved in an intimate relationship (partially) mediates the effect of high school graduation on adult offending (indirect effect hypothesis II).*

In the second study (i.e., RQ2-Study II), more detailed measures of different aspects of employment and intimate relationships will be used. In RQ2-Study II, analyses will be conducted separately for employment and intimate relationships. Thereafter, I will refer to these two parts of the analyses as RQ2-Study II-Employment and RQ2-Study II-Relationship. A variety of hypotheses derived from both social control theory and human capital theory will be tested.

*HRQ2-Study II-Employment a: Graduation from high school, as an indicator of high level of social control, increases commitment and attachment to work, which, in turn, decreases the likelihood of crime. Those who graduate from high school are more committed and attached to work (measured by the number of hours worked per week), and, in turn, are less likely to commit crime as adults.*

*HRQ2-Study II-Employment b: Having a high school diploma increases human capital, which in turn, increases the costs and decreases the benefits associated with committing crime, thus reduces the likelihood of crime. Those who graduate*

*from high school are more likely to have a higher level of human capital (measured by earning a higher income), and, in turn, are less likely to commit crime as adults.*

*HRQ2-study II-Employment c: Graduation from high school increases commitment and attachment to work, which, in turn, result in higher human capital. Increased human capital, together with commitment and attachment to work reduces the likelihood of offending. High school graduates are more likely to work more hours per week, which result in higher income, and, in turn, they are less likely to commit crime as adults.*

*HRQ2-Study II-Relationship a: Graduation from high school, as an indicator of a high level of social control, increases attachment to intimate relationships, which, in turn, decreases the likelihood of offending. Those who graduated from high school are more likely to have better quality relationships (measured by less negative interactions with spouse), and, in turn, are less likely to commit crime as adults.*

*HRQ2-Study II-Relationship b: Graduation from high school, as an indicator of high level of social control, increases commitment to intimate relationships, which, in turn, decreases the likelihood of crime. Those who graduated from high school are more likely to be more committed to their partners, and, in turn, are less likely to commit crime as adults.*

*HRQ2-Study II-Relationship c: Graduating from high school, as an indicator of a high level of social control, increases commitment to intimate relationships, which, in turn, decreases the likelihood of crime. Those who graduated from high school are more likely to view intimate relationships as important, and, in turn, are less likely to commit crime as adults.*

### **Section 3.3: Contributions**

This study will contribute to the life course criminology literature, both conceptually and empirically. Conceptually, this study will reintroduce the relevance of early developmental processes to understand criminal careers. As discussed in detail in the literature review chapter, high school graduation is conceptually different from the traditionally identified adult turning points. However, the same mechanisms can be applied to understand the effect of high school graduation. In addition, a unique mechanism of high school graduation effect is opening up opportunities for employment and (although to a lesser extent) for intimate relationships.

Empirically, this study will go beyond the existing literature on the high school graduation/dropout-subsequent delinquency relationship in the following fashion. First, this study will not only test whether high school graduation operates as a turning point in individual offending behavior, but also will explore the mechanisms of such an effect. In particular, it will examine the hypothesis that high school graduation opens up opportunities for employment and intimate

relationships, which, in turn, reduces the likelihood of adult offending. As mentioned in detail earlier, although past studies have made some effort in testing such a mechanism (e.g., Farrington et al. 1986; Thornberry et al. 1985), theoretical explanations of these mechanisms were not a main focus in these studies. In the present study, I discuss the theoretical explanations for these mechanisms from both a human capital and an informal social control theoretical perspective and test various hypotheses derived from these theories. I will also incorporate more detailed measures of both employment (such as hours worked per week and income) and intimate relationships (such as how important a relationship is) into the analyses. I will use mediation analysis to investigate these effects.

Second, in order to draw causal inferences, I will use a propensity score matching method to control for multiple risk factors of school dropout in all major domains (individual, peer, family, school and neighborhood), as indicated by previous studies on precursors to high school dropout, as well as delinquent behavior before high school graduation/dropout. Compared to regression adjustment procedures (used in most previous studies on the high school graduation-crime relationship), the propensity score matching method addresses the issue of selection bias and has more advantages in studying causal effects. (For a comparison between the two methods, refer to the method chapter.)

Third, the sample used in this study represents an under-studied population. While most of the previous studies used a sample of predominately European American individuals (with some exceptions, such as Ensminger and

Slusarcick 1992, Obot and Anthony 1999, and Voelkl et al. 1999), the sample in this study consists of predominately poor, urban, African-American youth from neighborhoods with high rates of unemployment and violence. Unlike most of the previous studies (e.g., Jarjoura 1993, 1996; Sweeten 2004, 2006) that used population-based samples, this study will use a local cohort data from Baltimore, Maryland. High poverty cities have a dropout rate between 30% and 50%, and this is substantially higher than the national average of 14.5% (Alexander et al. 2001). Baltimore, Maryland is one of those cities.

Baltimore has one of the highest dropout rates in the country. According to Census data from 1989, over 25% of young adults between ages 25 and 29 were out of school and without a high school diploma or a GED (U.S. Bureau of the Census 1992). Baltimore does not only have a high dropout rate, but also higher than national average childhood poverty, percentage of births to teen mothers, percentage of low birth weight babies, infant mortality, and juvenile and adult arrest rates (Annie E. Casey Foundation 1997; Alexander et al. 2001). The use of local data allows me to take into account the local situations and to draw policy implications directly related to these situations. Rich information regarding youth behavior and attitude is collected from multiple resources, such as teachers, self-reporting, school records, and official court records.

### **Section 3.4: Limitations and Offsetting Strength**

There are several potential limitations of the data used in this study. First, juvenile court records suffer from all the limitations of any official offending

records. However, several studies have reported agreement across self-report and official data sources (Erickson and Empey 1963; Maxfield et al. 2000; Krik 2007). Since official court records provide the exact dates of each offense, which are required in order to ensure the correct time sequence of events in this study, these records were used in the analyses.

In the Young Adult (YA) survey of this study, respondents were asked, “How many times have you been arrested or spent at least one night in jail or juvenile hall?” The response was dichotomized into 1 (at least once) and 0 (never) and then compared to juvenile court records to check validity. Such a comparison shows a reasonable level of agreement between the two with some discrepancies. Although the correlation between the two is modest (Spearman’s  $\rho = .367$ ; Measure of agreement Kappa = .327), the relationship between them is highly significant (P-value for Chi-square test is less than .001). Among those who did not have an official record, 66% did not self-report an arrest record. Among those who had an official record, 78% reported being arrested or spending one night in jail or juvenile hall. Among those who did not report having been arrested or spending one night in jail or juvenile hall, less than 10% had a juvenile court record. Among those who reported having been arrested or spending one night in jail or juvenile hall, 40% had a juvenile court record. Most of the discrepancies between the self-report measure and the official court records used in the study come from the large number of youth who reported an arrest without having an official court record (e.g., among those who did not have an official record, 34% reported an arrest). Such discrepancies are consistent

with past studies examining the convergence between self-reported and official crime data. For example, Maxfield et al. (2000) found that 79% of a sample without an official arrest record did not have a self-reported arrest record, while 73% of the sample with an official arrest record self-reported having been arrested. Kirk (2007) also found that a sizable number of youth who self-reported having been arrested before did not have an official arrest record. This common phenomenon is referred to as “over-reporting” (Kirk 2007, 108).

I speculate several reasons for the over-reporting in this study. First, while the official measures reflect court records, the self-reported variable measures arrest information. It is possible for someone to be arrested but a formal petition never filed. Second, since the YA survey was conducted when the average age of the sample was 20, it is possible that the self-report measure includes some arrests that occurred after age 18, and by definition, these cases were not processed in the juvenile court records. Third, the confusion between arrest and police contact may also contribute to the over-counting of self-report incidents (Blumstein et al. 1986).

Despite the discrepancies between the self-report arrests and official court records in this study, such discrepancies should not bias the results of this study. After carefully examining the effect of certain events (such as parental supervision) on offending changes with different data sources, Kirk (2007) suggested research questions intended to explain within-individual changes in offending might yield different results depending on the data sources. However, research questions designed to explain between-individual differences in



offending are more likely to yield similar results when using different data sources.

The second limitation is the geographical profiles of both the juvenile and adult offending data. The juvenile offending data used in this study represents Baltimore City only. However, given that about 80% of the subjects in the sample were residing in Baltimore City at the time of the Young Adult Survey, the bias in the estimation of juvenile offending is minimal. The adult offending data used in this study represents offenses committed in the State of Maryland only. However, given that about 93% of the subjects in the sample were residing in Maryland at the time of the Young Adult Survey<sup>4</sup>, the bias in the estimation of adult offending is minimal.

The third limitation is the lack of official measures for academic performance during middle and high school. As discussed in detail in the literature review chapter, poor academic performance is one of the most consistent predictors of dropping out (Alexander et al. 2001; Battin-Pearson et al. 2000; Ensminger and Slusarcick 1992; Rumberger 2001). Although the official standard reading score is measured in the first grade, there are no official measures of academic performance during middle and high school. However, previous studies have found that in predicting high school dropout, school-related predictors from the first grade are of particular importance (Alexander et al. 2001; Entwisle et al. 2005; Ensminger and Slusarcick 1992). The official standard reading score from the first grade was obtained from the school records and will

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<sup>4</sup> Over 90% of the subjects were residing in Maryland at the time of the new interviews that are currently being conducted. The subjects were on average 30 years old.

be included in the analyses. The official measure of the total number of school removals from grade 1 to grade 7 will also be included in the analyses.

In addition to these official measures of early predictors, retrospective self-evaluations of academic performance, number of classes skipped, and number of grades repeated at all three school levels were obtained from the Young Adult Survey, and they will be included in the analyses. Additionally, several other self-reported measures in the individual and family domains were obtained and included, such as number of times moved, conduct problems, and drug use from all school levels.

A common criticism of retrospective information is the potential recall bias in the respondents' answers. However, such recall bias will not compromise the results of this study for the following reasons. First, since there is a high level of agreement between the retrospective self-report measures and the official measures<sup>5</sup>, the retrospective information collected in this study is relatively reliable. Second, as shown later in the results chapter, all the observed relationships are in the hypothesized direction, which would not have been the case if the retrospective measures were totally biased. Third, it is reasonable to assume that the recall bias is random, i.e., evenly distributed in the sample. In addition to the retrospective information, complete juvenile justice records up to high school graduation/dropout will also be used in the study.

The last limitation is that I can only focus on males due to the small number of females involved in the criminal court system (less than 1% of females

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<sup>5</sup> For example, I compared self-reported data with the official information on grade repeating. There is a fairly high level of agreement between the two, and this is particularly true during elementary school where there is more valid information on the official records.

who participated in the YA survey had an adult offending record). The gender difference within the high school graduation effect warrants further investigation for a number of reasons. First, research has indicated that reasons for dropping out may be different for females. For example, pregnancy has been reported as a unique reason for female students to drop out of high school (Bridgeland et al. 2006). Second, apart from the gender difference in the direct effect of graduation, there has also been evidence that the indirect effect of graduation may differ by gender as well. According to a report by the U.S. Department of Education (2006), male dropouts have better economic outcomes than female dropouts. This indicates that dropping out may be more detrimental for females, especially when it comes to employment and income. In addition, studies have found that the effect of employment and romantic relationships differ by gender. For example, Simons et al. (2002) found that while a warm and caring relationship directly reduces offending for females, it only has an indirect effect through peer association for males.

Despite the above limitations, the offsetting strength of this study is that the use of propensity score matching allows causal inference between high school graduation and adult offending based on a sample of understudied population, i.e., a sample of predominately urban minority youth. More importantly, beyond the investigation of the simple relationship between graduation and offending, this study further investigates to what extent two of the opportunities that high school graduation may introduce, i.e., employment and intimate relationships, mediate such a relationship.

## **CHAPTER 4: DATA AND METHODS**

As mentioned in the present study chapter, this dissertation will investigate the causal relationship between high school graduation and adult offending, as well as the extent to which employment and intimate relationships mediate such a relationship. The structure of this chapter is as follows. I will first briefly introduce the data set used for the study, the Baltimore Prevention Study, followed by 1) a discussion on the criteria for the sample selection (i.e., valid information on graduation status, correct time sequence of event occurrence, and no missing value on covariates), 2) the sample description, and 3) attrition analysis to compare the composition of the included and the excluded cases. A section describing all the measures used in the different parts of the conceptual model will follow this section. I will end the chapter with a discussion of the two analytical methods used for the study.

### **Section 4.1: The Baltimore Prevention Study**

The data used in this study is part of the first generation of the intervention trial conducted by the Johns Hopkins Prevention Intervention Research Center (JHU PIRC) and funded by the National Institute of Mental Health (NIMH) (Kellam and Rebok 1992). The trial consists of the ongoing evaluation of two school-based universal preventive interventions, targeting early learning problems and aggressive behavior. The intervention design involved two first grade cohorts of students in 19 Baltimore City public schools. Cohort I began school during the 1985-1986 academic year (N=1196) and cohort II during 1986-

1987 (N=1115). The two universal classroom-based interventions were implemented over the first and second grades for each cohort.

The 19 schools were selected from five different urban areas (with three or four schools from each area) within one large elementary school district in eastern Baltimore. According to the statistics provided by the Baltimore City Planning Department, these five areas varied by ethnicity, type of housing, family structure, income, unemployment, violent crime, suicide, and school dropout rates. The population within each area, however, was relatively homogeneous in terms of the above-mentioned characteristics. Within these areas, one school received the ML (Mastery Learning) intervention, one received the GBG (Good Behavior Game) intervention, and one served as a control school. Within each intervention school, students were randomly assigned to intervention and control classrooms, and teachers were also randomly assigned to each classroom.

### ***NIMH study and the Young Adult Survey***

The majority of the measures used in this study are from the intervention study conducted by Johns Hopkins Prevention Intervention Research Center (JHU PIRC) and funded by the National Institute of Mental Health (NIMH) (Kellam and Rebok 1992). As mentioned earlier, the intervention design involved two first grade cohorts of students in 19 Baltimore City public schools, and two universal classroom-based interventions were implemented over first and second grades for each cohort. Information (such as teacher-rated aggressive behavior) from fall of first grade will be used for the analysis in this study. From late 1998 to

early 2002, follow-up on participants was conducted (age ranges from 19 to 24 with a mean of 20). Field interviews were conducted to assess their behaviors and attitudes during early adulthood, such as education history, employment history, and dating behavior. This survey will be referred as the “Young Adult Survey” (the YA Survey).

### ***NIDA follow up interviews***

Another trial funded by the National Institute on Drug Abuse (NIDA) followed the same sample about two years after the YA survey, focusing on adolescents’ substance use and determinants of substance use. Respondents were asked to report their drug use, parenting behaviors, deviant peer association, and other suspected determinants of drug use (Chilcoat and Anthony 1996). A variable asking about high school graduation status in the NIDA follow up trial will be used to augment and check the reliability of high school graduation status in the YA survey.

### ***School, court, and incarceration records***

School records – including attendance, grades, standardized test scores, disciplinary removals and suspensions, free lunch status, and demographic information – were obtained by electronic data file transfer, both with error and reliability checks. The report card data included grades for academic subjects, as well as ratings of work-study habits and independence. Juvenile court records were used to determine the frequency and nature of juvenile offending.

Incarceration data obtained from the State of Maryland's Department of Corrections will be used to determine the extent of adult offending. The complaint date for all the juvenile offending records and the arrest dates for all the adult records were provided in the data set.

### ***1990 Census information***

Neighborhood measures, i.e., neighborhood crime rates and median income, were obtained from Census information in 1990, when the subjects in the sample were in third grade. Using Geographic Information System software (GIS), children's addresses were mapped to census tracts, and neighborhood-level measures were merged with individual-level data using census tract as the linking variable. The study contains substantial variability at the census tract level. Youth in cohorts 1 and 2 are from 121 different neighborhood census tracts.

### **Section 4.2: Sample Selection and Attrition Analysis**

As presented in Figure 4.1, among the 2311 individuals in the original sample, 1715 participated in the Young Adult Survey, 32 were dead before the survey, and 564 could not be located or refused to participate (the participation rate is 74%). Among the 1715 individuals who participated in the YA survey, two died after the survey, and 81 were in prison at the time of the survey. I excluded them from this study and focused on the 1632 respondents who were not in

prison at the time of the YA survey<sup>6</sup>. Out of these 1632 cases, 701 were males. For this study, I focus on males for the reason that adult offending frequencies for females were relatively low (less than 1% females had an adult record). Three criteria were used to select the sample: 1) the individual has valid information on graduation status, 2) all the events in the study (e.g., juvenile offending, graduation, employment/intimate relationships, and adult offending) follow a logical time sequence, and 3) there is no missing on any of the covariates used for the propensity score matching.

### ***Criterion I: Determining the graduation status***

Since high school graduation is the independent variable of this study, it is important to determine the graduation status for every individual in the sample. Unfortunately, the graduation status is not readily available in the data. I utilized two variables from the YA Survey and a variable from the NIDA interviews to construct the graduation status. In the YA Survey, respondents were presented with the question “What is the last year of schooling that you have completed?” The answer categories range from “sixth grade” to “professional degree.” This is the main variable used to construct the high school graduation status. Another variable from the YA survey, asking about the respondents’ current course of study, was used to supplement this main variable. Respondents were asked, “How would you characterize the course of study you are in now?” Answers are

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<sup>6</sup> For those who died after the survey and those who were in prison at the time of the survey, since the time for them to commit crime as adults is shorter, their likelihood of adult offending is downward biased. Moreover, since those who were in prison at the time of the survey are less likely to have a job and be involved in intimate relationships for obvious reasons, their employment and relationship information is not reliable.



as follows: “in high school,” “in GED program,” “in university,” “in community college,” “in vocational school,” and “not in school.”

Another variable from the NIDA trials, asking about high school graduation status, was also used to check answer reliability and augmented the information when there is missing value. This variable asks about the respondents’ high school graduation status, and it has three answer categories: “high school diploma,” “GED,” and “non graduate.” The answers for both questions are compared whenever possible, and the NIDA survey is used to fill in the information when there is a missing value in the YA survey. Out of 701 males, a total of 581 had valid information on graduation status. Among the 581 males, 389 males graduated from high school and 192 cases did not. (Refer to Appendix 4.1-4.3 for details.)<sup>7</sup>

***Criterion II: Correct sequence of event occurrence***

Time sequence of the event occurrence is particularly important for this study, for both substantive and statistical reasons. Substantively, in order to establish a causal relationship between high school graduation, employment/intimate relationship, and adult offending behavior, it is important that graduation/dropout occurs before employment/intimate relationship, which occurs before adult offending behavior. Statistically, an important assumption of mediation analysis is that the order of causation has to be correct, that is, the

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<sup>7</sup> The decision to include both GED and dropouts as non-graduates is consistent with the past research (e.g., Sweeten et al. 2009; Lochner 2004; Bernburg and Krohn 2003). It is also supported by the preliminary results of this study; high school diploma has a negative and significant effect on adult offending, while GED has a non-significant effect on adult offending.

independent variable precedes the mediator and the mediator precedes the dependent variable. The current study only includes cases that follow the correct sequence of event occurrence that is presented in Figure 4.2.

In order to ensure the sequence of events presented in Figure 4.2, the age of graduation/dropout is needed. Unfortunately, graduation/dropout age is not available in the data set. However, both self-reported and official information on the number of grades repeated and official information on age at first grade are available. Using such information, graduation/dropout age was computed. (Refer to Appendix 4.4 for details.) A variable was created to represent the graduation age, if the respondent graduated from high school, and the dropout age, if the respondent did not graduate.

As mentioned above, it is important that the mediation variables (employment and intimate relationships) occur after graduation/dropout. Since information on employment and intimate relationships was obtained from the YA survey, graduation/dropout age needs to be compared to the age on the YA survey. In order to ensure the correct sequence of events, subjects need to graduate/drop out before the survey. After excluding the six males whose dropout age was younger than 16 (see Appendix 4.4 for details) and the 32 males who graduated/dropped out after the YA survey, a total of 543 males were left in the sample.

### ***Criterion III: No missing on covariates***

The last criterion for selecting the sample is that there is no missing data on all the covariates used to estimate the propensity score of graduating from high school. After excluding the 83 cases that are missing at least one of the covariates, a total of 460 males were left in the sample. Therefore, the sample of 460 males will be used for the propensity score matching analysis.

### ***Sample Description***

As shown in the first column of Table 4.1, more than half of the youth in the selected sample are poor urban minorities (with over 60% being African-Americans), most are age appropriate when entering the first grade (over 90% were between age 5 to 7), and half of them are from families with low SES. Among these youths, 70% graduated from high school, and 30% dropped out before obtaining high school diploma. This estimate is in line with other estimates for Baltimore (Alexander et al. 2001; Bomster 1992). For example, Alexander et al. (2001) found that 42% of the sample left school without a degree, and this number lowered to 24% when taking into account subsequent degree completion and GED certification.

On average, these youths experienced one residential move during each school level, and the males in the selected sample have some disciplinary problems. For example, on average they had less than one (0.6) school removal. Most of these youths repeated less than one grade during elementary, middle and high school. About 40% had three or more conduct problems before age 15,

and about 30% had three or more conduct problems since age 15. About 20% of these youths had used hard drugs at one point. About 15% of these youths had at least one violent juvenile record, 6% had at least one non-violent juvenile record, 12% had at least one other juvenile record, and 10% of them had at least one adult record. About 70% of these youth had a job and 70% were involved in a romantic relationship at the time of the YA survey.

### ***Attrition analysis***

In order to compare the composition of the included and the excluded cases, I conducted two attrition analyses: In the first analysis, I compared males selected for this study (N=460) with those not selected (N=83) due to missing on covariates, which were used to estimate the propensity scores. In the second analysis, I compared males selected for this study (N=460) with those not selected (N=241) due to all three criteria (i.e. valid graduation status, correct time sequence, and no missing covariates). Table 4.1 and 4.2 present the attrition analyses. For the continuous variables, the means and standard deviations for both the selected cases and the unselected cases are presented. For binary variables, the percentage of category 1 is shown for both the selected cases and the unselected cases. The p-values of the significance tests of the difference and number of missing cases for the unselected group are also shown in the tables. As shown in Table 4.1, the selected cases resemble the unselected cases on all the variables (the differences between the two groups did not reach a significance level of .05) with the following exceptions. First, a slightly higher

percentage of African-Americans are in the selected group (with a difference of 12.1%). However, the p-value for the significance test is only barely significant (P-value=.046). Second, the selected group has slightly better school performance during elementary school than the unselected group (with a difference of .29). However, the difference is less than a standard deviation, and the difference is significant only at a .05 level (p-value=.023). Third, the selected group earns slightly lower income than the unselected group (with a difference of 1.32). However, the difference is less than a standard deviation, and the p-value is barely significant at a .05 level (p-value=.042). In sum, the selected and the unselected groups are fairly similar on all the variables used in the study.

The comparison between the selected sample and the unselected sample due to all three criteria shows similar patterns. As shown in Table 4.2, the selected cases resemble the unselected cases on all the variables with some exceptions. For variables where the two groups significantly differ, the difference is less than a standard deviation. For example, while the select cases have better school performance during high school than the unselected cases (with a difference of .39), the difference is only a quarter of the standard deviation. In conclusion, the selected cases resemble the unselected cases on most of the variables used in this study.

## **Section 4.3: Measures and Variables**

### **4.3.1 Measures and variables for estimating the propensity score of high school graduation<sup>8</sup>**

#### ***Individual domain***

Previous studies have found a number of risk factors in the individual domain, such as race (Battin-Pearson et al. 2000), early antisocial behavior (Battin-Pearson et al. 2000; Ekstrom et al. 1986), and low self-esteem and self-confidence (Ekstrom et al. 1986; Rumberger 1983; Wehlage and Rutter 1986), to be predictive of high school dropout.

#### ***Race***

The original measure of race has four categories: African-American, White, Asian, and American Indian. Among the 460 males, 305 (66%) were African-Americans. Among the rest of the sample, 152 (33%) were Whites, one was Asian, and two were American Indian. Race was recorded into a binary variable (African-American versus other races).

#### ***Age at fall of first grade***

The majority of the students were younger than age 7 at fall of first grade (age 5: 29.3%, age 6: 63.5%). Among the remaining 7.2%, 6.8% were seven

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<sup>8</sup> Although personal skills, scholastic competence, and self-esteem in the individual domain, parental monitoring in the family domain, and delinquent peer association in the peer domain were presented in the conceptual model, they do not have significant effects on graduation status. In addition, the inclusion of these variables will result in the loss of over two thirds of the sample. Therefore, they will not be included in the analysis.

years old and 0.4% were eight years old. Given the upper and lower truncated distribution, age should not be treated as a continuous variable. It was hypothesized that children who are not in an age appropriate classroom are at higher risk of dropping out. However, the association between age at fall of first grade and the risk of dropout is not linear. Therefore, age was dichotomized into 0 for being 7 years or younger (i.e. age appropriate) and 1 for being older than age 7 in first grade.

### *Intervention status*

Although I am not interested in the specific effect of the interventions, I controlled for the confounding effect of intervention status. Students were assigned to five groups with different design status on both school and classroom levels: control school/control classroom, GBG school/control classroom, ML school/control classroom, GBG school/GBG classroom, and ML school/ML classroom. The variable is recoded into two categories: control, which includes the first three categories in the original variable (coded as 0), and intervention, which includes the last two categories in the original variable (coded as 1).

### *Aggression, concentration problems, and shy behavior*

The Teacher Observation of Classroom Adaptation-Revised (TOCA-R) is a brief measure of each child's adequacy of performance on the core tasks in the classroom as defined by the teacher (Werthamer-Larsson, Kellam, and Wheeler 1991). It is a structured interview administered by a trained member of the

assessment staff. The interviewer records the teacher's ratings of the adequacy of each child's performance on a six-point scale ("never true" to "always true") on six basic tasks. Teachers responded to 36 items pertaining to the child's adaptation to classroom task demands over the previous three weeks. Teacher ratings were obtained in the fall and spring semesters of the first and second grades, and annually thereafter. The following subscales were constructed: accepting authority (aggressive behavior), social participation (shy or withdrawn behavior), self-regulation (impulsivity), motor control (hyperactivity), concentration (inattention), and peer likeability (rejection). The Cronbach's alpha coefficients for reliability for all the subscales were above 0.8 (Werthamer-Larsson et al. 1991).

In this study, three subscales – aggressive behavior, concentration problems, and shy behavior – are measured as the item averaged means from the fall of first grade, and they are treated as continuous variables (ranging from 1 to 6). The aggressive/disruptive behavior subscale includes the following ten items: "breaks rules," "harms others and property," "breaks things," "takes others' property," "fights," "lies," "trouble accepting authority," "yells at others," "stubborn," and "teases classmates." The concentration/attention problems subscale includes the following nine items: "completes assignments," "concentrates," "poor effort," "works well alone," "pays attention," "learns up to ability," "eager to learn," "works hard," and "stays on task." The shy behavior subscale includes the following eight items: "plays with classmates," "gregarious (initiates interactions)," "engages with classmates (interacts with classmates),"



“engages with teachers (interacts with teachers),” “friendly,” “avoids classmates,” “avoids teacher,” and “rejected by classmates.”

#### *Numbers of conduct problems before and after age 15*

In the YA survey, respondents were asked about conduct problems before and after age 15. The instrument assessed behaviors such as running away from home, stealing something worth more than a few dollars from a store or somebody they knew, and being physically cruel to an animal. The participants were asked to count these behaviors and report the number of conduct problems before and after age 15. According to the standard in DSM IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) (American Psychiatric Association 1994), the cut off for the diagnosis of ASPD (Antisocial Personality Diagnosis) is 3. I treat these two variables as binary variables with 0 as having less than three conduct problems and 1 as having three or more conduct problems.

#### *Substance abuse*

In the YA survey, the respondents were asked whether they have ever used a series of substances including cigarettes, alcohol, marijuana, and hard drugs, such as crack cocaine and heroin. Since the use of cigarettes, alcohol, and marijuana is fairly prevalent, I only include the use of hard drugs in this study. Since there is a lack of variation on most the drug use variables (most of the sample did not use a specific type of hard drug), I recoded these variables

into a dichotomous variable with 0 as “never used hard drugs” and 1 as “ever used hard drugs.”

### *Juvenile delinquency*

Juvenile court records were obtained throughout the follow-up period to determine the frequency and nature of criminal convictions during adolescence. Juvenile court handles cases involving youths under age 18. Most children enter the juvenile court system after being arrested by the police, and virtually all arrestees are taken to a Department of Juvenile Service (DJS) intake officer before being released. Upon arrest, the intake officers have 25 days to make a recommendation. Such a recommendation may be refusing to authorize a formal petition, proposing a formal adjustment (such as diversion or drug treatment), or authorizing a formal petition. If a petition has been filed, the adjudicatory hearing must take place within 60 days.

The juvenile justice data used in this study were obtained in 1999 through the juvenile justice system located within the Baltimore City Circuit Court System at the Clarence M. Mitchell Jr. Courthouse. The data represents Baltimore City only. However, given that about 80% of the subjects in the sample were residing in Baltimore City at the time of the Young Adult Survey, the bias in the estimation of juvenile offending is minimal. Last name, first name, date of birth, and gender were used to determine a match. Each name was entered into the mainframe system separately for the search. If a match was found, the historical record for the case was printed and entered. These paper records were entered into a

computerized database. Juvenile records were updated after all participants had aged out of the juvenile court system (i.e., reached their eighteenth birthday), and represent the complete juvenile court data for this sample.

The cases included in the data were from the second stage of juvenile court procedure, that is, when the intake DJS officer recommends a formal petition. Since the intake DJS officer makes recommendations based on the amount of evidence presented in a case, there is usually enough evidence included in the data for conviction. This could potentially bias the estimation since the data do not include cases for which the DJS officer refused to file a formal petition or cases where the officer recommended a diversion. However, the estimation of juvenile offending is minimal. Since, in most cases, the reason that the DJS officer refuses to file a formal petition is that there is not enough evidence for the case; the case is likely to be dismissed even if it went to the court. Juvenile cases for which the intake officer recommended diversion are usually cases that are less serious in nature, such as truancy, violation of curfew laws, underage drinking, and minor drug use. Compared to arrest data (Mukherjee 1971; Thornberry et al. 1985) and self-report data (Bachman et al. 1971; Farrington et al. 1986) used in past studies on the dropout-delinquency relationship, the court records used in this study are a closer representation of the cases convicted. Some of the covariates used in the propensity score estimation, such as drug use, aggressive behavior, and conduct problems, capture some of the offenses that did not come to the attention of juvenile justice system.

In order to make sure that all the covariates occur before high school graduation or dropout, only juvenile offending records that occurred before the age of graduation or dropout are included in the analysis. In the original dataset, the exact complaint date, that is, the date associated with the complaint and charges, for each offense is available. Since the intake officers have only 25 days to make a recommendation, the maximum difference between the arrest date and the complaint date is 25 days. The complaint date can be used as a proxy for arrest dates. I computed the age of each juvenile record by comparing the complaint date and the date of birth, and compared this age with the graduation or dropout age, counting only those records that occurred before graduation or dropout.<sup>9</sup>

In terms of frequency of offending, 79% of the sample did not have any juvenile record, 9% had only one juvenile record, and the remaining 12% had more than one juvenile record. The crime type of juvenile records was also utilized in the analyses. Originally there were eight categories: violent sexual, violent non-sexual, non-violent sexual, non-violent non-sexual, drug, alcohol, Cina/Cins, and status. I combined these eight categories into three: violent (which includes violent sexual and violent non-sexual), non-violent (which includes non-violent sexual and non-violent non-sexual), and others (which includes drug, alcohol, Cina/Cins, and status). I counted the number of offenses

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<sup>9</sup> Among the selected sample of 460 males, two had all their juvenile records after graduation/dropout (each of them had one record). Since these records violated the correct time sequence, they were counted as "having no juvenile records." Neither of these two males graduated from high school. Another seven males had some of their records after graduation/dropout. Only those records that occurred before graduation/dropout were included in the analysis, and a total of 16 juvenile records were ignored. Among these seven males, one was a graduate, and the rest were dropouts.

in each of the three categories. Since most of the offenders (about 90%) had only one offending record, these variables are used as a dichotomous variable with having at least one juvenile record of such type coded as 1. About 15% of these youths had at least one violent juvenile record (among which 55% had only one violent record and the rest had more than one), 6% had at least one non-violent juvenile record (among which 76% had only one non-violent record and the rest had more than one), 12% had at least one other juvenile record (among which 65% had only one other record and the rest had more than one).

I conducted a validity check of the juvenile court records with the youth's self-reported delinquent behavior from the YA survey. As discussed in the present study chapter, the relationship between court records and self-reported delinquency is highly significant (P-value for Chi-square test is less than .001). Among those who did not have an official record, 66% did not self-report an arrest record. Among those who had an official record, 78% reported being arrested or spending one night in jail or juvenile hall.

### ***Family domain***

Risk factors in the family domain such as low SES (Alexander et al. 2001; Bachman 1971; Battin-Pearson et al. 2000; Lehr et al. 2004), poor supervision, and parental monitoring (Janosz et al. 1997; Jimerson et al. 2000; Rosenthal 1998) have been found to predict high school dropout and antisocial behavior.

## SES

Eligibility for free or reduced school lunch is one of the most frequently used measures of students' SES in educational research (Sirin 2005). Students from families earning up to 130% of federal poverty level qualify for free lunch at school, and those from families earning between 130% and 185% qualify for reduced-cost lunch. In this study, eligibility for free or reduced-cost school lunch upon entry into first grade was chosen as a measure of students' SES. Previous research (Ensminger et al. 2000) has demonstrated that free lunch eligibility is highly correlated with family income and other traditional measures of socioeconomic status. Students were classified as low-SES (coded as 1) if they received free or reduced-cost lunch or high-SES (coded as 0) if they did not receive free or reduced-cost lunch.

### *Number of residential moves during elementary, middle, and high school*

As discussed in detail in the literature review chapter, one of the factors correlated with education stability is residential mobility (Rumberger 2001; Teachman et al. 1996). Since residential moves are most likely to result in changing schools, residential mobility is another risk factor that contributes to the risk of dropping out. In the YA survey, the respondents were asked to report the number of residential moves during elementary, middle, and high school. The numbers of moves during each time period are treated as continuous variables.

### ***School domain***

A number of studies (Bachman et al. 1971; Bridgeland et al. 2006; Ekstrom et al. 1986; Wehlage and Rutter 1986; Rumberger 1983) have found that variables in the school domain are the most powerful predictors of high school graduation. These risk factors include suspension due to disciplinary problems (Alexander et al. 2001; Ekstrom et al. 1986; Kaufman et al. 1992), school performance (Alexander et al. 2001; Battin-Pearson et al. 2000), grade retention (Alexander et al. 2001; Rumberger 2001), as well as disengagement from school (Rumberger 2001).

### ***School suspensions and removals***

The school removal data were obtained from the Baltimore City Public School System's (BCPS) main office. BCPS ID numbers were collected at the start of first grade and were used to match up with later records collected over time from the schools and related back to the school system. In recognizing that school suspension is not a perfectly measured variable and its observed distribution may vary depending on the source of the data, Petras et al. (in press) compared the information about school removal from school records to teacher reports in grade 6 and 7. It was found that over 90% of the students with a school suspension record were also identified as a suspension case by the teacher interview, indicating sufficient levels of reliability. The total number of school removals from grades 1 to 7 was used as a continuous variable.

### *Academic achievement: The California Achievement Test (CAT)*

The California Achievement Test (CAT) represents one of the most frequently used standardized achievement batteries (Wardrop 1989). Subtests in CAT E and F cover both verbal (reading, spelling, and language) and quantitative topics (computation, concepts, and applications). Internal consistency coefficients for virtually all of the subscales exceed .90. Alternate form reliability coefficients are generally in the .80 range. In this study, academic achievement is measured by a standard reading score from grade 1 fall semester and is used as a continuous variable.

### *School performance during elementary, middle, and high school*

Since the official records or teacher reports of school performance are not available during middle and high school, retrospectively self-reported measures were obtained from the Young Adult Survey. In the YA survey, respondents were asked, "When it comes to grades, how well would you say you did in (elementary school, middle school, and high school)? Would you say very poor, poor, fair, good, very good, or excellent?" Each of the three variables has six categories: 1=very poor; 2=poor; 3=fair; 4=good; 5=very good; 6=excellent. These three variables are treated as continuous variables.

### *Truancy during elementary, middle, and high school*

In the YA survey, the respondents were asked, "How often did you skip class or skip school in (elementary, middle, and high school) without an excuse?"



Would you say never, rarely, sometimes, often, most of the time, or always?”

Each of the three variables has six categories: 1=never; 2=rarely; 3=sometimes; 4=often; 5=most of the time; 6=always. These three variables are treated as continuous variables.

#### *Grade retention during elementary, middle, and high school*

In the YA survey, the respondents were asked, “Which grade (and how many times) have you repeated or been held back?” The number of times a respondent repeated for each grade is used to construct three variables, i.e., the total number of times repeating a grade during elementary school, middle school, and high school. These three variables are used as continuous variables.

#### ***Neighborhood domain***

A body of studies (Bowen and Bowen 1999; Gottfredson 2001; Rumberger 2001; Wilson 1987) has suggested that risk factors in the neighborhood domain, such as neighborhood poverty and neighborhood crime, are related to academic achievement.

#### *Neighborhood crime rates*

Neighborhood crime rates were measured as number of crime incidents per thousand people in a Census tract in 1990 when the youths were in third grade. The crime types include aggravated assault, burglary, homicide, purse snatching, rape, larceny and theft, and unarmed robbery. Since it is generally not

recommended to use level 2 covariates as continuous variables in a single level regression equation, each variable was dichotomized into 1 (higher than the median) and 0 (lower than the median).

#### *Neighborhood median income*

Neighborhood median income was measured as the median yearly income divided by 100 in a Census tract in 1990 when the youths were in third grade. Since it is generally not recommended to use level 2 covariates as continuous variables in a single level regression equation, the variable was dichotomized into 1 (higher than the median) and 0 (lower than the median).

### **4.3.2 The outcome variable**

#### ***Adult offending***

The adult offending information comes from the State of Maryland's Department of Corrections. The data include the crimes for which the participants have been found guilty and incarcerated. The records were assessed in 2007 when the average age of the subjects in the sample was 28. Other than those participants who were housed in Maryland state prisons, the data also include participants who committed a federal crime in Maryland but were incarcerated in federal prisons. Unfortunately, the data do not include offenses that were committed in states other than Maryland. However, given that about 93% of the subjects in the sample were residing in Maryland at the time of the Young Adult

Survey<sup>10</sup>, the bias in the estimation of adult offending is minimal. In the original dataset, the arrest age of each offense is recorded. In order to ensure the logical time sequence of events (i.e., adult offending occurs after employment and intimate relationships), only adult offending records that occurred after the YA survey were included in the analysis<sup>11</sup>. Out of the 460 males used for the analysis, a total of 47 males had at least one adult offending record after the YA survey. A binary variable was created indicating the presence or absence of an adult criminal record.

Although not used in the analysis (due to the relatively small group of frequent offenders and the lack of variation in offense type), the frequency and type of offending records were also available in the data set. Among the 47 males who had at least one adult offending record, 19 (40%) had only one record, nine (19%) had two records, eight (17%) had three records, and the rest (24%) had more than three records. The crime type was recorded for each adult offending record in seven categories: murder or attempted murder, rape or sex offense, domestic assault, injury to person, robbery, crime against property, and alcohol or drug offense. Among males who had at least one adult offending record, about 60% had at least one index crime (murder or attempted murder, rape or sex offense, domestic assault, injury to person, robbery, crime against

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<sup>10</sup> Over 90% of the subjects were residing in Maryland at the time of the new interviews that are currently being conducted when the subjects are, on average, 30 years old.

<sup>11</sup> Among the selected sample of 460 males, nine cases had at least one adult offending record before the YA survey, and three had all their adult records before the YA survey, with one of them having three records and the other two each having one record. Since these records occurred before the YA survey and violated the correct time sequence, they were ignored in the analysis. None of these respondents graduated from high school. I conduct a sensitivity analysis to control for having adult offending records before the YA survey when estimating the graduation effect on adult offending and the results did not change significantly.

property). Among the seven categories, the most frequent offense type is alcohol or drug offense. Among males who had at least one adult offending record, 70% of them had at least one alcohol or drug related record. The least frequent offense type is rape or sex offense. Among males who had at least one adult offending record, only 6% had one rape or sex offense record (none of them had more than one rape or sex offense record). None of the males committed a domestic assault or a murder/attempted murder.

#### **4.3.3 The mediators used in the mediation analyses**

##### ***Employment***

A history of employment was obtained from the Young Adult Survey, including number and types of jobs held, reasons for leaving, current employment status and hours worked, self-perception of current job performance, health insurance, job aspirations, and military service and nature of discharge (if no longer in military).<sup>12</sup>

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<sup>12</sup> Although only three work-related variables (currently having a job, work hours, income) were used in the final analysis, I conducted preliminary analyses with all the other work-related variables. A factor analysis suggested that work hours and income loaded on the same factor. When using these factors as mediators, the only significant relationship is related to the factor with work hours and income. When using them as separate variables, the only two variables that were significantly related to adult offending were work hours and income. The reason that other measures were not related adult offending may be due to the lack of variation in these measures. I speculate such a lack of variation as an artifact of the relatively young age of the sample in this study. Future studies should test the mediating effects of other work related measures with an older sample.

### *Currently having a job*

In the YA survey, respondents were asked, “Do you currently have a job?” The answer constructs a binary variable with 1 as currently having a job and 0 as currently not having a job. Among the 361 matched males, 77 were attending college, and all of them graduated from high school. Among the 77 college students, over 70% had a job at the time of the YA survey. Since college students and non-college-students who were working are similar on most of the work variables, college students who were working are treated as currently having a job. College students who were not working are treated as currently not having a job.

### *Number of hours worked per week*

The number of hours worked per week is used to measure commitment and attachment to work. The number of hours per week has been used as a measure for commitment and attachment to work in a number of studies (Hudis 1976; O’Neil and Greenberger 1994)<sup>13</sup>. In the YA survey, respondents were asked, “How many hours do/did you work in a typical week?” This variable is treated as continuous. This question asks about either the current job or the last job the respondent held. Since I am only interested in the current job, I recoded the number of hours worked per week into 0 for those who were not currently working. Among the males who are matched, currently working, and with valid information for work hours, the mean of work hours is 39. I recoded the work

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<sup>13</sup> The factor analysis also indicates that the number of hours worked per week showed the highest factor loading among all the work-related measures.

hours into the mean 39 for the 24 cases who were working (out of which 18 cases were in the matched sample) but with missing value on work hours<sup>14</sup>.

### *Income*

In the YA survey, respondents were asked, “How much did you make last year?” A total of 23 categories are provided, ranging from under \$1,000 to over \$75,000. This variable is treated as continuous and is used as a proxy for current income. Out of the 309 males who were working, 42 (among which 32 cases were in the matched sample) with missing information on income. Among the matched males who were working and with valid information for income, the mean income is category 7 (i.e. \$7,000 to \$7,999). I recoded income into the mean 7 for those who were working but with missing value on income.<sup>15</sup>

### *Intimate relationship*

Similar to employment, a history of the youth’s intimate/romantic relationships, including dating, marriages, divorces, and separations was obtained through the Young Adult Survey. Young adults were asked to quantify the number of the relationships in which they have been involved. They were also asked to qualify the type of relationships in which they had been involved (casually dating, regularly dating, only seeing one person, commitment to marriage, married). For those males who were involved in an intimate

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<sup>14</sup> I re-ran the mediation analysis by excluding these 18 matched males with missing work hours and the results did not change significantly.

<sup>15</sup> I re-ran the mediation analysis by substituting the missing with the work income predicted by race, work hours, graduation, lunch status, and work length for the 32 matched cases with missing income. The results did not change significantly.

relationship at the time of the Young Adult Survey, questions were asked about partners' religious activities, job status, community involvement, substance use, weapon use, violence against others, arrests, criminal behavior, affective quality of the relationship, and the degree and nature of conflict (including physical fights).

#### *Currently involved in a relationship*

Unfortunately, there is no existing variable in the questionnaire indicating whether the respondent was involved in an intimate relationship at the time of the interview. In order to create a binary variable indicating whether the respondent was currently involved in an intimate relationship at the time of the interview, I count missing on all the relationship questions and if a person is missing on all these questions (with the exception of the question "How important is it to you to be in and maintain an intimate relationship?"), he was not involved in a relationship.<sup>16</sup>

#### *Minor negative interaction*

Minor negative interaction is a scale representing the sum of four items divided by four: "How often is your partner emotionally cold to you?" "When having disagreement, how often do you avoid issues?" "How often do the two of you insult or yell at each other?" "How often do the two of you threaten to end the relationship?" Answers to each item include six categories ranging from "never" to "always." The coefficient alpha for the reliability of the scale is .629. The scale

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<sup>16</sup> I have consulted with the data manager for this operation.

is treated as a continuous variable with the lowest possible value being 1 and highest being 6. Among the 460 males, 140 (out of which 105 are in the matched sample) had missing information on minor negative interaction, and none of them were in a relationship at the time of the interview. I substitute the missing with the mean value (2.04) based on those matched males who were in a relationship and with valid information on the variable for the 140 males.<sup>17</sup>

### *Commitment to the relationship*

Respondents were asked, “How would you characterize your relationship?” and provided with the following answer categories: “one night stand,” “casual dating,” “regularly dating,” “seeing only this person,” “committed to marriage,” and “married.” The variable is treated as continuous with values ranging from 1 to 6. Among the 460 males, 169 (among which 127 were in the matched sample) had missing information on commitment to the relationship, including 140 (among which 105 were in the matched sample) of those who were not in a relationship and 29 (among which 22 were in the matched sample) in a relationship. For these 169 males, I substitute the missing with the mean value of 4 based on those matched males who were in a relationship and with valid information on all the relationship variables.<sup>18</sup> Since the majority of the sample (about 80%) answered either “seeing only this person,” “committed to marriage,”

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<sup>17</sup> I re-ran the mediation analysis where I only included those matched males who were in a relationship and with valid information on the variable, and the results did not change significantly.

<sup>18</sup> I re-ran the mediation analysis where I only included those matched males who were in a relationship and with valid information on the variable, and the results did not change significantly.



or “married,” the variable was dichotomized into a binary variable with 1 as being committed and 0 as not being committed to a relationship.

#### *Importance of a relationship*

Respondents were presented with the question “How important is it to you to be in and maintain an intimate relationship?” and were provided with the following answer categories: “not at all,” “very little,” “a little,” “somewhat,” “pretty much,” and “very much.” The variable is treated as continuous with values ranging from 1 to 6. Among the 460 males, 120 (among which 91 in the matched sample) had missing information on the importance of a relationship, and none of them was involved in a relationship. For these 120 males, I substitute the missing with the mean value of 5 based on those matched males who were in a relationship and with valid information on all the relationship variables.<sup>19</sup> Since the majority of the sample (about 80%) answered either “pretty much” or “very much,” the variable was dichotomized into a binary variable with 1 as perceiving relationships as important and 0 as perceiving relationships as not important.

#### **Section 4.4: Analytical Methods**

In this section, the analytical methods used in this study will be introduced. I will first discuss some of the common methods used to identify turning points in life course research. I argue that these methods are not appropriate to draw causal inferences. I will then introduce the two methods I used in this

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<sup>19</sup> I re-ran the mediation analysis where I only included those matched males who were in a relationship and with valid information on the variable, and the results did not change significantly.

dissertation, propensity score matching (including sensitivity analysis to address selection bias) and mediation analysis. Last, I will present an alternative modeling strategy and discuss the reasons why I did not choose such a strategy.

#### **4.4.1 Methods used to identify turning points**

Different methods have been used to identify turning points, such as qualitative interviews (Giordano et al. 2002; Rönkä et al. 2002), fixed effect analysis (Sweeten 2004; Sweeten et al. 2009), semi-parametric group based trajectory models (Laub et al. 1998; Nagin 1999; Nagin et al. 2003), regression adjustment method (Warr 1998; Wright and Cullen 2004), and survival analysis (Uggen 2000). As Sweeten (2006) argues, these methods have been proven not appropriate for identifying turning points. For example, fixed effect analysis identifies causal effects basely only on within-individual differences, and it cannot shed light on the differences between graduates and dropouts. Sweeten concluded the study of turning points warrants more appropriate analytical tools. Sweeten (2006) used propensity score matching (Rosenbaum and Rubin 1983b) to study the effect of high school dropout on subsequent delinquent involvement. He argues that propensity score matching directly assesses the comparability of graduates and dropouts, and he estimates the effect of dropout by comparing graduates and dropouts with similar characteristics.

Propensity score matching has two advantages compared to the most commonly used method in studying the effect of graduation/dropout on adult offending, the regression adjustment method (i.e., regressing offending on

graduation status while controlling for observed covariates that may affect either graduation or offending). First, a regression analysis based on the full sample assumes the relationship between the covariates and the outcome to be linear across all values of covariates, which may not be true. Unlike regression analyses, propensity score matching does not rely on a linear functional form in estimating the treatment effect. Although propensity scores are estimated using either a logit or probit model (which assumes a certain distribution), individuals are matched in a non-parametric fashion.

Second, simple regression is particularly not recommended in the situation where treated cases are expected to be very different from control cases (Stuart 2007). For example, high school graduates are expected to be very different from high school dropouts in terms of early processes such as academic performance and juvenile offending (Alexander et al. 2001). Matching methods allow for a direct comparison between graduates and dropouts in terms of these early processes. Through selecting subsets of the original graduates and dropouts that are most similar to each other on the covariates, matching methods replicate a randomized experiment where graduation status can be seen as randomly assigned to individuals in the sample.

In a well-matched sample, when regressing adult offending on all the covariates and graduation status, none of the covariates other than graduation should have any effect on the outcome variable. In such a situation, propensity score matching will yield results identical to a regression analysis. If any of the observed covariates have an effect on the outcome variable, the regression

adjustment method will yield biased results. Since it is very likely that some of the covariates (e.g., juvenile delinquency) have significant effects on adult offending controlling for high school graduation, propensity matching is preferred to a regression adjustment procedure.

Propensity score matching is particularly advantageous when the outcome is rare and the treatment is common. There may be little data that can be used to estimate the relationship between the outcome and covariates, but plenty of data to estimate the relationship between the treatment and covariates (Stuart 2007). In this study, adult offending as the outcome is a rare event, but graduation as the treatment is common.<sup>20</sup> In such a case, propensity score matching may be more practical than the regression adjustment approach.

#### **4.4.2 Propensity Score Matching**

A propensity score matching method is used in order to answer the first research question: Does high school graduation have a causal effect on adult offending after taking into account early processes? The best practice to estimate a causal effect is through a randomized experiment, where subjects are randomly assigned to either a treatment or a control group. However, due to the financial and time constraint of the research or the nature of the topic (e.g., it is not feasible to randomly assign high school graduation status), random experiments are not always possible, especially in the social sciences.

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<sup>20</sup> The term “treatment” is used in order to be consistent with the literature on propensity score matching (e.g., Rosenbaum and Rubin 1983b). This is not to be confused with randomly assigned treatment in prevention research, i.e., high school graduation is not randomly assigned to individuals.

As a result, the most common type of data for research in social sciences is observational data. Matching can be performed on observational data, and the goal of matching is to match treated and control cases on covariates that influence the likelihood of being in the treated group, and thus to create a quasi-experimental situation where treatment can be seen as randomly assigned to individuals in the sample. One of the most popular matching methods is propensity score matching (Rosenbaum and Rubin 1983b). Instead of matching cases on covariates, propensity score matching estimates a propensity to graduate from high school for each case using all the risk factors of dropping out, and then matches together graduates and dropouts with similar propensity scores.

In this section, I will introduce the propensity score matching method in the following fashion. First, I will discuss the steps of performing propensity score matching. Second, I will introduce different methods in checking the balance of a matched sample. Finally, I will introduce a sensitivity analysis to test the robustness of the estimated treatment effect to the omission of a hypothetical covariate in propensity score matching.

### ***Matching procedure***

The matching procedure consists of several steps. The first step is to determine the treatment and outcome. As mentioned above, the treatment in this study is high school graduation, with high school graduates as the treated group, and high school dropouts as the control group. The outcome is having at least

one adult offending record. The goal of the propensity score matching method is to estimate the “treatment effect”<sup>21</sup> of graduation on adult offending.

The second step is to select a series of background covariates on which the matching is based. Two conditions need to be met: 1) the covariates need to occur before graduation and thus not be affected by graduation and 2) the covariates need to capture all possible confounding factors leading to graduation. As discussed in detail earlier and presented in the conceptual model of this study, there has been strong evidence that multiple risk factors in all five major domains (individual, peer, family, school, and neighborhood) increase the probability of dropping out of school before graduation and, conversely, decrease the probability of graduating from high school (Alexander et al. 1997, 2001; Ensminger and Slusarick 1992). At the same time, these same factors also increase the likelihood of adult offending (Robins 1978; Howell 2003). In this study, risk factors in these five domains assessed before high school graduation/dropout will be used as background covariates. Since these risk factors occurred before graduation/dropout, they are not affected by graduation/dropout. The first condition is met. While these covariates capture the most important risk factors of dropping out in all major domains, it is unlikely that the second condition, i.e., these covariates capture all the confounding factors, is met. There is a way to address this issue, and it will be discussed later in the sensitivity analysis section of this chapter.

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<sup>21</sup> The term “treatment effect” is used in order to be consistent with the literature on propensity score matching (e.g., Rosenbaum and Rubin 1983b). This is not to say that high school graduation is a treatment that is randomly assigned to individuals. In this case, “treatment effect” refers to the “causal effect” of graduation on adult offending.

Upon selecting a series of background covariates, a propensity score is estimated for each individual in the sample. This comprises the third step. The propensity score summarizes all of the observed covariates into a scalar, i.e., the probability of being in the treatment group, i.e. graduating from high school, given the observed covariates (Rosenbaum and Rubin 1983b). A logistic regression model is usually estimated, and the predicted probability of graduating from high school is the individual's estimated propensity score, i.e.,  $P(\text{graduation}) = \Pr(T_i=1|x_i)$ . When  $T_i=1$ , the individual graduated from high school.  $X_i$  represents a vector of covariates that are related to both high school graduation and adult offending. The propensity to graduate from high school is between 0 and 1.

Once a propensity score is estimated based on the observed covariates, the last step, matching, can be done on the propensity scores. The idea behind matching is that when two units have the same propensity score, graduation status can be seen as randomly assigned to individuals in the sample. As a result, any difference in adult offending is due to graduation status. Through matching, the distribution of covariates should be the same in the treatment and control groups. There are different ways of matching. Traditional ways of matching include 1:1 exact matching (each treated unit is matched to all possible control units with exactly the same propensity score), k:1 nearest neighbor matching (each treated unit is matched to k number of control units whose propensity score is the closest to the treated unit), and subclassification (the distributions of the covariates for the treated and the control groups are as similar as possible in each subclass) (Rosenbaum and Rubin 1983b). Each of these

three matching methods has its drawback (Stuart and Green 2008). With both the 1:1 exact and k:1 nearest neighbor matching, although the bias is reduced due to the selection of the most comparable individuals, the trade-off is that many individuals may be discarded and not used in the analysis. Whether this trade-off is worth it depends on the specific empirical research questions (Smith 1997). With simple subclassification matching, there are often still some differences in the observed covariates between the treated and control cases within each subclass. This can lead to potential bias. In addition, without clear guidance, it can be difficult to determine how many subclasses are needed (Du 1998).

Full matching, a relatively new matching method first developed by Rosenbaum (1991), overcomes the above disadvantages and can be thought of as a compromise between the k:1 nearest neighbor matching and the subclassification method (see Stuart and Green 2008). As a particular type of subclassification, full matching forms subclasses in an optimal way, that is, treated cases with many comparable control cases (based on propensity score) will be grouped with many controls, whereas treated cases with fewer comparable controls will be grouped with fewer controls (Rosenbaum 2002; Hansen 2004). This method is more flexible than k:1 nearest neighbor matching, where each treated individual is forced to be matched to the same k number of controls, regardless of how well these controls match the treated individuals. Unlike the simple subclassification matching, in which the number of classes needs to be decided on before the matching, full matching automatically determines the optimal number of subclasses by reducing the differences in the



propensity score in each matched set. In addition, Stuart and Green (2008) illustrated the use of full matching in comparison with 1:1 exact matching, k:1 nearest neighbor matching, and simple subclassification matching, and they concluded that full matching yields the best matching results by minimizing the distance within each pair of treated and control cases. Full matching is particularly recommended when there are more treated than control cases, as in this study where 70% of the sample graduated from high school (in personal consultation with Stuart).

For the above discussed reasons, a full matching is chosen to match graduates and dropouts based on their propensity for graduating from high school<sup>22</sup>. In a fully matched sample, each matched set contains one graduate and one or more dropouts. A weight is assigned when there is more than one dropout for each graduate. A weighted average of the estimated distance measure between each graduate and each dropout within each subclass is minimized. In a fully matched sample, the matched graduates resemble the matched dropouts in terms of the propensity scores and the covariate distributions.

The goal of propensity score matching is to find at least one match for each treated case. However, in practice, it is unlikely that there is a perfect overlap of covariates between the treated and control cases (Heckman et al. 1998). In these situations, the fundamental mismatch between the treated and control cases must be addressed. The overlap between the treated and control

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<sup>22</sup> I also conducted matching analysis using other matching methods and compared the matching results with full matching. Full matching yielded the best matching results (i.e., balance is achieved on the majority of the covariates) in this sample.

cases is called the “common support.” Treated cases for which control cases cannot be found are off the common support, and vice versa.

A narrower treatment effect can still be estimated by confining the sample only to treatment cases whose propensity scores fall between the minimum and maximum in the control group. The results can be interpreted as the estimates of the treatment effect for a subset of treated cases only: the common support treatment effect for the treated (Heckman et al. 1997, 1998). Such a treatment effect is informative only about those in the treatment and control groups who are comparable in the distribution of observed covariates. Morgan and Harding (2006) noted that throwing away some of the treated cases and estimating such a common support treatment effect can be considered an important substantive finding, and thus help clarify the contribution of the study.

In this study, since the process of high school dropout is a cumulative process that starts as early as the first grade (Alexander et al. 2001), it is reasonable to expect that graduates and dropouts are different on most of the covariates. In full matching, a discard option can be specified, in which case the cases outside the range of common support will not be placed into any subclass. When there are more treated than control cases, it is recommended to allow for the discarding of treated cases (Stuart and Green 2008). Since most of the cases in the sample (70%) are graduates, I allow for discarding graduates who are outside of the common support. The common support treatment effect for graduates will be estimated, and such results will be applicable only for those graduates and dropouts who are equivalent on the distribution of observed

covariates. The propensity score matching will be conducted using R-MatchIt developed by Ho et al. (2008).

### ***Checking for balance***

Once the matching is done, the next step is to check for balance. The purpose of this step is to make sure the distribution of covariates is the same in the treatment and control groups. This is related to an important assumption made in propensity score matching, that is, the conditional independence assumption (CIA). It is assumed that the treatment status is completely random, conditional on a set of observed characteristics.

One way to check for balance is to obtain balance statistics. In full matching, the balance statistics are shown for each subclass, and the overall balance statistics are aggregated across all the subclasses. These balance statistics usually include the weighted means of the propensity score and each covariate for the matched and control groups, the original control group standard deviation, mean differences between the two groups, and standardized mean differences (also called “standardized bias”) between the two groups (as mean differences divided by the original control group standard deviation). The standard mean difference for each covariate is usually used for checking for balance of that covariate. A smaller absolute value of standard mean difference indicates better balance (the treated and control groups are similar on the distribution of the covariate). The cut point suggested by Stuart (2007) is 0.25.

Other than using the balance statistics, balance can also be checked graphically using plots (Stuart and Green 2008). Three types of plots are generally used: Q-Q plots of each covariate, jitter plot of the propensity scores, and histograms of the propensity scores. The Q-Q plots show the differences in distributions of each covariate across the matched and unmatched treated and control units. The Q-Q plots are used to examine how successful the matching is for a particular covariate. If the distributions were the same in the treated and control units, the points in the Q-Q plots would be all on the 45-degree line. Deviations from the 45-degree line indicate differences in the distributions.

The jitter plot shows the overall distribution of the propensity score across the matched and unmatched treated and control units. In the jitter plot, each point represents one unit, and the size of each point is proportional to the weight given to that unit. The jitter plot can be used to examine the overlap of the propensity scores between the treated and control groups.

For the histograms, four histograms are used: the distribution of propensity scores for the original treated and control groups, and for the matched treated and control groups. If the matching is successful, the distribution for the treated and control groups should look more similar to each other.

Once matches are found and the balance on all the covariates is achieved, outcome analysis can be conducted on the matched sample. In this study, I will examine the effect of graduation status on the outcome variable “having at least one adult offending record”, by estimating a logistic regression

with adult offending as the dependent variable and graduation status as the independent variable. The analysis will be conducted on the matched sample.

### ***Sensitivity analysis to propensity score matching***

As discussed above, one of the conditions for selecting covariates for estimating propensity scores is to exhaust all possible factors that may influence the propensity of receiving the treatment. In practice, this condition is often violated, that is, there may be unobserved covariates that affect both the treatment and the outcome. Although close matching on the observed covariates will also reduce bias due to unobserved covariates that are correlated with observed covariates in the model, there may still be bias due to the unobserved differences between the treated and control groups. In other words, although propensity score matching can address the overt bias, it does nothing to address the hidden bias due to unobserved differences between the treated and control cases.

Bias due to unobserved differences is commonly referred to as “selection bias” (Harding 2003). For example, after matching the graduates and dropouts based on a series of covariates described in the last section, graduation is found to reduce adult offending. Such an effect may be partly due to omitted covariates, such as parental monitoring, association with delinquent peers, or school level predictors of high school graduation/dropout. These omitted covariates may affect both graduation as the treatment and adult offending as the outcome directly or indirectly.

While it is difficult to assess to what extent such differences bias the causal inferences, analyses may be conducted to assess sensitivity to a hypothetical unobserved variable. Such a sensitivity analysis was first developed by Rosenbaum and Rubin (1983a) and illustrated in detail by Harding (2003). Essentially, a sensitivity analysis assesses how strong the effects of the unobserved covariate on both the treatment and the outcome have to be to make the estimated treatment effect indistinguishable from zero. For example, if in order to render the observed treatment effect insignificant, such an unobserved covariate would have to have an enormously strong effect on the treatment or the outcome, the treatment effect is insensitive to selection bias due to the unobserved covariate.

Based on the sensitivity analysis first developed by Rosenbaum and Rubin (1983a), Harding (2003) provided a step-by-step guide to conducting a sensitivity analysis. The approach taken is to assess how both the point estimate of the treatment effect and the statistical significance of such an effect change with the inclusion of a hypothetical unobserved covariate with different levels of effects on the treatment and outcome. The table on the left in Figure 4.3 shows the 2 by 2 cross tabulate between graduation (X) and adult offending (Y). Assuming the unobserved covariate (denoted as U) is parental monitoring (with 1 as high level of parental monitoring and 0 as low level of parental monitoring), high level of parental monitoring is positively related to graduation ( $\Gamma$ ) and negatively related to adult offending ( $\Delta$ ).  $\Gamma$  and  $\Delta$  are called sensitivity parameters, and they are both expressed in odds ratios. The sensitivity analysis

involves the computation of new estimates of the treatment effect for different combinations of values of  $\Gamma$  and  $\Delta$ . Assuming that U is observed, a three way cross tabulate between graduation, adult offending, and parental monitoring can be established. Capital letters A through H indicate the counts of cases in each cell. The goal is to determine these counts. Once these counts are known, the effect of X on Y controlling for U, as the “real” treatment effect of graduation on adult offending controlling for parental monitoring, can be estimated.

These counts can be computed by utilizing the relationships between X, Y, and U, and two assumptions are made. First, it is assumed that there is no interaction among X, Y, and U, that is, the relationship between any of two variables does not depend on the value of the third variable. In this case, the effect of graduation on adult offending for an individual does not depend on the level of parental monitoring. Although in some cases, this assumption can be violated, for the purpose of illustration, the simple case of no interaction is assumed. Second, it is assumed that cases are evenly distributed between the two sub-tables in the latent table (when U=0 and U=1). Harding (2003) argued that this assumption is not crucial; simply shifting cases between the two sub-tables does not impact the relationship between X and Y. The relationships between these counts under the two assumptions can be written as:

$$AF/BE=\Delta$$

$$CH/DG=\Delta$$

$$AG/CE=\Gamma$$

$$BH/FD=\Gamma$$

$$A+B+C+D=E+F+G+H$$

The eight cell counts in the latent table can be solved using these equations, along with the four observed cell counts (A+E, B+F, C+G, and D+H). Once these cell counts are known, a simulated data set can be created that contains eight observations for different combinations of X, Y, and U, with the corresponding cell counts as the frequency weight. Using this simulated data set, the treatment effect can be re-estimated through a logit model:  $\text{Logit}(Y) = b_0 + b_1X + b_2U + e$ .  $b_1$  is the “real” treatment effect of graduation on offending when controlling for parental monitoring, and the confidence interval of  $b_1$  can also be computed.

#### **4.4.3 Mediation Analysis**

Mediation analysis will be used to answer the second research question: Do employment or intimate relationships partially mediate the direct relationship between high school graduation and adult offending? This type of analysis is used to identify the separation between the direct and indirect effects of high school graduation on adult offending. This process is called “effect decomposition” (MacKinnon et al. 2002). In this section, I will first introduce some basic concepts in a single mediator model with continuous dependent and intermediate variables, and methods to compute mediation effects. Second, I will discuss the complications introduced when involving a binary dependent variable (e.g., in this study, the dependent variable “having at least one adult offending record” is binary) and the correct method to use to compute the mediation effects. Third, I will introduce different methods to test the statistical significance



of the mediation effect and provide reasons for the method I chose to use in this study. Fourth, I will present the steps to conduct a mediation analysis. Last but not least, I will present two extensions of a simple single mediator model used in this study, that is, the presence of moderation in a mediation model and the three-path model.

### ***The basics of mediation analysis***

Mediation analysis was first designed as an appropriate method for theory-driven evaluation of prevention trials (MacKinnon and Dwyer 1993; MacKinnon et al. 1989, 1991). It does not only allow researchers to assess the success of a program, but also informs them for whom the program works. A mediation analysis is able to evaluate whether a program changed the mediating variable and whether the change in the mediating variable is responsible for changes in outcome. The usefulness of mediation analysis has been extended to provide insight into the mechanisms underlying the observed relations among variables and latent constructs (MacKinnon and Dwyer 1993).

The essential idea of mediation is that a third variable (mediator) transmits the effect of the independent variable on the dependent variable (MacKinnon 2008). In a basic single mediator causal model, the theory driven causal variables can be conceptualized as a potential mediating variable  $M$ , intervening in the relation between an independent variable  $X$  and a dependent variable  $Y$ . In other words, the independent variable causes the mediator, and the mediator then causes the dependent variable.

Figure 4.4 presents the model with one independent and one dependent variable, and Figure 4.5 presents the model where a third variable (mediator) is added.  $Y$  is the dependent variable,  $X$  is the independent variable, and  $M$  is the mediating variable. The paths specified in Figure 4.5 can be estimated using multiple OLS regression, logistic regression, or other regression methods. Eq. 1, 2, and 3 present these models. In all the three equations,  $i$ 's represent the intercepts, and  $e$ 's represent the error terms. In Eq.1,  $c$  represents the relationship between the independent and dependent variable when there is no mediating variable. In Eq.2,  $a$  represents the relationship between the independent variable  $X$  and the mediating variable  $M$ . In Eq.3,  $c'$  represents the relationship between them when adjusting for the mediating effect of  $M$ , and  $b$  represents the relationship between the mediating variable  $M$  and the dependent variable  $Y$  when adjusting for the independent variable  $X$ .

$$Y = i_1 + cX + e_1 \quad \text{Eq.1}$$

$$M = i_2 + aX + e_2 \quad \text{Eq.2}$$

$$Y = i_3 + c'X + bM + e_3 \quad \text{Eq.3}$$

There are two commonly used methods to obtain point estimation of the mediation effect, the effect of the independent variable  $X$  on  $Y$  mediated by the mediator  $M$  (MacKinnon et al. 2002; MacKinnon et al. 1995; MacKinnon 2008). One method is “the difference in coefficients” method. This method defines the mediation effect as the difference between the regression coefficient of the dependent variable  $Y$  on  $X$  ( $c$  in Eq. 1) and the partial regression coefficient of

the dependent variable  $Y$  on  $X$  ( $c'$  in Eq. 3). The mediation effect estimated using this method is expressed as  $c-c'$ . The effect of the independent variable  $X$  on the dependent variable  $Y$  without the introduction of the mediating variable  $M$ ,  $c$ , is called the “total effect.” The effect of the independent variable  $X$  on the dependent variable  $Y$  when adjusting for the mediating variable  $M$ ,  $c'$ , is called the “direct effect.” The mediation effect is also called “indirect effect.” When  $c'$  is zero, the effect of  $X$  on  $Y$  is completely mediated by  $M$ , and when  $c'$  is non-zero, the effect of  $X$  on  $Y$  is only partially mediated by  $M$ .

The other method is “the product of coefficients” method. This method defines the mediation effect as the product of the regression coefficient of the mediating variable  $M$  on the independent variable  $X$  ( $a$  in Eq. 2) and the partial regression coefficient of the dependent variable  $Y$  on the mediating variable  $M$  ( $b$  in Eq. 3). The estimation of the mediation effect using this method is expressed as  $ab$ . For standard OLS regression models without missing data or latent variables, the two methods yield identical results,  $c-c'=ab$ .

### ***The estimation of mediation effect with a binary dependent variable***

When the dependent variable  $Y$  or the mediating variable  $M$  is binary, the two above-stated methods to obtain the point estimate for the mediation effect yield non-identical results, and they can be dramatically different. In this study, since the outcome variable (having at least one offending record) is binary and a logistic regression is used to estimate the effects, the two estimates are not identical,  $c-c' \neq ab$ . Upon conducting a simulation study to compare the two

estimates with the population mediated effect, MacKinnon et al. (2007) recommended the use of the product of coefficient method to obtain the point estimate because it is generally less biased than the difference in coefficients method; it is also quite robust against departures from the logit or probit assumptions. In this study, I will use the product of coefficients method recommended by MacKinnon and colleagues.

### ***Significance test of mediation effect***

After estimating the mediated effect, the next step is to test whether such a mediated effect is significant. There are four methods in testing the statistical significance of a mediated effect. The first method is the “causal steps test.” Using this method, when the effects in each step proposed by Baron and Kenny (1986) – the effect of  $X$  on  $Y$  ( $c$ ), the effect of  $X$  on  $M$  ( $a$ ), and the effect of  $M$  on  $Y$  ( $b$ ) – are significant, the mediated effect is significant. The second method “joint significance test” is similar to the first method, except that it does not require a significant effect of  $X$  on  $Y$  ( $c$ ) (MacKinnon et al. 2002). The third method is the “product of coefficient test.” This method directly tests the statistical significance of the indirect effect,  $ab$ , by dividing  $ab$  by its standard error and comparing the result with a normal distribution or by creating the confidence interval around the indirect effect  $ab$  (Sobel 1982; MacKinnon et al. 2007). The last method is the “difference in coefficients test.” This method evaluates the statistical significance of the indirect effect,  $c-c'$ , by dividing  $c-c'$  by its standard error and comparing the result with a normal distribution or by creating the confidence interval around the

indirect effect  $c-c'$  (MacKinnon et al. 2002). In a Monte Carlo study, MacKinnon et al. (2002) compared different methods to test the statistical significance of mediated effect, and they concluded that the best balance of Type I error and statistical power across all the cases is the “joint significance test.” In this study, I will use this method to evaluate the statistical significance of the mediated effects.

### ***Steps in mediation analysis***

In order to test whether and to what extent employment or intimate relationships mediates the effect of high school graduation on adult offending, I will follow Baron and Kenny’s (1986) four step procedure. First, high school graduation, as an independent variable, must have an effect on the likelihood of adult offending, as the dependent variable.<sup>23</sup> Second, graduation must have an effect on employment or intimate relationships, as the mediator. Third, employment or intimate relationships must have an effect on adult offending while controlling for graduation status. Fourth, the direct effect of graduation on adult offending must be non-significant. This last step determines the extent to which the effect of graduation on adult offending is mediated by employment or intimate relationships. If the direct effect of graduation on adult offending is non-significant, the effect of graduation is entirely mediated by the mediator,

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<sup>23</sup>This step is not necessary for establishing mediation effect (MacKinnon 2008). Even if there is not a significant relation between the independent and the dependent variable, mediation can still exist. The test of mediated effect has more statistical power than the test of the overall effect between X and Y. For example, McFatter (1979) described a hypothetical situation where the direct effect and the indirect effect of X on Y are in the opposite directions. In this situation, the two effects may cancel each other out, resulting in a total effect that is indistinguishable from zero.

employment or intimate relationships. Otherwise, this effect is only partially mediated by the mediator.

### ***Specification error in mediation analysis***

An important assumption in mediation models is that there is no omitted variable that causes both the mediator and the outcome. The violation of this assumption is referred to as a “specification error” or “omitted variable problem” and discussed by Judd and Kenny (1981). After a careful review of 50 articles using mediation analysis since 2002, Gelfand et al (2009) concluded that in only seven articles (14%) did author acknowledge the possibility of omitted variables. For example, in studying the relationship between high school graduation, employment, and adult offending, it is possible that educational or occupational aspiration is related to both employment and adult offending. Previous studies (Judd and Kenny 1981; Gelfand et al. 2009) have found that when the independent variable is randomized, the “no omitted variable” assumption is justified. For example, the use of propensity score matching created an experimental situation where graduation status can be seen as randomly assigned to individuals. In this case, an omitted variable does not bias the estimation of the effect of graduation on adult offending or that of graduation on employment. Gelfand et al. (2009) concluded that random assignment to treatment allows one to make the strongest possible inference regarding the independent variable as a cause of both the mediator and the dependent variable. Although the effect of employment on adult offending is subject to the

influence of potential omitted variables, it is unlikely that any omitted variable is unrelated to any of the covariates controlled for in the propensity score estimation. Future studies involving the random assignment of the mediator, employment, would allow one to make stronger causal inferences.

### ***The presence of moderation in a mediation model***

Other than mediating the effect of  $X$  on  $Y$ , a third variable can also moderate this effect. The moderation effect is also known as an interaction effect (Baron and Kenny 1986; MacKinnon 2008). A moderator is commonly defined as “a variable that modifies the form or strength of the relation between an independent and a dependent variable” (MacKinnon 2008, 275). From a substantive standpoint, the observed relation between an independent and a dependent variable can be strengthened, weakened, removed, or made opposite in sign when the moderator is taken into account. Although theory may be used to predict a moderator effect in some cases, in other cases, moderators may reflect an exploratory search for possible different relations across subgroups (MacKinnon 2008).

The most discussed moderators take two forms: 1) when the moderator variable is also a significant predictor of the dependent variable, the moderator is called a quasi-moderator and 2) when the moderator variable is not a significant predictor of the dependent variable, the moderator is called a pure moderator (Sharma et al. 1981). The moderation effect model is shown in Equation 6, where  $Y$  is the dependent variable,  $X$  is the independent variable,  $Z$  is the moderator,

and  $XZ$  is the interaction between the moderator and the independent variable.

$e_1$  is a residual, and  $c_1$ ,  $c_2$  and  $c_3$  represent the effect of the independent variable  $X$ , the effect of the moderator  $Z$ , and the effect of the interaction between  $X$  and  $Z$  on the dependent variable  $Y$  respectively.

$$Y = i_1 + c_1X + c_2Z + c_3XZ + e_1 \quad \text{Eq. 6}$$

If the  $XZ$  interaction is statistically significant, the conditional effects are often explored with both plots and simple main effect tests. These tests and plots test the significance and strength of the relation between  $X$  and  $Y$  at different values of  $Z$ . Plots are obtained by computing the predicted values of  $Y$  given the regression equation and values of  $X$ ,  $Z$ , and  $XZ$ . Equation 7 shows a rearrangement of Equation 6 that makes the plotting more straightforward. In this equation,  $c_1 + c_3Z$  is called a simple slope, and  $c_2Z + i_1$  is called a simple intercept. When  $X$  is continuous and  $Z$  is binary, the relations between  $X$  and  $Y$  at each level of  $Z$  can be plotted. The significance tests of the simple slopes at different values of  $Z$  are called tests of simple main effects.<sup>24</sup>

$$\hat{Y} = (c_1 + c_3Z)X + (c_2Z + i_1) \quad \text{Eq. 7}$$

Despite the differences between moderation and mediation, they can both be present in the same model. Baron and Kenny (1986) provided a general framework for combining moderation and mediation in the same model. One of

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<sup>24</sup> Statisticians do not universally approve of the use of tests of simple main effects. In particular, there are concerns over the conceptual error rate. Tests of simple main effects are one tool that can be useful in interpreting interactions. Caution should be exercised in interpreting the results produced. In general, the results of tests of simple main effects should be considered suggestive and not definitive.



the most important models frequently discussed by Baron and Kenny and others (e.g. James and Brett 1984; MacKinnon 2008) is the moderated mediation model, indicating that the mediational effects of the intermediate variable vary across the level of the moderator. The definitions and interpretations of mediation in the presence of moderation effects can be statistically and conceptually complex (Baron and Kenny 1986; MacKinnon 2008). Despite the potential substantive benefits of incorporating moderation effects in mediation models, few research studies include both mediation and moderation. This, in part, is due to the difficulty of specifying and interpreting these models (MacKinnon 2008).

A special case of a moderated mediation model is when the moderator is the independent variable, that is, the mediational effect of the intermediate variable  $M$  depends on the level of the independent variable  $X$ . MacKinnon (2008) provided a helpful guideline for specifying and interpreting mediation models with an interaction term between the mediator and the independent variable in a single mediator model. One of the most important assumptions of a single mediator model is that the relation from the mediator to the dependent variable is the same across levels of the independent variable. The test of  $XM$  interaction provides a test of such an assumption and has important substantive implications. If  $XM$  interaction is significant, then the main effects of  $X$  or  $M$  do not provide a complete picture of the effects in the data. In such a case, the relation between  $M$  and  $Y$  differs across levels of  $X$ . In other words, the  $b$  path in Equation 3 differs across levels of  $X$ .

Equation 8 describes such a model. The  $h$  coefficient represents the effect of  $XM$  interaction. If such an effect is significant, the assumption of a single mediator model is relaxed. It is important to explore the source of this significant interaction with plots and effects of simple main effects. It is often expected for the  $XM$  interaction to be significant in a mediation model. In a large simulation study, Merrill (1994) demonstrated that the mediated effect is inflated in an analysis that ignores the  $XM$  interaction. In the situation where  $X$  is a binary variable and the  $XM$  interaction is estimated, the estimation of the mediated effect and the significance test are the same as a single mediator model without moderation effect (Merrill 1994; MacKinnon 2008).

$$Y = i_2 + c'X + bM + hXM + e_2 \quad \text{Eq. 8}$$

In order to test whether employment or intimate relationships are equally beneficial to both graduates and dropouts, the interaction between the mediator (e.g., having a job or the number of hours worked per week) and the independent variable high school graduation status will be included when estimating their effects on the dependent variable adult offending. Since graduation status is binary, the same methods used in a single mediator model without  $XM$  interaction can be used to estimate the mediated effects for both graduates and dropouts and to test the statistical significance of such effects.<sup>25</sup>

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<sup>25</sup> Mackinnon recommended to evaluate the mediation effect in the general model before including the interaction between  $X$  and  $M$  (personal consultation).

### ***The three-path mediation model***

While most of the mediation models involve one mediator transmitting the effect of an independent variable to a dependent variable, a mediation model could include more than a single mediator in the causal chain connecting the independent variable and the dependent variable (Taylor et al. 2008). Such a model has been found in social sciences research. For example, Allen and Griffeth (2001) found that job performance positively impacted employees' perceived employment alternatives, which positively influenced their intention to leave, which in turn affected their actual behavior of leaving the job.

Taylor et al. (2008) extended several methods used in a single two-path mediation model to the three-path mediation models with two mediators in series. Taylor et al. (2008) defined the three-path mediation model as shown in figure 4.6. The following three regression equations are estimated:

$$M_1 = \beta_{01} + \beta_1 X + \varepsilon_1 \quad \text{Eq. 9}$$

$$M_2 = \beta_{02} + \beta_2 M_1 + \beta_5 X + \varepsilon_2 \quad \text{Eq. 10}$$

$$Y = \beta_{03} + \beta_4 X + \beta_3 M_2 + \beta_6 M_1 + \varepsilon_3 \quad \text{Eq. 11}$$

The direct effect of  $X$  on  $Y$ , controlling for both mediators, is  $\beta_4$ , and the mediated effects for each of the paths are estimated by the product of the coefficients for that path (Alwin and Hauser 1975). The total mediated effect of  $X$  on  $Y$  is  $\beta_1\beta_2\beta_3 + \beta_1\beta_6 + \beta_5\beta_3$ . While  $\beta_1\beta_2\beta_3$  is the effect passing through both mediators,  $\beta_1\beta_6$  and  $\beta_5\beta_3$  are the effects passing through only one mediator.

In this study, since it is likely that one's income is influenced by number of hours worked per week, it is possible that income mediates at least part of the

relationship of work hours to adult offending. I will test both work hours and income as two mediators in a three-path mediation model. All the mediation analysis in this study will be conducted using Mplus developed by Muthén and Muthén (1998-2010).

#### **4.4.4. Alternative modeling strategies**

An alternative modeling strategy is semi-parametric group based trajectory models (Nagin et al. 1995; Nagin 1999; Nagin and Tremblay 1999). This method makes the assumption that behavior patterns over time can be approximated by a finite number of groups with different trajectories. Using repeated measures of the same behavior over time, this method captures the developmental patterns (i.e., trajectories) of the behavior over time for a number of groups. It also reports the estimated proportion of the population that follows each trajectory. This method has been used to examine the effects of high school dropout on subsequent offending. In his dissertation, Sweeten (2006) attempted to balance characteristics of dropouts and non-dropouts based on posterior probabilities of criminality trajectory group membership. Patterns of offending prior to dropout are used to match dropouts to non-dropouts.

I did not choose to use this method because there is a tendency to run out of power since the number of chronic offenders is small. More importantly, trajectory analysis is not a preferred method for this dissertation because I consider the mechanism through which high school graduation could influence adult offending. Trajectory analysis answers questions such as whether high

school graduation has a differential effect on adult offending depending on juvenile offending trajectories. Mediation analysis is better suited for studying mechanisms through which high school graduation influences adult offending. Future studies could use trajectory analysis and explore whether high school graduation as a turning point operates differently depending on patterns of delinquent behavior during adolescence.

## CHAPTER 5: RESULTS

### Section 5.1: Results from Propensity Score Matching

In order to answer the first research question, i.e., whether high school graduation has a causal effect on adult offending behavior, the propensity score matching method is used to address the issue of selection bias. The matched sample consists of 361 males, with 220 graduates and 141 dropouts. A total of 99 graduates are outside the common support and could not be matched. They were discarded from the sample.<sup>26</sup> In this chapter, I will first assess whether the matching is successful in balancing the treated group (the graduates) and the control group (the dropouts). To this end, I will assess the degree of imbalance between graduates and dropouts prior to matching by presenting the differences in all covariates between the two groups. In addition, I will present the balance information on all of the covariates after matching. If matching is successful, the differences between graduates and dropouts on all covariates should be reduced considerably. I will also compare the matched graduates, matched dropouts, and unmatched graduates in terms of all covariates. This is to show that the unmatched graduates are significantly different from the matched sample. Lastly, I will examine whether the sample after matching is still representative of the sample of interest, by comparing the sample description before and after matching.

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<sup>26</sup> The 99 discarded cases will be discussed later in the chapter.

### 5.1.1 Covariate balance prior to matching

I first examine the differences over the 35 covariates between dropouts and graduates prior to the matching procedure, as presented in Table 5.1a-d. The first and third columns present the mean propensity score and the means of the covariates prior to matching for graduates and dropouts respectively. As discussed in more detail in the method chapter, a propensity score is estimated for each individual in the sample as the predicted probability of graduating from high school based on the observed covariates. For those who graduated, the mean propensity score is .868, and for those who dropped out, the mean propensity score is .299. The standardized bias between graduates and dropouts is 3.132, indicating a considerable difference between the two groups. In addition to the substantial difference in terms of propensity score, graduates and dropouts also show sizeable differences on most of the covariates. For example, 32% of graduates had three or more conduct problems before the age of 15; this number increased to 58.9% for dropouts. While only 5.6% of graduates had a juvenile violent record, over a third (34.8%) of dropouts had a juvenile violent record. This lack of balance that we observe on covariates between graduates and dropouts clearly indicates the strong selection process that is at work, i.e., graduation is not a random event.<sup>27</sup>

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<sup>27</sup> I regress graduation status on all the covariates. The majority of these covariates are significantly related to graduation status.

### 5.1.2 Covariate balance after matching

I use the following three methods to assess the quality of matching. First, I compare the mean differences in the propensity score and the covariates between graduates and dropouts before and after matching. Second, I compare the standardized bias for the propensity score and the covariates before and after matching. Third, I examine the plots for the propensity score and the covariate distribution.

I first compare the mean differences in the propensity score and the 35 covariates between dropouts and graduates before and after matching. In Table 5.1a-d, the second and fourth columns contain the mean propensity score and the weighted means of the covariates after matching for graduates and dropouts respectively. Since the matching is done by selecting for each graduate a dropout with the closest propensity score, the weighted average propensity scores for the matched graduate group and the matched dropout group are the same (.811). The differences between the two groups on most of the covariates have also reduced considerably, compared to before matching. For example, while the difference in percentage of having three or more conduct problems before age 15 between graduates and dropouts is 36.9 (58.9 for dropouts and 32.0 for graduates), this difference reduced to 0.6 (37.9 for dropouts and 37.3 for graduates). A similar pattern is observed for most of the other covariates. This indicates that the balance has been achieved on most of the covariates.

In addition to comparing the mean differences between the two groups, I also compare the standardized bias for the propensity score and each covariate



before and after matching, as presented in the last two columns of Table 5.1. The standardized bias value for most of the covariates exceeds 0.25 before matching, indicating a lack of balance in the original sample. After matching, the standardized bias for most of the covariates has reduced considerably. Out of these 35 covariates, most variables had a standardized bias value below the 0.25 cut point, with the exception of age at fall of first grade (.283) and number of times moved during high school (-.284). Since they are both borderline, I concluded that the matching has achieved a reasonable balance.

The third method I used to evaluate balance is to examine plots of the propensity score and covariate distribution. Figure 5.1a (jitter plot) presents the distribution of propensity scores for the matched treatment units (matched graduates), the matched control units (matched dropouts), and the unmatched treatment units (unmatched graduates). The distributions of propensity scores are similar between the matched graduates and matched dropouts, while dropouts with higher propensity to graduate carry greater weights than dropouts with lower propensity to graduate. As expected, the group of unmatched graduates has extremely high propensity scores. Figure 5.1b (histogram) presents the distribution of the propensity score for the treated (graduates) and control (dropouts) groups before and after matching. As presented in the figure, the distributions of the propensity score for graduation seem substantially different for the two groups before matching. After performing the matching, the distributions of propensity score for graduation are almost identical. In addition, the Q-Q plot for each covariate also shows that most matched graduates and

dropouts are on the 45-degree line, indicating that the distribution of each covariate is similar for the two groups. (For Q-Q plots, refer to Appendix 5.1.)

In summary, all three methods for assessing matching quality suggest that the matching procedure has achieved reasonable balance on the propensity score and all covariates.

### **5.1.3 Unmatched cases**

As mentioned above, 99 high school graduates were outside the common support and could not be matched to dropouts. In order to understand why they were discarded from the sample, I compare the means of all covariates among the three groups, i.e., the matched graduates, the matched dropouts, and the unmatched graduates. Table 5.2 presents such a comparison. Matched graduates and matched dropouts are very similar in terms of their propensity for graduation (0.81 for both graduates and dropouts) and all covariate values. The unmatched graduates, as expected, are rather different from the matched graduates and dropouts. For example, among the unmatched graduates, only about 27% are from low-SES families, while among the matched graduates and dropouts, about half (50.5% for graduates and 47.5% for dropouts) are from low-SES families. The unmatched graduates had better reading scores, better school performance during elementary, middle, and high school, and fewer conduct problems than the matched graduates and dropouts. The unmatched graduates also were less likely to have juvenile offending records than the matched

graduates and dropouts. Out of the 99 unmatched graduates, only one person (1%) had a juvenile record for a status offense.

#### **5.1.4 Comparison between the matched sample and the full sample**

In order to assess whether the matched sample is representative of the original sample before matching, I compare the means of all covariates between the matched sample and the full sample. Table 5.3 presents the means and standard deviations of all the 35 covariates for the matched sample and the full sample.<sup>28</sup> Most of the covariates have similar means and standard deviations across the two groups with a few exceptions. For example, the total number of school removals is slightly lower in the matched sample than in the full sample (.41 versus .60). The percentage of having a juvenile violent record is significantly lower in the matched sample than in the full sample (7.9% versus 14.6%). This indicates that the matched sample is slightly more conventional than the full sample. However, given that the two samples are comparable across most of the covariates, I conclude that the matched sample is reasonably similar to the full sample. Therefore, the analysis results can be generalized to the population of interest, to a reasonable extent.

### **Section 5.2: Regression Results**

Having used matching, the causal effect of graduation can now be examined on the well-balanced sample. In this section, I will answer the first

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<sup>28</sup> I cannot use a significance test given the dual membership for some cases, i.e., cases that are in both the matched sample and the full sample.

research question: Does high school graduation have a causal impact on adult offending among the matched sample? Table 5.4 shows the distribution of the outcome variable and the mediating variables among the three groups: matched graduates, matched dropouts, and unmatched graduates. As shown in the table, 36.2% of the dropouts had at least one adult offending record. This percentage is significantly higher than the 3.6% for matched graduates. There is no significant difference in terms of either frequency or type of offending between matched graduates and dropouts. Among the unmatched graduates, nobody had an adult offending record.

Using logistic regression, having at least one adult offending record is regressed on high school graduation status, in order to test whether graduation status has a significant effect on adult offending among the matched sample. High school graduation has a large negative effect on adult offending, and such an effect is statistically significant at a .01 level. Compared to dropouts, high school graduates are about 93% less likely to have an adult offending record (logit coefficient=-2.702; Std. error=.411; odds ratio=.067).<sup>29</sup> This effect can also be interpreted using predicted probabilities (Long 1997). While the predicted probability of having an adult offending record for dropouts is 0.36, it is only .04 for graduates.

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<sup>29</sup> I compare this result with the result using a regression adjustment procedure, regressing adult offending on graduation status while controlling for all covariates used in the propensity score matching among the full sample (n=460). Although the effect of graduation is in the expected direction, both the point estimation of the effect size and the standard error are slightly larger when using the regression adjustment procedure.

### Section 5.3: Sensitivity Analysis

While propensity score analysis is a useful approach to control for selection bias (graduation is influenced by individuals' self-selection), it is only as good as the covariates included in the propensity score estimation. In order to gauge how the effect of an omitted variable may change the result, I perform a sensitivity analysis. As discussed in detail in the method chapter, the goal of the sensitivity analysis is to assess how an omitted covariate that influences both high school graduation and adult offending would change my conclusion about the graduation effect.<sup>30</sup> Examples of such hypothetical omitted covariates could be risk factors at the school level, such as structural features and school climate. Studies (Bryk and Thum 1989; Rumberger 1995; Rumberger and Thomas 2000) have collectively found certain school level variables, such as student composition, school structure, school resources, and school processes, have important effects on dropout. Other examples of omitted covariates may include association with delinquent peers (Catalano and Hawkins 1995; Elliott and Voss 1974) and parental monitoring (Janosz et al 1997; Rosenthal 1998). If any of these covariates have significant effects on both graduation and adult offending (net of all the covariates included in the propensity score matching), failing to include them will bias the estimate of the graduation effect.

Table 5.5 presents the estimated treatment effect of graduation and its confidence interval, given various values of sensitivity parameters  $\Gamma$  (the effect of the omitted variable on graduation) and  $\Delta$  (the effect of the omitted variable on

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<sup>30</sup> The reason that some covariates are not included in the analysis is either because they are not available in the data (such as school level predictors) or their inclusion will result in a significantly smaller sample size (such as parental monitoring).

adult offending). Since the common concern is that selection bias will lead to the overestimation of a graduation effect, it is expected that the inclusion of an omitted covariate will reduce the estimated graduation effect. In order to address this concern, I am considering omitted variables that are positively related to graduation but negatively related to adult offending (e.g., parental monitoring). Results are the same for variables that are negatively related to graduation but positively related to adult offending (e.g., having delinquent peers). As expected, when either  $\Gamma=1$  or  $\Delta=1$ , the treatment effect is not affected by the omitted covariate because the omitted covariate either has no effect on the treatment or the outcome.

As the magnitude of either  $\Gamma$  or  $\Delta$  increases, the estimated graduation effect decreases. For example, the omitted variable is parental monitoring. All else equal, those who have a high level of parental monitoring are 3.5 times more likely to graduate ( $\Gamma=3.5$ ), and about 70% less likely to commit crime as adults ( $\Delta=.286$ ). Including parental monitoring in the analysis, the treatment effect of graduation will reduce from .067 to .094 with a 95% confidence interval of (.042/.210). Although the treatment effect is slightly smaller, it is still statistically significant at a .01 level. For all values of  $\Gamma$  and  $\Delta$  presented in the table ranging from 1 to 64 (.016), the confidence interval never includes 1, indicating that the graduation effect stays significant.

As Harding (2003) pointed out, it is important to keep in mind that such an omitted variable would need to have unrealistically strong effects on both the treatment and the outcome net of all the covariates used in the propensity score

matching, because the treatment is already balanced on all these covariates. Since it is unrealistic to expect any covariates to have such strong effects ( $\Gamma = 64$  and  $\Delta = .016$ ) on the treatment and the outcome net of all the covariates used in the propensity score matching, it is safe to conclude that the effect of graduation on adult offending is reasonably robust to selection bias in this study.

#### **Section 5.4: RQ2-Study I**

Having established a causal effect of high school graduation on adult offending, the next three sections will answer the second research question: What are the mechanisms through which high school graduation influences adult offending, and, in particular, do employment or intimate relationships partially mediate the relationship between high school graduation and adult offending? As discussed in the present study chapter, I will employ a two study approach. This section will focus on the first study, i.e. whether having a job or being involved in a relationship partially mediates the effect of graduation on adult offending. The next two sections will focus on the second study, i.e., whether particular aspects of employment (such as the number of hours worked per week) and intimate relationships (such as the perceived importance of romantic relationships) mediate such an effect.

In order to establish the mediation effects, I follow the same four-step approach proposed by Baron and Kenny (1986) for all the models presented in all three sections. The first step was tested in the first section of this chapter. It

was found that high school graduation has a significant effect on the likelihood of adult offending, decreasing the odds of adult offending by 93% (logit coefficient=-2.702; Std. error=.411; odds ratio=.067). This model is presented in Figure 5.2a and includes path 1. The results are shown Table 5.6 as model 1 (LL=-126514.2; df=2), and will be used as step 1 for all the models in the next three sections. For the rest of the chapter, I will focus on the last three steps.

#### **5.4.1 Mediation effect of having a job**

As discussed in the literature review chapter, one of the most frequently studied adult turning points is employment. It has been consistently found that being employed reduces the likelihood of adult offending (Laub and Sampson 2003; Sampson and Laub 1993). As I hypothesized, one of the opportunities that high school graduation facilitates may be employment. In this sub-section, I test whether being employed mediates the effect of high school graduation on adult offending (i.e., hypothesis *HRQ2-Study I-Employment*).

As shown in Table 5.4, while over 74.1% of the matched graduates had a job, only 58.9% of the matched dropouts did. Such a difference is statistically significant at a .01 level. A higher percentage (81.8%) of the unmatched graduates had a job. I regress “having a job” on graduation status (step 2), and adult offending on both graduation status and having a job (step 3). This model is presented in Figure 5.2a and includes paths 1, 2, and 3. As presented in model 2 (LL=-341705.1; df=5) in Table 5.6, graduates are about twice as likely to have a job in early adulthood than dropouts, and this effect is significant at .01 level (logit



coefficient=.684; Std. error=.221; odds ratio=1.983). Having a job significantly decreases the likelihood of adult offending by about 70% (logit coefficient=-1.127; Std. error=.316; odds ratio=.324).

As the last step, I assess the significance of the indirect path from graduation to adult offending through having a job. The indirect effect of high school graduation on adult offending through having a job is -.771.<sup>31</sup> I use the joint significance test recommended by MacKinnon et al (2002) to assess the significance of such indirect effect. Since both the effect of graduation on having a job and that of having a job on adult offending are significant, the indirect effect is significant. Apart from this indirect effect through having a job, graduating from high school has a direct effect on adult offending. Regardless of having a job, graduation decreases the likelihood of having an adult offending record by about 93% (logit coefficient=-2.620; Std. error=.411; odds ratio=.073). Since the total effect is made up of both direct effect and indirect effect through the mediator, the total effect of graduation on adult offending is -3.391.<sup>32</sup>

The mediation in this model is best described as a partial mediation, with about 23%<sup>33</sup> of the total effect of high school graduation on adult offending explained by having a job during early adulthood. Figure 5.3 provides a graphic representation of the relationship between high school graduation, having a job, and adult offending. In summary, the results from model 2 provide support for my hypothesis *HRQ2-Study I-Employment*, and I conclude that having a job partially mediates the effect of graduation on adult offending.

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<sup>31</sup> .684\*(-1.127)=-.771.

<sup>32</sup> (-2.620)+(-.771)=-3.391.

<sup>33</sup> (-.771)/(-3.391)=.227.

In addition to the mediation effect of having a job, I also test whether having a job is equally beneficial for graduates and for dropouts, by including the interaction between having a job and graduation status in predicting the likelihood of adult offending. This model is presented in Figure 5.2a and includes paths 1, 2, 3, and 4. As presented in model 3 (LL=-340267.704; df=6) in Table 5.6, the interaction between graduation and having a job has a borderline significant effect on adult offending at a .10 level (logit coefficient=1.454; Std. error=.917), indicating that having a job has different effects for graduates and for dropouts.<sup>34</sup> For dropouts, having a job during early adulthood has a significant effect on adult offending, decreasing the likelihood of having an adult offending record by about 75% (logit coefficient=-1.405; Std. error=.379; odds ratio=.245). For graduates, the effect of having a job is near 0 and it is not statistically significant (logit coefficient=.050; Std. error=.822; odds ratio=1.051)<sup>35</sup>. Contrary to what I hypothesized, being employed only benefits dropouts but not graduates.

Compared to presenting odds ratios, a more straightforward way to interpret logistic regression results is to compute predicted probabilities (Long 1997) for different groups in the sample. From the results in model 3, I computed the predicted probabilities for the four groups: 1) high school graduates who have a job, 2) high school graduates who do not have a job, 3) high school dropouts who have a job, and 4) high school dropouts who do not have a job. These predicted probabilities are presented in Figure 5.4. High school dropouts have

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<sup>34</sup> Aiken and West (1991) argue that most studies are underpowered to test for interactions. A common approach is to raise the p-value to 0.10.

<sup>35</sup> In order to test the different effects of having a job on adult offending for graduates and dropouts, I regress offending on having a job separately for graduates and dropouts.

much higher predicted probabilities of adult offending than high school graduates, regardless of the employment status. For dropouts, those who have a job are only half as likely to offend as adults than those who do not have a job (.230 vs. .548). However, for graduates, the predicted probability of adult offending is roughly the same for those who have a job and those who do not (.037 vs. .035). Interesting, despite that having a job reduces the likelihood of offending by half for dropouts, dropouts are still much more likely to offend as adults than high school graduates, regardless of their employment status. Despite the fact that graduates are more likely to have a job after graduation, having a job only benefits dropouts but not graduates. In addition, although having a job can substantially benefit dropouts, dropouts are still much more likely to offend as adults than graduates.

In addition to the predicted probabilities for the above four groups, I also computed the predicted probabilities of having a job and adult offending for high school graduates and dropouts, taking into consideration that graduation status predicts the likelihood of having a job. High school dropouts have an average .59 probability of having a job, and, in turn, have an average .35 probability of offending as adults. High school graduates, on the other hand, have an average .74 probability of having a job, and, in turn, have an average .04 probability of offending as adults.

In summary, the results suggest that employment partially mediates the effect of high school graduation. In other words, having a job helps explain the difference in terms of the likelihood of adult offending between high school

graduates and high school dropouts. However, having a job is only beneficial for dropouts but not for graduates. Despite such a finding, dropouts who are employed are still considerably more likely to offend as adults than high school graduates.

#### **5.4.2 Mediation effect of being involved in an intimate relationship**

Apart from employment, another frequently studied adult turning point in life course research is marriage. It has been consistently found that marriage reduces the likelihood of adult offending (Sampson et al 2006; Laub and Sampson 2003; Sampson and Laub 1993). As I hypothesized, one of the opportunities that high school graduation offers may be marriage or involvement in stable intimate relationships. In this sub-section, I test whether being involved in an intimate relationship partially mediates the direct effect of graduation on adult offending (hypothesis *HRQ2-Study I-Relationship*).

As shown in Table 5.4, while 70.9% graduates were involved in a relationship, less than 58.9% of dropouts were involved in a relationship. Such a difference is significant at a .05 level. The percentage of being involved in a relationship is 64.6% for the unmatched graduates. I regress “being involved in an intimate relationship” on graduation status (step 2) and adult offending on both graduation status and being involved in an intimate relationship (step 3). This model is presented in Figure 5.2b and includes paths 1, 5, and 6.

As presented in model 4 (LL=-353858.0; df=5) in Table 5.7, graduates are about 1.7 times as likely to be involved in an intimate relationship in early

adulthood than dropouts, and this effect is significant at a .05 level (logit coefficient=.536; Std. error=.221; odds ratio=1.710). However, contrary to my prediction, being involved in an intimate relationship does not have a significant effect on adult offending (logit coefficient=.439; Std. error=.348; odds ratio=1.551).

As the last step, I assess the significance of such an indirect effect. Although graduation status has a significant effect on intimate relationships, the effect of being involved in an intimate relationship on adult offending fails to reach the appropriate significance level. Being involved in an intimate relationship does not mediate the effect of high school graduation on adult offending, and hypothesis *HRQ2-Study I-Relationship* is not supported by the results.

### **Section 5.5: RQ2-Study II-Employment**

In addition to findings on the employment status-offending relationship, previous studies have also documented the relationship between certain aspects of employment and offending behavior. For example, Sampson and Laub (1993) found that quality of employment – measured by a scale composed of employment status, stability of employment, and work habits – significantly reduces offending. In this section, I will present results to answer the second part of the second research question, i.e., whether specific aspects of employment mediate the effect of high school graduation on adult offending. In this section, I

will focus on the number of hours worked per week and income, interpreting their mediation effects for the reasons discussed in the method chapter.

### **5.5.1 Mediation effect of the number of hours worked per week**

I first test whether the number of hours worked per week partially mediates the effect of graduation on adult offending (hypothesis *HRQ2-Study II-Employment a*). As shown in Table 5.4, while dropouts work 23 hours a week on average, both matched and unmatched graduates work 29 hours a week on average. The difference between matched dropouts and matched graduates is significant at a .01 level. I regress the number of hours worked per week on graduation status (step 2) and adult offending on both graduation status and work hours (step 3). This model is presented in Figure 5.2c and includes paths 1, 7, and 8.

As presented in model 5 (LL=-1709160.4; df=6) in Table 5.8, high school graduates work six hours more than dropouts (coefficient=6.092; Std. error=2.150), and this effect is significant at a .01 level. For every additional hour worked per week, the odds of adult offending decrease by about 3% (logit coefficient=-.035; Std. error=.008; odds ratio=.965). While an increase of one hour is not substantively meaningful, I also look at the change in the likelihood of offending when the number of hours worked per week changes from 0 to part time (20 hours per week), and from part time to full time (40 hours per week). When the number of hours worked change from 0 to part time, or from part time to full time, the odds of adult offending decrease by 60%.

As the last step, I assess the significance of the indirect path from graduation to adult offending through the number of hours worked per week. The indirect effect of high school graduation on adult offending through the number of hours worked is  $-.213$ .<sup>36</sup> Since both the effect of graduation on the number of hours worked and that of the number of hours on adult offending are significant, such an indirect effect is significant. Apart from this indirect effect through the number of hours worked per week, graduating from high school also has a direct effect on adult offending. Regardless of the number of hours worked, graduation decreases the likelihood of having an adult offending record by about 93% (logit coefficient= $-2.643$ ; Std. error= $.411$ ; odds ratio= $.071$ ). The total effect of graduation on adult offending is  $-2.856$ <sup>37</sup>, and about 7.5%<sup>38</sup> of such a total effect of high school graduation on adult offending is mediated by each additional number of hours worked per week. Figure 5.5 provides a graphic representation of the relationship between high school graduation, the number of hours worked per week, and adult offending. In summary, the results from model 2 provide support for my hypothesis *HRQ2-Study II-Employment a*, and I conclude that the number of hours worked per week partially mediates the effect of graduation on adult offending.

In addition to the mediation effect of hours worked per week, I also tested whether working more hours per week is equally beneficial for graduates as for dropouts, by including the interaction between the number of hours worked per week and graduation status in predicting the likelihood of adult offending. This

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<sup>36</sup>  $6.092*(-.035)=-.213$ .

<sup>37</sup>  $(-2.643)+(-.213)=-2.856$ .

<sup>38</sup>  $(-.213)/(-2.856)=.075$ .

model is presented in Figure 5.2c and includes paths 1, 7, 8, and 9. As presented in Model 6 (LL=-1706741.3; df=7) in Table 5.8, the interaction between graduation and having a job has a borderline significant effect on adult offending at a .10 level (logit coefficient=.045; Std. error=.032), indicating that number of hours worked per week has different effects for graduates and for dropouts.

For dropouts, the number of hours worked per week has a significant effect on adult offending, with each additional hour worked decreasing the likelihood of an adult offending record by about 4% (logit coefficient=-.045; Std. error=.009; odds ratio=.956). For graduates, on the other hand, the effect of number of hours worked per week is near 0 and it is not statistically significant (logit coefficient=.000; Std. error=.032; odds ratio=1.000).<sup>39</sup> Consistent with my prior finding that having a job only benefits dropouts not graduates, increased number of hours worked per week also has a significant and negative effect on adult offending only for dropouts, not for graduates.

Figure 5.6 presents the relationship between the number of hours worked per week and the predicted probability of having an adult offending record for both graduates and dropouts. The circle-connected line represents this relationship for graduates, and the square-connected line represents this relationship for dropouts. For graduates, the relationship between the number of hours worked and the predicted probability of adult offending is shown as a flat line, indicating lack of relationship. For dropouts, as the number of hours worked

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<sup>39</sup> In order to test the different effects of work hours on offending for graduates and dropouts, I regress offending on the number of hours worked per week separately for graduates and dropouts.



per week increases, the predicted probability of adult offending decreases and such a relationship appears approximately linear.

In addition to odds ratios, I also computed predicted probabilities of having an adult offending record for different groups in the sample. From results in model 6, I computed the predicted probabilities for six groups: 1) dropouts who do not work, 2) dropouts who work 20 hours per week, 3) dropouts who work 40 hours per week, 4) graduates who do not work, 5) graduates who work 20 hours per week, and 6) graduates who work 40 hours per week. These predicted probabilities are presented in Figure 5.7. High school dropouts have a much higher predicted probability of adult offending than high school graduates, regardless of the number of hours worked per week. For dropouts, working more hours a week decreases the predicted probability of adult offending. Those who work 40 hours per week are only half as likely to have an adult offending record as those who work 20 hours per week (.187 vs. .362), and those who work 20 hours per week are only half as likely to have an adult record as those who do not work (.362 vs. .583). However, for graduates, the predicted probability of adult offending is about the same regardless of the number of hours worked (about .036 for all three groups). Interestingly, although working more hours a week significantly reduces the probability of offending for dropouts, dropouts who work 40 hours per week still have a much higher probability of having an adult record than graduates who do not work at all. This result indicates that despite the fact that graduates on average work more hours than dropouts, working more hours per week only benefits dropouts but not graduates. In addition, although

working more hours can substantially benefit dropouts, dropouts are still substantially more likely to offend as adults than graduates.

Given that number of hours worked per week is predicted by graduation status, I also computed the predicted number of hours worked per week and the predicted probabilities of having an adult offending record for both high school graduates and dropouts. High school dropouts work on average 23 hours per week, and, in turn, have an average of .33 probability of offending as adults. High school graduates, on the other hand, work on average 29 hours per week, and, in turn, have an average of .04 probability of offending as adults.

In summary, the results suggest that the number of hours worked per week partially mediates the effect of graduation on adult offending. In other words, the number of hours worked per week helps explain the difference in terms of the likelihood of adult offending between high school graduates and dropouts. However, working more hours is only beneficial for dropouts but not for graduates. Despite such a finding, dropouts who work full time are still considerably more likely to offend as adults than graduates.

### **5.5.2 Mediation effect of income**

As shown in Table 5.4, the mean income category is 6 (\$6,000-\$6,999) for all three groups: matched dropouts, matched graduates, and unmatched graduates. The difference between matched dropouts and matched graduates is not significant at a .05 level. In order to test the mediation effect of income (hypothesis *HRQ2-Study II-Employment b*), I regress income on graduation

status (step 2) and adult offending on both graduation status and income (step 3). This model is presented in Figure 5.2c and includes paths 1, 10, and 11. As presented in model 7 (LL=-1180750. 7; df=6) in Table 5.8, although graduating from high school increases income, this effect fails to reach the .05 significance level (coefficient=.444; Std. error=.506). Income has a significant effect on adult offending. When income increases by \$1,000, the odds of adult offending decrease by 23% (logit coefficient=-.262; Std. error=.063; odds ratio=.770).

As the last step, I assess the significance of the indirect path from graduation to adult offending through income, using the joint significance test. Although income has a significant effect on adult offending, the effect of graduation status on income fails to reach the .05 significance level. Therefore, the indirect effect of graduation through income is not significant. In other words, income does not mediate the effect of graduation on adult offending.

In addition to the mediation effect of income, I also tested whether increased income is equally beneficial for graduates and for dropouts, by including the interaction between income and graduation status in predicting the likelihood of adult offending. This model is presented in Figure 5.2c and includes paths 1, 10, 11, and 12. As shown in model 8 (LL=-1180139. 6; df=7), the interaction between income and graduation status is borderline significant at a .10 level (logit coefficient=.134; Std. error=.095), indicating that income has different effects for graduates and for dropouts.

For dropouts, income has a significant effect on adult offending, with a \$1,000 increase in income decreasing the odds of having an adult offending

record by about 25% (logit coefficient=-.287; Std. error=.063; odds ratio=.751). For graduates, on the other hand, the effect of income on offending is not statistically significant (logit coefficient=-.153; Std. error=.095; odds ratio=.858).<sup>40</sup> Consistent with the findings regarding having a job and the number of hours worked per week, income has a significant and negative effect on adult offending only for dropouts, but not for graduates.

In summary, the results suggest that although income has a significant effect on adult offending, it does not mediate the effect of graduation on adult offending. In addition, a higher income is beneficial in reducing the likelihood of adult offending only for dropouts, but not for graduates.

### **5.5.3 Mediation effect of number of hours worked per week and income together**

In the last sub-section, I concluded income does not mediate the effect of high school graduation on adult offending. As discussed in the present study chapter, income is closely related to the number of hours worked per week; a higher number of hours worked per week leads to a higher income. Therefore, it is possible that income may mediate the graduation effect through the number of hours worked. In this sub section, I tested hypothesis *HRQ2-study II-Employment c*, that is, whether hours worked per week and income together mediate the effect of high school graduation on adult offending (three-path mediation effect).

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<sup>40</sup> In order to test the different effects of income on offending, I regress offending on income separately for graduates and dropouts.

This model is presented in Figure 5.2c and includes paths 1, 7, 8, 9,10,11,12, and 13. This model is shown in Table 5.8 as model 9 (LL=-2729952.8; df=13).

In order for the three-path mediation effect to be significant, all three paths – graduation status predicting number of hours worked per week (path 7), the number of hours worked per week predicting income (path 13), and income predicting adult offending (path 11) – have to be significant (MacKinnon et al 2002). As discussed above, graduation status has a significant effect on the number of hours worked per week, with graduates on average working six hours more than dropouts (coefficient=6.092; Std. error=2.150).

In order to test whether the number of hours worked per week predicts income, I regress income on the number of hours worked per week while controlling for graduation status. It was found that the number of hours worked per week has a significant effect on income. For every additional hour worked per week, income increases by about \$100 (coefficient=.106; Std. error=.009). When the number of hours worked per week changes from 0 to 20 hours or from 20 hours to 40 hours, income increases by \$2,000. I then regress adult offending on income, controlling for graduation status, the number of hours worked per week, the interaction between work hours and graduation, and the interaction between income and graduation. All else equal, income was found to have a significant effect on adult offending. When income increases by \$1,000, the odds of adult offending decrease by 20% (logit coefficient=-.242; Std. error=.063; odds ratio=.785). The three-path mediation effect of high school graduation on adult offending through both the number of hours worked and income together is -

.156.<sup>41</sup> Such a mediation effect is significant because the following effects are significant: graduation on the number of hours worked per week, the number of hours worked per week on income, and income on adult offending. Figure 5.4 provides a graphic representation of the relationship between high school graduation, the number of hours worked per week, income, and adult offending.

In summary, the results from model 9 provide support for my hypothesis *HRQ2-Study II-Employment c*. I conclude that hours worked per week and income together mediate the effect of high school graduation on adult offending, i.e., high school graduates are more likely to work more hours per week, which results in higher income, and, in turn, are less likely to commit crime as adults.

## **Section 5.6: RQ2-Study II-Relationships**

In addition to finding that being married reduces the likelihood of offending, previous studies have also documented the relationship between certain aspects of marriage and offending behavior. For example, Simons et al. (2002) found that spousal interaction is significantly related to one's criminal involvement, with warm and caring relationships leading to less criminal behavior. In this sub-section, I will provide results to answer the second part of the second research question, i.e., whether specific aspects of intimate relationships mediate the effect of high school graduation on adult offending. In this section, I will focus on minor negative interactions with a partner,

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<sup>41</sup>  $.106 * 6.092 * (-.242) = -.156$ .

commitment to the relationship, and the perceived importance of intimate relationships in interpreting their mediation effects for the reasons I discussed in the method chapter.

### **5.6.1 Mediation effect of minor negative interaction with partner**

As presented in Table 5.4, the average negative interaction with a partner is about the same for matched graduates and dropouts (1.95 versus 1.97), and the difference is not statistically significant at a .05 level. This number is slightly lower for the unmatched graduates (1.85). In order to test the mediation effect of minor negative interaction with a partner (hypothesis *HRQ2-Study II-Relationship a*), I regress minor negative interaction on graduation status (step 2) and adult offending on both graduation status and minor negative interaction (step 3). This model is presented in Figure 5.2d and includes paths 1, 14, and 15.

As presented in model 10 (LL=-405140.6; df=6) in Table 5.9, graduation status does not predict the frequency of minor negative interaction with a partner (coefficient=-.012; Std. error=.063). Minor negative interaction has a significant effect on adult offending. Having frequent minor negative interaction with one's partner increases the likelihood of adult offending. For each one unit increase on the minor negative interaction scale, the odds of adult offending increase two times (logit coefficient=.751; Std. error=.379; odds ratio=2.119).

As the last step, I assess the significance of such an indirect path from graduation to adult offending through minor negative interaction. Although minor negative interaction has a significant effect on adult offending, the effect of

graduation status on minor negative interaction fails to reach the .05 significance level. Therefore, the indirect effect of graduation through minor negative interaction with one's partner is not significant. In other words, minor negative interaction does not mediate the effect of graduation on adult offending. In summary, the results suggest that although minor negative interaction has a significant effect on adult offending, it does not mediate the effect of graduation on adult offending.<sup>42</sup>

### **5.6.2 Mediation effect of commitment to the relationship**

As presented in Table 5.4, while 80% of matched graduates are committed to the intimate relationship in which they are involved, this number is slightly higher for dropouts (85.8%). However, such a difference is not statistically significant at a .05 level. About 76.8% of unmatched graduates are committed to an intimate relationship. The percentage of each category is also shown the table. The majority of the sample answered "seeing only this person." In order to test whether being committed to the relationship partially mediates the effect of graduation on adult offending (hypothesis *HRQ2-Study II-Relationship b*), I regress commitment on graduation status, and adult offending on both graduation status and commitment. This model is presented in Figure 5.2d and includes paths 1, 16, and 17. As presented in model 11 (LL=-551762.7; df=6) in

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<sup>42</sup> Given the low variability of negative interaction, commitment, and importance, I did not probe for interactions between these variables and graduation status.



Table 5.9, the effect of graduation on commitment is borderline significant at a .05 significance level (logit coefficient=-.057; Std. error=.032; odds ratio=.945).<sup>43</sup>

Commitment has a borderline significant effect on adult offending. Being committed to an intimate relationship decreases the likelihood of adult offending by about 50% (logit coefficient=-.745; Std. error=.411; odds ratio=.475). As the last step, I assess the significance of the indirect path from graduation to adult offending through commitment to one's relationship. Since both the effect of graduation on commitment and the effect of commitment on adult offending are borderline significant, the mediation effect of perceived importance is borderline significant.<sup>44</sup>

### **5.6.3 Mediation effect of perceived importance of intimate relationships**

As presented in Table 5.4, compared to matched dropouts, a higher percentage of dropouts perceive relationships as important (87.9% versus 78.2%), and this effect is significant at a .05 level.<sup>45</sup> An even lower percentage of unmatched graduates perceive relationships as important (77.8%). The percentage of each category is also shown the table. The majority of the sample answered "pretty much" or "very much." In order to test the mediation effect of perceived importance of relationships (hypothesis *HRQ2-Study II-Relationship c*),

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<sup>43</sup> Although this effect is borderline significant, the effect size is relatively small. Moreover, when including only those who were in a relationship, the effect failed to reach a .10 significance level.

<sup>44</sup> Although the mediation effect is borderline significant, it is not substantively meaningful because the effect size of graduation on commitment is relatively small, and it became non-significant when including only those who were in a relationship.

<sup>45</sup> When including only those who were in a relationship (N=239), the difference between matched graduates and matched dropouts became non-significant.

I regress importance of relationships on graduation status (step 2) and adult offending on both graduation status and importance (step 3). This model is presented in Figure 5.2d and includes paths 1, 18 and 19. As shown in model 12 (LL=-695839.2; df=6) in Table 5.9, the effect of graduation is significant at a .01 level (logit coefficient=-.099; Std. error=.032; odds ratio=.906)<sup>46</sup>.

Importance of a relationship has a significant effect on adult offending. Perceiving intimate relationships significantly reduces the likelihood of adult offending by almost 60% (logit coefficient=-.869; Std. error=.411; odds ratio=.419.) As the last step, I assess the significance of the indirect path from graduation to adult offending through importance of a relationship. Since both the effect of graduation on perceived importance and the effect of perceived importance on adult offending are significant, the mediation effect of perceived importance is statistically significant.<sup>47</sup>

## **Section 5.7: Post Hoc Analyses**

Apart from the above two main research questions, I also make an attempt to address two additional issues discussed in the literature review: the possible mediation effect of attending college and the heterogeneity of high school graduates. However, given the limitation of the data, I was not able to

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<sup>46</sup> Although this effect is borderline significant, the effect size is relatively small. Moreover, when including only those who were in a relationship, the effect failed to reach a .10 significance level.

<sup>47</sup> Although the mediation effect reached significance level, it is not substantively meaningful because the effect size of graduation on perceived importance is relatively small, and it became non-significant when including only those who were in a relationship.

conduct sophisticated analyses, and, therefore, I conduct post hoc analyses in an attempt to address the above-mentioned issues.

The first issue that the post hoc analysis intends to address is that high school graduation may open up opportunities other than steady employment and intimate relationships; one example is attending college. In the first part of the post hoc analysis, I explore whether going to college can explain the effect of high school graduation on adult offending. Table 5.10 presents the percentage comparison of adult offending among different groups. I first compare the percentage of adult offending among graduates who went to college and those who did not go to college. Among the 77 graduates who went to college, none of them offended as adults. Among the 143 graduates who did not go to college, 5.6% offended as adults. The difference between the two percentages is borderline significant (Chi-square P-value=.053), indicating that attending college decreases the likelihood of adult offending. I conclude that attending college helps explain some of the effect of high school graduation on adult offending.<sup>48</sup>

In order to answer the question of whether attending college fully explains the effect of high school graduation, I then compare the percentage of adult offending between graduates who did not go to college and high school dropouts.<sup>49</sup> Among the 141 dropouts, 36% offended as adults. This number is substantially higher than the percentage of adult offending among graduates who

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<sup>48</sup> Since high school graduation perfectly predicts college attendance, and college attending perfectly predicts offending in this sample, it is statistically impossible for me to conduct a mediation analysis to test the mediation effect of attending college.

<sup>49</sup> If attending college fully explains the relationship between graduation and offending, high school graduates who did not attend college should have the same likelihood of offending as high school dropouts.

did not go to college (5.6%). This indicates that apart from the effect of attending college, high school graduation has a direct effect on adult offending. In summary, attending college only partially explains the effect of high school graduation on adult offending.

The second part of the post hoc analysis intends to explore the heterogeneity of high school graduates. As discussed in the literature review, high school graduates are not a homogeneous group. There may be different groups of graduates, for whom high school graduation may open up different opportunities. For some, high school graduation provides an opportunity for college education; for others, it opens up an avenue for long-term employment. For example, past studies have made a distinction between college-bound-graduates and non college-bound-graduates (or “stay-ins”), and non college-bound-graduates are nearly indistinguishable from dropouts on earlier processes (Bachman et al 1971; Wehlage and Rutter 1986). The results from the propensity score suggest that there is a group of graduates (n=99) for whom there are no closely matched dropouts. As shown in Table 5.2, these unmatched graduates are different from matched graduates on most of the covariates used to estimate the propensity scores.

In this part of the post hoc analysis, I compared the matched and unmatched graduates in terms of their likelihood of attending college and having a job. As shown in Table 5.11, the likelihood of attending college is significantly higher among unmatched graduates than among matched graduates. While two thirds of the unmatched graduates went to college, only one third of the matched

graduates went to college. In terms of the likelihood of having a job, matched graduates are similar to unmatched graduates (74.1% versus 81.8%). These results are consistent with the speculation about different groups of high school graduates. The two groups differ in their likelihood of attending college, but are similar in their likelihood of having a job.

## CHAPTER 6: DISCUSSION

In his March 10th, 2009 speech on educational reforms, President Obama urged Congress to invest in “developing new strategies to make sure at-risk students don't give up on their education; new efforts to give dropouts who want to return to school the help they need to graduate; and new ways to put those young men and women who have left school back on a pathway to graduation” (Remarks by the president to the Hispanic Chamber of Commerce on a complete and competitive American Education, March 10<sup>th</sup>, 2009). His speech refers to the well-known differences between high school graduates and dropouts in terms of their academic achievement, employment opportunities, antisocial and criminal behavior, as well as their general quality of life. A high school diploma is believed to protect individuals from various negative outcomes in life and involvement in criminal behavior in particular.

Guided by the general theoretical paradigm of life course criminology, this study investigates the relationship between high school graduation and adult offending. This dissertation builds upon the idea of turning points in reducing offending behavior and extends this idea from adulthood to late adolescence/early adulthood. In the conceptual foundation of this dissertation, two types of turning points are discussed, those that change life circumstances and those that open up opportunities. High school graduation can be studied as a second type of turning point that opens up future opportunities (e.g., employment, secondary education, and intimate relationships).

There are two main goals of this dissertation. The first goal is to examine whether high school graduation causally reduces adult offending behavior, given that the differences between high school graduates and dropouts can be traced to as early as the first grade of elementary school (Alexander et al. 2001). If graduating from high school reduces the likelihood of adult offending above and beyond the influence of early differences, policies should be tailored toward investing in at-risk students and encouraging them to graduate from high school. Otherwise, efforts should be focused on early processes that lead to both non-graduation and adult offending.

The second goal of this dissertation is to examine the mechanisms of the effect of high school graduation. Steady employment and stable marital relationships (Lloyd and South 1995; Monk-Turner 1989; Siennick and Staff 2008) are the most frequently discussed positive outcomes of high school graduation. Past studies (Farrington et al. 1986; Thornberry et al. 1985) have also discussed the potential indirect effect of high school graduation on adult offending through employment. This study examines whether and to what extent employment and intimate relationships mediate the relationship between graduation and adult offending.

## **Section 6.1: The Causal Effect of High School Graduation on Adult Offending**

In my first research question, I investigate whether high school graduation has a causal effect on early adult offending, after taking into consideration early processes such as aggressive behavior, family background, school performance, and juvenile delinquency. I test two competing hypotheses. The first hypothesis is derived from the general theory of crime, that is, not graduating from high school and adult offending can both be explained by prior processes. For example, dropouts have a long history of poor academic performance and antisocial behavior, which may account for the observed differences in offending between dropouts and graduates.

The second hypothesis is that high school graduation reduces adult offending, even after taking into account prior processes that lead to both dropping out and adult offending. Using a sample of 460 predominately minority urban males, it was found that those individuals who graduated from high school displayed a significantly lower likelihood of having an adult offending record during early adulthood compared to dropouts. In fact, high school graduates are about 93% less likely to have an adult record than high school dropouts.

This finding is consistent with past studies that found dropping out of high school increases adult offending or graduating from high school decreases adult offending (Bridgeland et al. 2006; Eggleston and Laub 2002; Farrington et al. 1986; Thornberry et al. 1985). For example, Eggleston and Laub (2002) found that graduating from high school significantly reduces adult offending, and this



effect is the same for those with or without a delinquent past. Bridgeland et al. (2006) reported that dropouts are eight times more likely to be incarcerated than graduates. However, this finding is contradictory to other studies that either found that dropout reduces delinquency (Elliott 1966; Elliott and Voss 1974; Mukherjee 1971) or no effect of high school dropout (Bachman et al. 1971; Drapela 2005; Krohn et al. 1995; Sweeten 2006; Sweeten et al. 2009). However, most of the past studies did not adequately take into account the pre-dropout differences (with the exception of recent studies such as Sweeten 2006 and Sweeten et al. 2009). Importantly, most of the previous studies did not use propensity score matching or instrumental variables to study the causal effect of high school graduation/dropout, with the exception of Sweeten (2006). As a result, most of the past studies are not equipped to study the causal relationship between graduation and offending.

As argued in the literature review, a potential threat to the study of the causal effect of turning points is selection bias, i.e., changes in offending behavior are due to the unobserved characteristics of the person rather than the occurrence of turning points. As Sampson and Laub (2005) argued, the biggest challenge to studying the effect of any social state is to account for the nonrandom selection of individuals into that state. Selection bias is also the main source of doubt about whether events in adulthood influence offending (e.g., Gottfredson and Hirschi 1990). In order to control for selection bias, this study uses propensity score analysis, which creates a quasi-experimental situation where graduates and dropouts are matched on an array of prior predictors.

Consequently, the causal effect of graduation on adult offending can be estimated among matched individuals. The propensity score analysis allows causal inferences about the effect of high school graduation on adult offending.

In a recent dissertation, Sweeten (2006) explores the causal effect of high school dropout on adult offending, using the same method on a sample from the 1997 National Longitudinal Survey of Youth. However, their finding is inconsistent with this study; although propensity score matching achieved balance, the effect of dropping out was not significantly different from zero. It was concluded that dropout does not have a causal effect on adult offending. I attribute this inconsistency to the different populations on which the two studies were based.

While the sample in Sweeten's study is a population-based sample from the National Longitudinal Survey of Youth, the sample used in this study consists of predominately poor, urban, African-American youth from inner city Baltimore, Maryland. Baltimore is a city with not only a higher than national average dropout rate, but also higher than national average childhood poverty, percentage of births to teen mothers, percentage of low birth weight babies, infant mortality, and juvenile and adult arrest rates (Annie E. Casey Foundation 1997; Alexander et al. 2001). As suggested by Sweeten (2006), it may be fruitful to apply the matching method to a sample dominated by inner city minorities with higher dropout rates, as the effect of life events may vary with social context. In inner city areas with much higher than national average dropout rates, the benefits of graduating from high school may be dramatically different. Using a sample from

inner city Baltimore where the dropout rate is over 30% (compared to the national average of 14%), this dissertation provides support for Sweeten's speculation, and, in turn, complements his findings.

This dissertation also went beyond past studies in testing the robustness of the causal effect. A common criticism of propensity score matching is that the causal effect observed may be subject to selection bias, caused by an omitted covariate in the propensity score estimation. As discussed in detail in the methods chapter, propensity score matching is not immune to hidden bias due to unobserved differences between the treated and control cases. In this study, after matching the graduates and dropouts based on a series of covariates, graduation is found to reduce adult offending. However, such an effect may be partly due to some omitted covariates, such as parental monitoring and association with delinquent peers. These omitted covariates may affect both graduation as the treatment and adult offending as the outcome. As a result, the observed relationship between graduation and adult offending may be spurious. Using a new method of sensitivity analysis (Rosenbaum and Rubin 1983a; Harding 2003), this study shows that in this sample, the causal effect of high school graduation is robust to such a selection bias due to omitted covariates. Although the effect size of high school graduation appears smaller when controlling for a hypothetical omitted variable with unreasonably strong effects on both graduation and adult offending, it remains significant.

## **Section 6.2: The Mediation Effect of Employment**

Building upon established evidence regarding the direct effect of high school graduation on adult offending, a second important goal of this study was to investigate the mechanisms through which graduation influences adult offending behavior. High school graduation, as a second type of turning point, may open up employment opportunities, and thus part of the relationship between high school graduation and adult offending may be mediated through employment. Two theories, human capital theory and informal social control theory, provide possible explanations for the relationship between educational attainment, employment, and adult offending behavior. The human capital approach suggests that educational attainment increases individuals' human capital, which leads to more favorable economic outcomes, such as higher income and shorter periods of unemployment. The increased level of human capital raises costs and decreases benefits associated with criminal behavior and punishment resulting from such behavior, therefore reducing involvement in criminal behavior. Informal social control theory suggests that education increases social capital imbedded in social networks, which increases one's attachment and commitment to work, which in turn reduces the likelihood of adult offending.

Several hypotheses were tested in order to answer the questions whether and how much of the graduation effect is mediated through having a job during early adulthood, as well as the number of hours worked per week and income. In

addition, I also tested whether employment benefits both graduates and dropouts to the same degree. Findings indicate that employment partially mediates the relationship between graduation and offending. However, contradictory to my prediction, employment only benefits high school dropouts, but not graduates.

The most important findings regarding the mediation effects of employment are as follows: First, having a job partially mediates the graduation effect, i.e., graduates are twice as likely to have a job and being employed reduces the odds of adult offending by about 70%. Being employed mediates about 23% of the total effect of high school graduation on adult offending.

Second, an increased number of hours worked per week partially mediates the graduation effect, i.e., high school graduates on average work six hours more per week compared to high school dropouts. When the number of hours worked changes from 0 to part time, or from part time to full time, the odds of adult offending decrease by 60%. Each additional hour worked per week mediates about 7.5% of the total effect of high school graduation on adult offending.

Third, although income by itself does not mediate the graduation effect, it mediates the graduation effect when combined with the number of hours worked per week. Compared to dropouts, high school graduates work more hours per week, which leads to higher income. When the number of hours worked per week changed from 0 to 20 hours or from 20 to 40 hours, income increases by \$2,000. A higher income, in turn, decreases the likelihood of adult offending. A \$1,000 increase in income results in 20% reduction in the odds of adult

offending. Having a job, income, and number of hours worked per week reduce adult offending only for dropouts, but not for graduates.

The finding that high school graduation opens up employment opportunities is consistent with the body of literature on the positive relationship between education, employment opportunities, and income (Lerner and Galambos 1998; Lochner and Moretti 2004; Monk-Turner 1989; Rutter 1987). As Rutter (1987) has suggested, the decision to stay in school enables at-risk youths to improve their qualifications and open up future occupational opportunities, perhaps in turn, redirecting a risky trajectory to a more adaptive pathway. In contrast, those who drop out of high school lose opportunities to experience protective processes such as employment. The finding that employment, as a traditionally defined turning point, reduces the likelihood of adult offending provides support for Sampson and Laub's age-graded social control theory. This finding is in line with empirical research (Bushway and Reuter 1997; Haynie et al. 2008; Laub and Sampson 2003; Paternoster et al. 2003; Sampson and Laub 1993; Savolainen et al. 2009; Uggen 1999, 2000; Uggen and Staff 2001; Uggen and Wakefield 2008; Wright and Cullen 2004) that found negative association between successful employment and involvement in criminal behavior.

The finding that employment helps explain the graduation-offending relationship is also consistent with past studies that suggest post-school experience may explain part of the effect of high school graduation (Farrington et al. 1986; Thornberry et al. 1985). Methodologically, most of the past studies

tested the effect of post-school experiences, either by including them as covariates in the regression models (Thornberry et al. 1985; Jarjoura 1993, 1996) or by simply comparing offending rates during periods of employment and unemployment (Farrington et al. 1986; Elliott and Voss 1974). This study uses a recommended method, mediation analysis, to test not only whether but also to what extent employment mediates the relationship between graduation and adult offending. It not only tests whether, controlling for graduation, having a job reduces adult offending, but also tests whether graduation has a significant effect on employment status. Therefore, the results provide a more complete picture. In addition, the mediation analysis allows a test of how much of the total effect of graduation is mediated by employment. Although a considerable percentage of the total graduation effect is mediated through employment, there is still a substantially direct effect of graduation on adult offending.

This study went beyond past studies on the mediating effect of employment by further investigating what job characteristics mediate the graduation-offending relationship. The finding that certain aspects of employment – the number of hours worked per week (as a measure of attachment and commitment to work) and income (as a measure of human capital) – decrease the likelihood of adult offending is consistent with past research on the relationships between different aspects of employment and offending (Laub and Sampson 2003; Sampson and Laub 1993; Uggen 1999). For example, Sampson and Laub (1993) found that quality of employment, measured by a scale

composed of employment status, stability of employment, and work habits, significantly reduces offending.

Findings provide support for both human capital and informal social control theories in explaining the relationship between education, work, and crime. On one hand, the finding that the number of hours worked per week partially mediates the effect of graduation supports informal social control theory. Increased number of hours worked per week indicates stronger attachment and commitment to work, as a conventional social institution. Such attachment and commitment to work reduces the likelihood of offending. On the other hand, the finding that income partially mediates the effect of number of hours worked per week on adult offending is consistent with human capital theory. Higher income, as a favorable economic outcome, is a reflection of increased human capital, which increases the costs and decreases the benefits associated with criminal behavior and punishment resulting from such behavior, therefore reducing the likelihood of offending.

This study also went beyond past studies in investigating whether employment has the same effect for graduates and dropouts. The findings indicate that employment does not benefit graduates and dropouts equally. Having a job, the number of hours worked per week, and income reduce the likelihood of adult offending only for dropouts, but not for graduates. This finding is consistent with past findings that the effect of dropping out depends on the reasons for doing so (Jarjoura 1993, 1996; Sweeten 2004; Sweeten et al. 2009). Some students leave school simply because they find schoolwork uninteresting,



but other students take on different positive roles such as worker, partner, or parent. Drawing on identity theory, Sweeten et al. (2009) found that those who drop out to get stable employment are moving in a positive direction. For these youths, dropping out does not increase criminal behavior. The findings in this study indicate that the likelihood of offending for dropouts with employment is only half as high as dropouts without employment. In addition, dropouts who work full time are only 50% as likely to offend as adults as dropouts who only work part time.

### **Section 6.3: The Mediation Effect of Intimate Relationships**

In addition to employment, high school graduation may be related to forming intimate relationships with pro-social peers. This study investigates whether and to what extent the relationship between high school graduation and adult offending may be mediated through intimate relationships. Informal social control theory provides an explanation for how high school graduation may be related to intimate relationships. According to informal social control theory, the successful completion of high school increases attachment to conventional institutions such as marriage and romantic relationships, which, in turn, reduces the likelihood of adult offending.

Several hypotheses were tested in order to determine whether and to what extent the graduation effect is mediated through being involved in an intimate relationship, negative interaction with one's partner, commitment to the

relationship, and perceived importance of intimate relationships. Contradictory to what I hypothesized, intimate relationships do not mediate the relationship between graduation and offending. In particular, I found several important findings.

First, although high school graduates are more likely to be involved in a romantic relationship, being involved in a romantic relationship does not have a significant effect on adult offending. Second, although negative interaction with one's partner, commitment to the relationship, and perceived importance of intimate relationships all have significant effects on adult offending in the expected directions, high school graduation status has either non-significant or significant but trivial effects on these variables. These findings indicate that intimate relationships do not mediate the relationship between graduation and adult offending in this sample.

The finding that high school graduates are more likely to be involved in a romantic relationship is consistent with past findings that men's economic and educational circumstances, such as their job stability and educational attainment, affect both their own marital intentions and their attractiveness to potential partners (Mare and Windhip 1991; Oppenheimer et al. 1993; Wilson 1987). In particular, the employment and education status of potential husbands are of particular importance for women seeking partners (Fossett and Kiecolt 1991; Lichter et al. 1992; South and Lloyd 1992b; Wilson 1987). Negative interaction (as a measure of quality of a relationship), relationship commitment, and perceived importance of a relationship reduce the likelihood of adult offending,

but simply being involved in a romantic relationship does not. This finding is in line with Sampson and Laub's (1993) conclusion that merely being married is not enough to reduce offending, and only men who are attached to their spouses benefit from the crime reducing effect of marriage. Such a finding provides support for informal social control theory in explaining the effect of marriage or romantic relationships on offending behavior.

The finding that being involved in an intimate relationship does not reduce offending is inconsistent with some of the life course research that found marriage to have a significant effect on offending (Horney et al. 1995; Laub and Sampson 2003; Sampson et al. 2006; Warr 1998). I speculate three reasons for such an inconsistency. First, the sample in this study is substantially younger than the samples in most studies on marriage effect. Given the relatively young age group, only 1% of the graduates and 2% of the dropouts were married at the time of the Young Adult Survey (which was conducted at the average age of 20). While most of the studies on relationship effect focus on the effect of being married, I study the effect of being in a romantic relationship. As found in the past (Horney et al. 1995; Duncan et al. 2003), living together does not reduce criminal behavior to the same extent as being married does. Studies that focus on younger populations (Thornberry et al. 1985) also found non-significant effects of being married. Therefore, given that the majority of the sample is relatively young and not married, such a finding is to be expected.

Second, although I could not study the length of their relationships, I speculate given their relatively young age at the time of the survey, the intimate

relationships they were referring to may not be long enough to have an impact on their offending behavior. Third, measurement error is likely to be present in the measure of “being involved in a relationship.” The measure of “being involved in a relationship” is much more ambiguous than marital status. Individuals may interpret “being involved in an intimate relationship” differently.

Another finding that is contradictory to my prediction is that high school graduation has either a non-significant influence or a significant but trivial influence on the quality of relationships, commitment to a relationship, and perceived importance of relationships. This conclusion may be due to the fact that there is very little variability in these specific aspects of intimate relationships. For example, over 80% of the sample claimed to be committed to the relationship in which they were involved, and over 80% of the sample perceived intimate relationships as important. Such lack of variability could also be an artifact due to the relatively young age of the sample.

Compared to employment, there has been much less research on how marriage or romantic relationships help explain the effect of graduation on offending, and findings have been inconsistent. While some studies (such as Thornberry et al. 1985) found that marriage does not help explain such an effect, others studies (e.g., Jarjoura 1993, 1996) found the opposite. However, these studies tested the effect of post- school experiences by including them as covariates in the regression models. This study uses mediation analysis to test the mediation effect of romantic relationships. However, as discussed above, due to the relatively young age of the sample and possible error in the relationship

measures, I could not detect any significant and meaningful mediation effect of romantic relationships. Future studies should apply mediation analysis to a different sample and test whether marriage or long-term romantic relationships mediate the graduation effect.

## **Section 6.4: Implications**

### **6.4.1 Implications for life course criminology**

Drawing on the life course paradigm (Elder 1985), Sampson and Laub (2005) conceptualize a turning point as “an alteration or deflection in a long-term pathway or trajectory that was initiated at an earlier point in time” (16). They found that regardless of prior differences in criminal propensities, adult turning points, such as marriage and employment, can counteract risk accumulation during childhood and adolescence, redirect individual offending trajectories, and ultimately facilitate desistance from crime. The idea of turning points is crucial in understanding changes in individual offending behavior.

This dissertation is guided by the theoretical framework of life course criminology, with a focus on the concept of turning points. In the literature review, I raise three remaining issues related to turning points: the definition, clarification, and criteria of turning points, the focus on adulthood, and other types of turning points. Through studying the causal effect of high school graduation as a turning point that opens up opportunities in late adolescence/early adulthood, I make an attempt to address these three issues. This study contributes to life course criminology by reintroducing the importance of late adolescence/early adulthood

into the life course framework; it also contributes to study of the high school graduation-offending relationship by incorporating the idea of turning points in life course criminology.

Is high school graduation a turning point? An important criterion for a turning point is that it leads to change rather than continuity (Pickles and Rutter 1991). In order to determine whether high school graduation is a turning point, we must answer this question: Does high school graduation lead to change, or is it rather a continuation of the past? The biggest challenge in answering this question is to fully take into account the selection bias involved in high school graduation. The matching method used in this study creates a quasi-experimental situation where graduates resemble dropouts on an array of prior processes. It was found that high school graduation significantly reduces the likelihood of adult offending, and that such an effect is robust to selection bias due to omitted covariates in the propensity score estimation. Based on such a robust finding, it is safe to conclude that high school graduation does lead to change and is a turning point. A caveat in such a conclusion is that this finding is based on a matched sample, i.e., such a conclusion only speaks to those graduates who resemble dropouts in terms of prior processes.

Such a finding is also in line with past literature on the heterogeneity among high school graduates. Past studies (Bachman et al. 1971; Wehlage and Rutter 1986) have suggested two distinct groups of high school graduates, college-bound graduates and non-college-bound graduates or “stay-ins.” These “stay-ins” share many similar characteristics and academic experiences with

dropouts. The matched graduates in this sample represent the group of “stay-ins.” For these graduates, the decision to stay in school enables at-risk youths to improve their qualifications and open up future occupational opportunities, possibly redirecting a risky trajectory to a more adaptive pathway (Rutter 1987).

The unmatched graduates in this study represent the college-bound graduates. They displayed better academic achievement and less antisocial behavior before graduation than the matched graduates and dropouts, and their likelihood of attending college is twice as high as the matched graduates. For these graduates, graduation is more a continuation of their superior academic performance and more conventional behavior before graduation. In conclusion, the answer to the question of whether high school graduation is a turning point is two-fold. For at-risk youth who are candidates for dropping out, staying at school and finishing their degree is a turning point; for youths who are not likely to drop out of high school, graduation is more a continuation of their past behavior.

The finding that high school graduation is a turning point for at-risk youth supports the age-graded informal social control theoretical framework. The mechanisms discovered to explain the effects of adult turning points can also provide reasonable explanations for the mechanisms of high school graduation. For example, the effect of high school graduation can be explained by increased social control. Youths who graduated from high school have already invested considerable time and energy in education as a conventional institution. Graduation from high school signals the benefit of such a commitment and may

encourage youths to continue to invest in other conventional social institutions (Hirschi 1969).

In this dissertation, I do not only speculate on the mechanisms through which high school graduation influences adult offending, but also empirically test them. I explore how employment and intimate relationships, as two possible opportunities high school graduation may offer, mediate the relationship between high school graduation and adult offending. An important finding regarding the mechanisms of graduation effect is that employment helps explain some of the differences in offending behavior between graduates and dropouts. While employment explains part of such difference, the biggest observed difference in the predicted probability of adult offending is between high school graduates and dropouts.

Interestingly, although high school graduates are twice as likely to find a job, work more hours per week, and, in turn, make a higher income than dropouts, none of these variables further reduces their likelihood of offending. This indicates that the effect of graduating from high school is so strong that it is difficult for post-graduation experiences to explain such a strong effect. It is possible that a high school diploma may have a ceremonial effect by sending a message that the student has the ability to overcome difficult times and adversity, and, in turn, provides psychological benefits (Natsuaki et al. 2008). Although I could not formally test whether going to college mediates the effect of high school graduation, the post hoc analysis indicates that going to college further



reduces the likelihood of offending to 0. It is possible that going to college is another turning point for high school graduates.

For high school dropouts, on the other hand, having a job, working more hours per week, and income all significantly reduce their likelihood of offending. This indicates that for dropouts, employment may be another turning point in reducing adult offending. This is consistent with Sampson and Laub's (1993) theory as well as most of the theories and empirical research in life course criminology. Although age-graded social control theory supports the argument that individuals with criminal tendencies are less likely to establish strong social bonds, such as successful employment, Sampson and colleagues maintain their position that "‘good’ things sometimes happen to ‘bad’ actors, and when they do desistance has a chance" (Laub et al 1998, 237).

In this dissertation, it was found that although successful employment may be a turning point for dropouts, ironically dropouts are much less likely to experience such a turning point than high school graduates. It is possible that at the time of the Gluecks' (1950) sample, everyone had more or less equal opportunities to secure employment. However, in today's society, dropping out of high school has a similar stigmatizing effect as having a criminal record, and those who drop out carry this effect with them as they seek employment. This indicates that although "good" things may happen to "bad" actors, "good" things do not happen by chance. It is important to identify why turning points occur for some but not others.

The conclusion that being involved in an intimate relationship does not reduce the likelihood of adult offending indicates that the life course paradigm may not be universally applicable. It is possible that at certain developmental periods, such as early young adulthood, some aspects of the paradigm are less relevant.

#### **6.4.2 Policy implications**

Recently, as part of educational reform, the Obama administration launched the task of rewriting the “No Child Left Behind” law, the signature education law of the Bush administration. In a recent speech, President Obama emphasized the importance of ensuring at-risk students stay in school and finish their education. In fact, two major goals of the Obama administration education policies are reducing the high school dropout rate and increasing the number of high school degree holders. The most important finding of this dissertation is that for inner city minority youths who are at great risk of dropping out of high school, the decision to stay in school enables them to overcome difficult times and adversity and redirect a risky trajectory to a more adaptive pathway. Such a finding provides research support for President Obama’s emphasis on the importance of high school graduation, especially for at-risk students.

The finding that, in inner city public schools with a high percentage of minority students, high school graduation has a causal effect in reducing adult offending indicates that efforts should continue to identify important risk factors of dropout. One of the most well known programs that aim at improving educational

outcome is the fast track program. These programs allow high school seniors to earn their diploma and college credits while in high school. Until recently, most of these programs aimed at affluent, overachieving students as a way to keep them challenged and give them a head start on college education.

The goal is different in early college high schools in North Carolina, which enroll only students whose parents did not earn college degrees. The goal is to keep at-risk students in school and to reduce the gap between high school and college. Results are impressive – although not all students earned two full years of college credits before they graduated from high school, few dropped out. This model started by North Carolina has been spreading rapidly to other states, such as California, New York, and Texas. Most early college high schools serve a largely minority, low-income student body. This approach has been seen as a promising avenue in reducing high school dropouts among at-risk students. A recent evaluation of the Early College High School Initiative (prepared for The Bill and Melinda Gates Foundation, jointly by American Institutes for Research and SRI International 2007) found that these schools have a significantly improved graduation rate. The success of early college high schools in reducing dropout indicates that high expectations and challenges can improve academic performance for at-risk students and encourage them to stay at school and finish their education.

Apart from the turning point effect of high school graduation on adult offending, it was also found that for high school dropouts, employment could be another turning point. Acquiring steady employment reduces the likelihood of

adult offending for high school dropouts and provides another opportunity for them to develop a more positive pathway. This finding has important policy implications. Although dropping out of high school substantially increases the likelihood of adult offending, programs can be tailored to reduce such a high likelihood of adult offending by providing job training opportunities. This is consistent with the principle of “never too late” in prevention research.

There have been a good number of successful programs that help high school dropouts obtain job training and secure steady employment throughout the country. For example, a successful job training program for dropouts is the American Conservation and Youth Service Corps (Jastrazb et al. 1996). By providing job training and paid work experiences for high school dropouts, the program has successfully increased employment and decreased participation in criminal activities, especially for African American males.

### **Section 6.5: Limitations**

The current study is characterized by several limitations. The first limitation regards the population to which the findings can be applied. As mentioned above, one of the caveats to the conclusion that high school graduation has a causal effect in reducing adult offending is that it is only applicable to those graduates who are similar to dropouts, i.e. “stay-ins.” As shown in the results chapter, high school graduates are substantially different from dropouts on most of the earlier processes that lead to graduation/dropout. This is consistent with the empirical evidence and indicates that high school

graduation is not a random process. While the matching method successfully addresses the selection bias caused by non-random selection into high school graduation, the casual effect estimated with this method is only applicable to cases that are in the range of common support, i.e., those graduates who share similar school performance and antisocial behavior patterns with dropouts.

One of the standards often used for propensity score matching method is to discard as few cases as possible. Although it would be ideal to discard as few cases as possible, this standard may not be substantively meaningful, especially in a situation where the treatment is clearly non-random (such as high school graduation and incarceration), and when the treated cases are substantially different from the control cases. As Morgan and Harding (2006) argued, excluding some of the treated cases and estimating such a common-support treatment effect can be considered an important substantive finding, and these methods can help clarify the contribution of the study. In such a case, the estimate is the treatment effect for the subset of the treated cases, and it can only be informative about those in treatment and control groups who are similar on the observed covariates used in the propensity score estimation. Focusing on those at the margin of either treatment participation or causal event exposure will shed light on both theoretical and policy implications (also see Heckman and Vytlačil 1999, 2000, 2004).

In this study, since the process of high school dropout is a cumulative process that starts as early as first grade (Alexander et al. 2001), it is reasonable to expect that graduates and dropouts are different on most of the early

processes. As Alexander et al. (2001) pointed out, even in a city like Baltimore, where the dropout rate is substantially higher than the national average, not every kid is at risk for dropping out. The unmatched graduates found in this study represent youths who are not at great risk of dropping out. The reason why these graduates were not matched to any dropouts is that their performance at school is significantly stronger than the matched graduates, and they also displayed considerably less antisocial and delinquent behavior. As a result, they have substantially higher propensity to graduate from high school than both the matched graduates and the matched dropouts. Compared to the matched graduates, these graduates are also more likely to attend college and much less likely to offend as adults. Therefore, it may be misleading to analyze these graduates together with the graduates who share similar academic performance and antisocial behavior patterns with dropouts, and therefore are prime candidates for dropping out.

Another limitation of this study regards the timeframe to which the findings can be applied. Given the relatively young age of the respondents in this sample, the findings can only be applied to late adolescence/early adulthood. There is a lack of variability in terms of the nature and length of their employment. For example, about 80% of those who were working were paid hourly, more than 50% of them had been in their job for less than six months, and more than 70% had been in their job for less than 12 months. The findings may be different when looking at more steady employment at a later point of time. Despite this limitation, both having a job and working more hours per week mediate the relationship

between high school graduation and adult offending. As discussed earlier, such a finding is consistent with research in life course criminology. This indicates that successful employment may serve as a turning point in redirecting individuals' offending trajectories; a finding established in adulthood can be applied to an earlier point in time, early adulthood.

## **Section 6.6: Future Studies**

Due to limitations of the data, there are a few remaining issues which I was not able to address in this dissertation. Future studies on the high school graduation-adult offending relationship should make an effort to address these issues when possible.

### **6.6.1 Reasons for dropout**

As discussed in the literature review, it has been found that students drop out of school for different reasons, such as disliking school, falling behind academically, and financial burdens. Past studies (Jarjoura 1993, 1996; Sweeten 2004; Sweeten et al. 2009) have suggested that dropping out has different effects on offending, depending on the different reasons for dropout. While some reasons for dropping out, such as disliking school, lead to higher delinquency, dropping out followed by successful employment does not lead to higher delinquency. It is important to distinguish different types of dropouts based on reasons for dropping out. Unfortunately, reasons for dropping out are not

provided in the data set used in this study. As a result, I was not able to study dropout effects by reasons for dropping out. However, the finding that employment reduces the likelihood of offending for dropouts supports the speculation that dropping out for employment may have a different effect; this is consistent with the past finding that dropout followed by successful employment does not increase offending. Future studies need to take into account reasons for dropout whenever possible.

### **6.6.2 The timing of graduation**

Some programs are designed to encourage high school dropouts to re-enroll in school and finish their education. An example of such a program is National Guard Youth ChalleNGe Program, which provides academic training for high school dropouts (Bloom and Millenky forthcoming). Early results show a significantly larger percentage of dropouts in the program group earned high school diplomas, compared to dropouts in the control group. This and other programs with the goal of re-enrolling high school dropouts in school are based on the assumption that regardless of the timing, high school graduation can lead to more positive outcomes. However, there has not been much research on whether the effect of graduation differs by timing of graduation. Given the relatively small sample size, I could not study the effect of timing. However, since the average graduation age for this sample is 18, most of the high school graduates are on time graduates. Future research with larger samples should take into account timing when studying graduation effect.



Future research may also focus on high school dropouts and compare the offending outcomes between dropouts who acquired successful employment and those who went back to school to finish their education. If it is found that dropouts who went back to school displayed lower likelihood of offending, policies should be tailored toward re-enrolling high school dropouts in school. In contrast, if it is found that high school dropouts who secured successful employment displayed lower likelihood of offending, policy should be tailored toward providing dropouts with skills training and opportunities for employment. Of course, such a comparison may be highly sensitive to the timing of dropout.

### **6.6.3 Other mechanisms**

It was found that employment partially mediates the graduation effect. Having a job mediates about 20% of the effect, and each additional hour worked per week mediates about 7% of such an effect. This indicates that 80% of the effect is not mediated through employment. Other mechanisms could explain such a direct effect. For example, it is possible that attending college mediates part of this direct effect. Since in this sample, all the youths who attended college graduated from high school and none of them had an adult offending record, it was statistically impossible to test whether attending college mediates the graduation effect. Future studies with a different sample should consider addressing such an issue.

When discussing protective mechanisms, Rutter (1987) argues that beyond future occupational opportunities, another mechanism through which

positive school experience redirects a risky trajectory to a more adaptive pathway is to increase self-esteem and self-efficacy, useful qualities for future success. Other scholars have made similar arguments. For example, as Natsuaki et al. (2008) suggested, a high school diploma may send out the message that the student has the ability to overcome difficult times and adversity, providing psychological benefits to the student. Werner and Smith (1992, 2001) also argue that education can increase one's self-esteem and restructure individuals to develop in a more adaptive direction. Since self-esteem or self-confidence was not measured in the data set used for this dissertation, I was not able to study this mechanism. Future studies with these measures should empirically test this mechanism when possible.

#### **6.6.4 The interrelationships between turning points**

Employment, as a traditionally identified adult turning point, partially mediates the effect of high school graduation. This conclusion indicates that turning points could be interconnected, in that one may lead to another. The study of the interrelationship between turning points is an important topic that needs to be addressed in future research. In this dissertation, I have applied the idea of turning points to late adolescence/early adulthood. Such an idea can be applied to earlier time points as well. For example, Alexander et al. (2001) argue that first grade can be particularly interesting to developmental research since it marks the transition to full time formal schooling. It is possible that first grade could be another turning point. In addition to first grade, another well-known

important transition year is third grade. When students enter third grade, both reading and math become more challenging. Students are expected to take more responsibility for their education, and they transition from “learning to read” to “reading to learn.” It is important for future research to identify these earlier turning points and study how these early turning points are connected to high school graduation and, in turn, to adult turning points.

### **Section 6.7: Conclusion**

This dissertation applies the idea of turning points in life course criminology to late adolescence/early adulthood in order to understand the relationship between high school graduation and adult offending. Using a sample of 460 predominately minority urban males, it was found that for youths who share similar academic experiences and antisocial behavior patterns with dropouts, graduating from high school significantly reduces the likelihood of offending in early adulthood. Such an effect is causal and robust to selection bias. In studying the mechanisms of such a causal effect, it was found that employment partially mediates the high school graduation-offending relationship. For high school dropouts, employment may be another turning point in reducing likelihood of offending. In order to prevent adult offending, policies need to be tailored toward encouraging at-risk students to stay in school and finish their education. It is also important to reach out to those who do drop out and provide them with skills training and opportunities for successful employment.

**Table 2.1: Previous studies on dropout-delinquency relationship**

Author (year)	Data and sample	Measures	Methods	Findings
Elliott (1966)	743 10 <sup>th</sup> grade boys who entered high school in 1959. Data collected from 10 <sup>th</sup> grade to graduation. Retrospective and cross sectional data	Crime measured by police contacts. Only control for SES	Compared mean differences in delinquency rates in school and out of school between graduates and dropouts	Dropping out reduces delinquency
Mukherjee (1971)	Phil Cohort I N=9945 Cross sectional data	Police contacts measure of crime	Compared mean differences in delinquency rates before and after dropout/graduation between dropouts and graduates	Dropping out reduces delinquency
Bachman et al. (1971, 1978)	Youth in Transition Use cross sectional data N=1620	All measures from 1970 Self report measure of crime	1971 study simply compared mean differences in offending rates between dropouts and non-dropouts 1978 study used OLS	Dropping out is a symptom of early problem behavior and it does not lead to more delinquency
Elliott and Voss (1974)	Panel study of 2617 subjects from 9 <sup>th</sup> grade graduation  Cross sectional data	Official measures of delinquency Controlled for employment and marriage	Compared mean differences in delinquency rates before and after dropout/graduation between dropouts and graduates	Dropping out reduces delinquency

**Table 2.1: Previous studies on dropout-delinquency relationship (Cont')**

Author (year)	Data and sample	Measures	Methods	Findings
Pronovost and LeBlanc (1980)	Longitudinal survey of Montreal adolescents Age 12-18 in 1974 N=825 Interviewed in 1974 and 1976	Self report measure of crime No controls Employment	Compared mean differences in offending rates between dropouts and non-dropouts (students still in school)	Dropping out when followed by employment reduces crime
Thornberry et al. (1985)	10% Phil Cohort I (N=9945) followed up to age 25 Longitudinal data of 12 years Final sample N=567	Police contacts measure of crime Control for age, race, social status, marital status, and unemployment	OLS regression	Dropping out increases delinquency It's unemployment after leaving school rather than leaving school itself that causes higher delinquency
Farrington et al. (1986)	Cambridge study Only use the interviews at ages 16 and 18 Retrospective N=399	Self report measures of crime Control for employment	Compared numbers of crime committed during employment and unemployment among dropouts and graduates using Poisson regression	Unemployment after school leaving is associated with higher delinquency
Mensch and Kandel (1988)	National Longitudinal Survey of Young Adults, a national longitudinal sample of young Americans aged 19-27 in 1984 Used as cross sectional data	Self report measures of drug use	Event history analysis	High school dropouts are more likely to use drugs than high school graduates. Drug use increases the likelihood of dropping out of high school.

**Table 2.1: Previous studies on dropout-delinquency relationship (Cont')**

Author (year)	Data and sample	Measures	Methods	Findings
Chavez et al. (1989)	Longitudinal data followed from grade 6 to grade 12 N=543	Dropouts and non dropouts are matched on sex, ethnicity, and school grade At risk students were also matched by age and GPA	Matching and comparison of mean differences in rates of substance use	Dropout students have the highest rate of alcohol and drug use, followed by at risk students
Jarjoura (1993)	National Longitudinal Survey of Youth 1979 (age 14-21) Interviewed first in 1979 and then in 1980 (retrospective data) Using data only from 1980 interview N=12141	Self report delinquency Control for prior misconduct, school performance and experience, marriage and employment, and demographic variables	Ordered Probit regression	The effect of dropping out depends on the reasons of dropping; dropping out for some reasons lead to higher delinquency. Post dropout experiences in general do not have effects on delinquency
Krohn et al. (1995)	Rochester Youth Development Survey (longitudinal) 7 <sup>th</sup> and 8 <sup>th</sup> grades Interviewed every 6 months N=867	Control for risk factors in family, individual and school domains, including family and school attachment and educational expectations Control for prior drug use and delinquency	Logistic regression	Dropout and delinquency are both consequences of school related problem behaviors

**Table 2.1: Previous studies on dropout-delinquency relationship (Cont')**

Author (year)	Data and sample	Measures	Methods	Findings
Jarjoura (1996)	National Longitudinal Survey of Youth 1979 (age 14-21) Only use the interview in 1980 (retrospective data) N=1214	Self report delinquency; To study moderate effect of social class on dropout-delinquency relationship	Logistic regression	Middle class dropouts are more likely to engage in delinquency than lower class dropouts
Obot and Anthony (1999)	National Household Surveys on Drug Abuse (1991-1993) Retrospective Cross-sectional African American 18 years or older Recent users=117 (matched 1722) Past users=109 (matched 631)	Matching injectors and non-injectors Age, sex, Ethnicity, and educational background	Matching and Logistic regression	African Americans who dropped out of high school and GED holders are more likely to be recent drug injectors than high school graduates
Voelkl et al. (1999)	Interviewed youths from age 16 to 19 from New York State Retrospective data Cross sectional N=625	Self report delinquency SES Enrollment status Grades Absenteeism Delinquency	OLS Regression	For African Americans, dropping out of school predicts higher delinquency

**Table 2.1: Previous studies on dropout-delinquency relationship (Cont')**

Author (year)	Data and sample	Measures	Methods	Findings
Bernberg and Krohn (2003)	Rochester Youth Development Study which followed 7 <sup>th</sup> and 8 <sup>th</sup> graders from academic year 1987-1988. Sample N=529. Cover 9 years (13-22)	Measure police intervention Self reported criminal behavior Self reported graduation and employment information	Mediation analysis	High school graduation is indirectly associated with offending through unemployment, while unemployment is directly related to adult offending
Lochner (2004)	National Longitudinal Survey of Youth; Sample from 1980 when respondents were age 15-20	Arrest data from UCR	Probit regression	High school graduation is negatively associated with offending
Sweeten (2004)	National longitudinal Survey of Youth 1997 Longitudinal data follow from age 12 to 17 and interviewed every year Use five waves of data (multi-cohort) N=7548	Wave five measures of self report delinquency Wave one measures of independent variables from individual, family and school domains Reasons for dropout	Random effect OLS and Logistic regression	The effect of dropout depends on the reasons of dropout: dropout for school and other reasons increases delinquency, while dropout for personal or economic reasons do not have effect



**Table 2.1: Previous studies on dropout-delinquency relationship (Cont')**

Author (year)	Data and sample	Measures	Methods	Findings
Drapela (2005)	National Education Longitudinal Study of 1988 of 8 <sup>th</sup> graders Use first three waves: 1988, 1990, 1992 (grade 8, 10 and 12) N=16,489	Self report measures of drug use Drug use measures from 1992 are used as dependent variable; measures from prior waves are used as controls Independent variables are all from 1992 wave	Logistic regression	Antecedents to dropout, such as school discipline problems and pre-dropout levels of drug use, have more effect on post dropout drug use than dropout status
Sweeten (2006)	National Longitudinal Survey of Youth 1997 Longitudinal data follow from age 12 to 17 and interviewed every year Use five waves of data (multi-cohort) N=2990	Self report measure of delinquency Control for risk factors in family, school and individual domains through propensity score matching	Group-trajectory modeling, Propensity Score Matching, and IRT trajectory analysis	Dropout does not have any impact on subsequent delinquency above and beyond the processes leading to school dropout
Sweeten et al. (2009)	National Longitudinal Survey of Youth 1997 Longitudinal data follow from age 12 to 17 and interviewed every year Use seven waves of data (multi-cohort) N=8112	Self report measure of delinquency Control for risk factors in family, school and individual domains Reasons for dropout	Random effect and fixed effect Logistic regression	Above and beyond the gradual process of disengagement from school, dropout does not have causal impact on delinquency.

**Table 4.1: Attrition analysis comparing selected and not selected males (N=543)**

	Selected (n=460)	Not selected (n=83)	# of mis.	Diff. test (P- value)
	Mean Std. (%)	Mean Std. (%)		
Covariates used for propensity score matching				
Individual domain				
African American	66.3%	54.2%	0	.046
Age at fall of first grade (1=older than 7)	7.0%	8.4%	0	N.S.
Design status (1=intervention)	41.3%	41.0%	0	N.S.
Teacher rated aggressive behavior (fall 1 <sup>st</sup> grade)	1.89 (.92)	2.06 (1.21)	51	N.S.
Teacher rated concentration problem (fall 1 <sup>st</sup> grade)	2.98 (1.33)	3.15 (1.39)	51	N.S.
Teacher rated shy behavior (fall 1 <sup>st</sup> grade)	2.68 (1.00)	2.73 (1.02)	51	N.S.
Having 3 or more problem behavior before age 15	40.2%	33.7%	0	N.S.
Having 3 or more problem behavior since age 15	33.5%	40.7%	2	N.S.
Ever use hard drugs	19.6%	21.7%	0	N.S.
Having juvenile violent records	14.6%	14.5%	0	N.S.
Having juvenile non violent records	6.3%	4.8%	0	N.S.
Having other juvenile records	12.0%	9.6%	0	N.S.
Family domain				
SES (1=low SES)	50.7%	39.8%	0	.074
Times moved during elementary school	1.22 (4.90)	1.12 (1.98)	0	N.S.
Times moved during middle school	1.21 (1.50)	1.17 (1.51)	0	N.S.
Times moved during high school	.81 (1.44)	1.08 (1.39)	0	N.S.
School domain				
Total number of school removals	.60 (1.41)	.82 (1.70)	0	N.S.
Reading score (fall 1 <sup>st</sup> grade)	272 (43)	270 (46)	6	N.S.
School performance during elementary school	4.47 (1.04)	4.76 (1.05)	0	.023
School performance during middle school	4.16 (1.04)	4.28 (1.09)	0	N.S.
School performance during high school	3.85 (1.19)	3.80 (1.39)	2	N.S.
Skipping class during elementary school	1.23 (.698)	1.42 (.898)	7	N.S.
Skipping class during middle school	1.81 (1.08)	1.91 (1.17)	7	
Skipping class during high school	2.76 (1.37)	2.81 (1.60)	9	N.S.
Grades repeated during elementary school	.30 (.50)	.40 (.52)	0	N.S.
Grades repeated during middle school	.13 (.39)	.12 (.48)	0	N.S.
Grades repeated during high school	.26 (.61)	.18 (.42)	0	N.S.

**Table 4.1: Attrition analysis comparing selected and not selected males (N=543) (Cont')**

	Selected (n=460)	Not selected (n=83)	# of mis.	Diff. test (P- value)
	Mean Std. (%)	Mean Std. (%)		
Neighborhood domain				
Neighborhood aggravated assault	46.1%	38.2%	15	N.S.
Neighborhood burglary	47.4%	36.8%	15	N.S.
Neighborhood homicide	48.5%	44.1%	15	N.S.
Neighborhood purse snatching	47.6%	54.4%	15	N.S.
Neighborhood theft	48.0%	47.1%	15	N.S.
Neighborhood rape	49.8%	48.5%	15	N.S.
Neighborhood unarmed robbery	50.9%	50.0%	15	N.S.
Neighborhood median income higher than median	52.0%	57.4%	15	N.S.
Outcome variables				
Graduation (vs. .GED or dropout)	69.3%	66.3%	0	N.S.
Having at least one adult offending record	10.2%	9.6%	0	N.S.
Mediating variables				
Having a job	67.2%	74.7%	0	N.S.
Number of hours worked per week	25.47 (20.66)	29.82 (20.04)	0	.077
Income	5.87 (4.67)	7.19 (5.52)	0	.042
Being involved in a relationship	69.6%	77.1%	0	N.S.
Negative interaction with partner	2.00 (.65)	2.05 (.77)	0	N.S.
Committed to one's partner	78.0%	72.3%	0	N.S.
Perceiving relationships as important	78.5%	80.7%	0	N.S.

**Table 4.2: Attrition analysis comparing selected and not selected males (N=701)**

	Selected (n=460)	Not selected (n=241)	# of mis.	Diff. test (P- value)
	Mean Std. (%)	Mean Std. (%)		
Covariates used for propensity score matching				
Individual domain				
African American	66.3%	64.7%	0	N.S.
Age at fall of first grade (1=older than 7)	7.0%	9.1%	0	N.S.
Design status (1=intervention)	41.3%	41.1%	0	N.S.
Teacher rated aggressive behavior (fall 1 <sup>st</sup> grade)	1.89 (.92)	2.08(1.07)	60	.022
Teacher rated concentration problem (fall 1 <sup>st</sup> grade)	2.98 (1.33)	3.41 (1.40)	60	<.001
Teacher rated shy behavior (fall 1 <sup>st</sup> grade)	2.68 (1.00)	2.84 (1.08)	60	N.S.
Having 3 or more problem behavior before age 15	40.2%	51.0%	0	.007
Having 3 or more problem behavior since age 15	33.5%	45.0%	3	.004
Ever use hard drugs	19.6%	22.0%	0	N.S.
Having juvenile violent records	14.6%	15.7%	20	N.S.
Having juvenile non violent records	6.3%	6.6%	20	N.S.
Having other juvenile records	12.0%	10.7%	20	N.S.
Family domain				
SES (1=low SES)	50.7%	49.8%	0	N.S.
Times moved during elementary school	1.22 (4.90)	1.27 (2.20)	0	N.S.
Times moved during middle school	1.21 (1.50)	1.38 (2.09)	0	N.S.
Times moved during high school	.81 (1.44)	.99 (1.53)	0	N.S.
School domain				
Total number of school removals	.60 (1.41)	.79 (1.56)	0	N.S.
Reading score (fall 1 <sup>st</sup> grade)	272 (43)	265 (42)	9	.031
School performance during elementary school	4.47 (1.04)	4.43 (1.19)	0	N.S.
School performance during middle school	4.16 (1.04)	4.03 (1.11)	0	N.S.
School performance during high school	3.85 (1.19)	3.46 (1.35)	2	<.001
Skipping class during elementary school	1.23 (.698)	1.38 (.93)	14	.016
Skipping class during middle school	1.81 (1.08)	2.05 (1.24)	14	.008
Skipping class during high school	2.76 (1.37)	3.22 (1.64)	16	<.001
Grades repeated during elementary school	.30 (.50)	.46 (.58)	0	<.001
Grades repeated during middle school	.13 (.39)	.20 (.51)	0	.026
Grades repeated during high school	.26 (.61)	.54 (.86)	0	<.001

**Table 4.2: Attrition analysis comparing selected and not selected males (N=701) (Cont')**

	Selected (n=460)	Not selected (n=241)	# of mis.	Diff. test (P- value)
	Mean Std. (%)	Mean Std. (%)		
Neighborhood domain				
Neighborhood aggravated assault	46.1%	45.1%	17	N.S.
Neighborhood burglary	47.4%	45.5%	17	N.S.
Neighborhood homicide	48.5%	49.1%	17	N.S.
Neighborhood purse snatching	47.6%	50.4%	17	N.S.
Neighborhood rape	49.8%	46.9%	17	N.S.
Neighborhood theft	48.0%	47.3%	17	N.S.
Neighborhood unarmed robbery	50.9%	47.8%	17	N.S.
Neighborhood median income higher than median	52.0%	54.0%	17	N.S.
Outcome variables				
Graduation (vs. .GED or dropout)	69.3%	57.9%	120	.022
Having at least one adult offending record	10.2%	10.4%	0	N.S.
Mediating variables				
Having a job	67.2%	67.5%	1	N.S.
Number of hours worked per week	25.47 (20.66)	26.25 (20.73)	1	N.S.
Income	5.87 (4.67)	5.77 (4.87)	1	N.S.
Being in a relationship	69.6%	76.3%	0	.063

**Table 5.1a: Covariate balance before and after matching for males (individual domain)**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
Propensity Score	.868	.811	.299	.811	3.132	.004
African American	62.4%	66.8%	75.2%	72.1%	-.264	-.109
Age at fall of first grade (1=older than 7)	3.8%	4.1%	14.2%	14.2%	-.291	.283
Design status (1=intervention)	45.8%	41.4%	31.2%	51.8%	.292	-.210
Teacher rated aggressive behavior (fall 1st grade)	1.797	1.897	2.090	1.812	-.328	.095
Teacher rated concentration problem (fall 1st grade)	2.725	3.021	3.546	2.919	-.648	.081
Teacher rated shy behavior (fall 1st grade)	2.591	2.752	2.895	2.785	-.299	-.033

**Table 5.1a: Covariate balance before and after matching for males (individual domain) (Cont')**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
Having 3 or more problem behavior before age 15	32.0%	37.3%	58.9%	37.9%	-.576	-.013
Having 3 or more problem behavior sine age 15	26.3%	32.7%	49.6%	33.5%	-.528	-.017
Ever use hard drugs	19.1%	22.7%	20.6%	28.1%	-.037	-.137
Having juvenile violent records	5.6%	8.2%	34.8%	7.4%	-1.260	.035
Having juvenile non violent records	1.3%	1.8%	17.7%	1.7%	-1.478	.014
Having other juvenile records	3.8%	5.0%	30.5%	3.1%	-1.403	.100

**Table 5.1b: Covariate balance before and after matching for males (family domain)**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
SES (1=low SES)	43.3%	50.5%	67.4%	47.5%	-.486	.059
Times moved during elementary school	0.972	1.168	1.780	0.835	-.158	.065
Times moved during middle school	0.972	1.155	1.759	1.397	-.650	-.200
Times moved during high school	.627	.691	1.227	1.005	-.541	-.284



**Table 5.1c: Covariate balance before and after matching for males (school domain)**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
Total number of school removals	0.373	0.455	1.121	0.352	-.829	.114
Reading score (fall 1st grade)	279.972	270.736	254.504	280.595	.591	-.229
School performance during elementary school	4.564	4.414	4.270	4.417	.285	-.003
School performance during middle school	4.254	4.123	3.950	4.327	.299	-.201
School performance during high school	4.141	3.905	3.177	3.702	.872	.183
Skipping class during elementary school	1.154	1.177	1.404	1.134	-.467	.080
Skipping class during middle school	1.643	1.659	2.184	1.878	-.557	-.225

**Table 5.1c: Covariate balance before and after matching for males (school domain) (Cont')**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
Skipping class during high school	2.414	2.636	3.546	2.890	-.968	-.217
Grades repeated during elementary school	0.219	0.309	0.482	0.364	-.623	-.129
Grades repeated during middle school	0.047	0.064	0.305	0.030	-1.217	.157
Grades repeated during high school	0.116	0.168	0.574	0.132	-1.281	.100

**Table 5.1d: Covariate balance before and after matching for males (neighborhood domain)**

Covariate	Graduates Mean		Dropouts Mean		Standardized Bias	
	Before Matching (n=319)	After Matching (n=220)	Before Matching (n=141)	After Matching (n=141)	Before Matching (n=460)	After Matching (n=361)
	Mean (%)	Weighted Mean (%)	Mean (%)	Weighted Mean (%)		
Neighborhood aggravated assault above median	38.2%	48.2%	63.8%	53.8%	-.526	-.116
Neighborhood burglary	38.2%	50.5%	68.1%	53.8%	-.613	-.069
Neighborhood homicide above median	45.5%	49.5%	55.3%	51.6%	-.198	-.040
Neighborhood purse snatching above median	41.4%	47.3%	61.7%	55.5%	-.412	-.167
Neighborhood rape above median	45.1%	49.1%	60.3%	53.5%	-.304	-.088
Neighborhood theft above median	42.3%	46.8%	61.0%	51.4%	-.377	-.092
Neighborhood unarmed robbery above median	44.5%	50.0%	65.2%	57.9%	-.417	-.160
Neighborhood median income above median	59.9%	51.8%	34.0%	46.6%	.526	.106

**Table 5.2: Comparison of covariates between matched and unmatched cases for males (N=460)<sup>1</sup>**

Covariates	Matched Graduates (n=220)	Matched Dropouts (n=141)	Unmatched Graduates (n=99)
	Weighted Mean Std. (%)	Weighted Mean Std. (%)	Mean Std. (%)
Propensity to graduate from high school	.811	.811	---
Individual domain			
African American	66.8%	72.3%	52.5%
Age at fall of first grade (1=older than 7)	4.1%	14.2%	3.0%
Design status (1=intervention)	41.4%	51.8%	55.6%
Teacher rated aggressive behavior (fall 1 <sup>st</sup> grade)	1.90 (.95)	1.81 (.74)	1.58 (.71)
Teacher rated concentration problem (fall 1 <sup>st</sup> grade)	3.02 (1.26)	2.92 (1.28)	2.07 (1.02)
Teacher rated shy behavior (fall 1 <sup>st</sup> grade)	2.75 (1.01)	2.79 (1.09)	2.23 (.96)
Having 3 or more problem behavior before age 15	37.3%	37.6%	20.2%
Having 3 or more problem behavior since age 15	32.7%	33.3%	12.1%
Ever use hard drugs	22.7%	28.4%	11.1%
Having juvenile violent records	8.2%	7.1%	0%
Having juvenile non violent records	1.8%	1.4%	0%
Having other juvenile records	5.0%	2.8%	1.0%
Family domain			
SES (1=low SES)	50.5%	47.5%	27.3%
Times moved during elementary school	1.17 (6.11)	.83 (2.49)	.54 (.86)
Times moved during middle school	1.15 (1.29)	1.40 (1.31)	.57 (.88)
Times moved during high school	.69 (1.18)	1.01 (1.55)	.48 (.93)
School domain			
Total number of school removals	.45 (1.01)	.35 (.92)	.19 (.55)
Reading score (fall 1 <sup>st</sup> grade)	270.74 (40.54)	280.60 (39.51)	300.49 (41.79)
School performance during elementary school	4.41 (1.04)	4.42 (.97)	4.90 (.94)
School performance during middle school	4.12 (.98)	4.33 (.95)	4.55 (1.03)
School performance during high school	3.90 (1.06)	3.70 (.84)	4.67 (1.03)
Skipping class during elementary school	1.18 (.60)	1.13 (.42)	1.10 (.36)
Skipping class during middle school	1.66 (1.02)	1.88 (.83)	1.61 (.88)

<sup>1</sup> This comparison is for descriptive purposes, and significant tests for comparing the matched treated and control cases are not accurate (Stuart 2007).

**Table 5.2: Comparison of covariates between matched and unmatched cases for males (N=460) (Cont')**

Covariates	Matched Graduates (n=220)	Matched Dropouts (n=141)	Unmatched Graduates (n=99)
	Weighted Mean Std. (%)	Weighted Mean Std. (%)	Mean Std. (%)
Skipping class during high school	2.64 (1.21)	2.89 (1.15)	1.92 (.89)
Grades repeated during elementary school	.31 (.47)	.36 (.49)	.02 (.14)
Grades repeated during middle school	.06 (.24)	.03 (.18)	.01 (.10)
Grades repeated during high school	.17 (.42)	.13 (.40)	.00 (.00)
Neighborhood domain			
Neighborhood aggravated assault above median	48.2%	53.9%	16.1%
Neighborhood burglary above median	50.5%	53.9%	11.1%
Neighborhood homicide above median	49.5%	51.8%	36.4%
Neighborhood purse snatching above median	47.3%	55.3%	28.3%
Neighborhood rape above median	49.1%	53.2%	36.4%
Neighborhood theft above median	46.8%	51.1%	32.3%
Neighborhood unarmed robbery above median	50.0%	58.2%	32.3%
Neighborhood median income above median	51.8%	46.8%	77.8%

**Table 5.3: Comparison of covariates before and after matching for males (N=460)**

Covariates	Matched Sample (N=361)	Sample Before Matching (N=460)
	Weighted Mean Std. (%)	Mean Std. (%)
Individual domain		
African American	68.9%	66.3%
Age at fall of first grade (1=older than 7)	8.0%	7.0%
Design status (1=intervention)	45.5%	41.3%
Teacher rated aggressive behavior (fall 1 <sup>st</sup> grade)	1.86 (.87)	1.89 (.92)
Teacher rated concentration problem (fall 1 <sup>st</sup> grade)	2.98 (1.26)	2.98 (1.33)
Teacher rated shy behavior (fall 1 <sup>st</sup> grade)	2.76 (1.04)	2.68 (1.00)
Having 3 or more problem behavior before age 15	37.5%	40.2%
Having 3 or more problem behavior since age 15	33.0%	33.5%
Ever use hard drugs	24.8%	19.6%
Having juvenile violent records	7.9%	14.6%
Having juvenile non violent records	1.8%	6.3%
Having other juvenile records	4.3%	12.0%
Family domain		
Free Lunch (1=free or reduced lunch)	49.3%	50.7%
Times moved during elementary	1.04 (5.02)	1.22 (4.90)
Times moved during middle	1.25 (1.31)	1.21 (1.50)
Times moved during high	.81 (1.34)	.81 (1.44)
School domain		
Total number of school removals	.41 (.98)	.60 (1.41)
Reading score (fall 1 <sup>st</sup> grade)	275 (40)	272 (43)
School performance during elementary school	4.41 (1.01)	4.47 (1.04)
School performance during middle school	4.20 (.98)	4.16 (1.04)
School performance during high school	3.83 (.98)	3.85 (1.19)
Skipping class during elementary school	1.16 (.53)	1.23 (.698)

**Table 5.3: Comparison of covariates before and after matching for males (N=460) (Cont')**

Covariates	Matched Sample (N=361)	Sample Before Matching (N=460)
	Weighted Mean Std. (%)	Mean Std. (%)
Skipping class during middle school	1.74 (.95)	1.81 (1.08)
Skipping class during high school	2.74 (1.20)	2.76 (1.37)
Grades repeated during elementary school	.33 (.48)	.30 (.50)
Grades repeated during middle school	.05 (.22)	.13 (.39)
Grades repeated during high school	.15 (.41)	.26 (.61)
Neighborhood domain		
Neighborhood aggravated assault	50.4%	46.1%
Neighborhood burglary	51.8%	47.4%
Neighborhood homicide	50.3%	48.5%
Neighborhood purse snatching	50.5%	47.6%
Neighborhood rape	50.8%	49.8%
Neighborhood theft	48.6%	48.0%
Neighborhood unarmed robbery	53.1%	50.9%
Neighborhood median income higher than median	49.8%	52.0%

**Table 5.4.: The distribution of the outcome and the mediating variables among the matched graduates, the matched dropouts, and the unmatched graduates for males (N=460)**

	Matched Graduates (n=220)	Matched Dropouts (n=141)	Diff. Test (P-value)	Unmatched Graduates (n=99)
	Weighted Mean Std. (%)			Mean Std. (%)
<b>Outcome Variable</b>				
Having at least one adult offending record	3.6%	36.2%	.000	0%
Frequency of adult offending (among males with at least one adult offending record)				
Total offenses=1	50.0%	38.5%	N.S.	0%
Total offenses=2	0%	23.1%	--	0%
Total offenses=3	25.0%	15.4%	--	0%
Total offenses=4	12.5%	7.7%	--	0%
Total offenses=5	12.5%	2.6%	--	0%
Total offenses>5	0%	12.9%	--	0%
Type of adult offending (among males with at least one adult offending record)				
Alcohol or drug	62.5%	71.8%	N.S.	0%
Crime against property	12.5%	23.1%	N.S.	0%
Robbery	12.5%	23.1%	N.S.	0%
Injury to person	37.5%	35.9%	N.S.	0%
Domestic assault or battery	0%	0%	--	0%
Rape or sex offense	12.5%	5.1%	N.S.	0%
Murder or attempted murder	0%	0%	--	0%
<b>Mediating Variables (employment)</b>				
Having a job	74.1%	58.9%	.003	81.8%
Number of hours worked per week	29 (19.74)	23 (20.32)	.005	29 (18.99)
Income	6 (4.66)	6 (4.93)	N.S.	6 (4.32)
<b>Mediating Variables (intimate relationship)</b>				
Involved in an intimate relationship	70.9%	58.9%	.022	64.6%
Minor negative interaction	1.95 (.56)	1.97 (.48)	N.S.	1.85 (.56)
<b>Commitment to the relationship</b>				
Being committed	80.0%	85.8%	N.S.	76.8%
One night stand	0%	0%	N.S.	0%
Casual dating	7.7%	8.5%	--	5.1%
Regularly dating	12.3%	5.7%	--	18.2%
Seeing only this person	64.5%	65.2%	--	70.7%
Committed to marriage	14.5%	18.4%	--	5.1%
Married	0.9%	2.1%	--	1.0%



**Table 5.4.: The distribution of the outcome and the mediating variables among the matched graduates, the matched dropouts, and the unmatched graduates for males (N=460) (Cont')**

	Matched Graduates (n=220)	Matched Dropouts (n=141)	Diff. Test (P-value)	Unmatched Graduates (n=99)
	Weighted Mean Std. (%)			Mean Std. (%)
Perceived importance of relationships				
Perceive relationships as important	78.2%	87.9%	.024	77.8%
Not at all	4.1%	4.3%	.019	1.0%
Very little	3.2%	0%	--	2.0%
A little	5.5%	0.7%	--	8.1%
Somewhat	9.1%	7.1%	--	11.1%
Pretty much	41.8%	54.6%	--	45.5%
Very much	36.4%	33.3%	--	32.3%

**Table 5.5: Sensitivity to selection bias for males (N=361)<sup>1</sup>**

	$\Delta=1.0$	$\Delta=0.667$	$\Delta=0.286$	$\Delta=0.111$	$\Delta=.031$	$\Delta=.016$
$\Gamma=1.0$	.067 (.030/.146)	.067 (.030/.146)	.067 (.030/.148)	.067 (.030/.150)	.067 (.029/.053)	.067 (.029/.054)
$\Gamma=1.5$	.067 (.030/.146)	.069 (.032/.152)	.075 (.034/.166)	.079 (.035/.178)	.083 (.036/.188)	.083 (.036/.191)
$\Gamma=3.5$	.067 (.030/.150)	.075 (.034/.168)	.094 (.042/.210)	.111 (.049/.251)	.124 (.055/.282)	.127 (.056/.290)
$\Gamma=9.0$	.067 (.028/.159)	.081 (.034/.191)	.115 (.049/.270)	.152 (.066/.351)	.182 (.079/.417)	.189 (.083/.433)
$\Gamma=32$	.067 (.024/.185)	.087 (.032/.236)	.140 (.054/.362)	.204 (.083/.499)	.264 (.112/.620)	.280 (.120/.652)
$\Gamma=64$	.067 (.021/.209)	.089 (.029/.269)	.149 (.054/.412)	.225 (.089/.570)	.301 (.126/.717)	.323 (.137/.758)

<sup>1</sup> Effects are presented in odds ratios and 95% confidence intervals.

$\Gamma$ =effect of the omitted covariate on graduation (in odds ratios).

$\Delta$ =effect of the omitted covariate on adult offending (in odds ratios).

**Table 5.6: The effect of high school graduation on adult offending, mediated through having a job for males (N=361)<sup>1</sup>**

	Model 1	Model 2	Model 3
Offending on graduation (1)	-2.702 (.411)** .067	-2.620 (.411)** .073	-3.508(.759)** .030
Offending on having a job (3)	--	-1.127 (.316)** .324	-1.405 (.379)** .245
Offending on graduation X having a job (4)	--	--	1.454 (.917) <sup>#</sup> N/A
Having a job on graduation (2)	--	.684 (.221)** 1.983	.684 (.230)** 1.983
LL (df)	-126514.2 (2)	-341705.1(5)	-340267.7 (6)

<sup>1</sup>Effects presented in logit coefficients (std. errors) and odds ratios

\*\* Significant at a .01 level

<sup>#</sup> Borderline significant at .10 level

**Table 5.7: The effect of high school graduation on adult offending, mediated through being involved in an intimate relationship for males (N=361)<sup>1</sup>**

	Model 1	Model 4
Offending on graduation (1)	-2.702 (.411)** .067	-2.766 (.411)** .063
Offending on being involved in a relationship (5)	--	.439 (.348) 1.551
Being involved in a relationship on graduation (6)	--	.536 (.221)* 1.710
LL (df)	-126514.2 (2)	-353858.0 (5)

<sup>1</sup> Effects presented in logit coefficients (std. errors) and odds ratios.

\*\* Significant at a .01 level

\*Significant at a .05 level

**Table 5.8: The effect of high school graduation on adult offending, mediated through work hours and income for males (N=361)<sup>1</sup>**

	Model 5	Model 6	Model 7	Model 8	Model 9
Offending on graduation (1)	-2.643 (.411)** .071	-3.617 (.632)** .027	-2.874 (.443)** .056	-3.325 (.569)** .036	-3.885 (.664)** .021
Offending on work hours (8)	-.035 (.008)** .965	-.045 (.009)** .956	--	--	-.025 (.009)** .976
Offending on graduation X work hours (9)	--	.045 (.032) <sup>#</sup> N/A	--	--	.039 (.032) N/A
Offending on income (11)	--	--	-.262 (.063)** .770	-.287 (.063)** .751	-.242 (.063)** .785
Offending on graduation X income (12)	--	--	--	.134 (.095) <sup>#</sup> N/A	.059 (.126) N/A
Work hours on graduation (7)	6.092 (2.150)**	6.092 (2.150)**	--	--	6.092 (2.150)**
Income on graduation (10)	--	--	.444 (.506)	.444 (.506)	-.201 (.474)
Income on work hours (13)	--	--	--	--	.106 (.009)**
LL(df)	-1709160.4 (6)	-1706741.3 (7)	-1180750.7 (6)	-1180139.6 (7)	-2729952.8 (13)

<sup>1</sup> Effects presented in logit coefficients (std. errors) and odds ratio for binary dependent variables (i.e. offending), and coefficients (std. errors) for continuous dependent variables (i.e. work hours and income).

\*\* Significant at a .01 level

<sup>#</sup> Borderline significant at a .10 level

**Table 5.9: The effect of high school graduation on adult offending, mediated through minor negative interaction, commitment, and importance for males (N=361)<sup>1</sup>**

	Model 10	Model 11	Model 12
Offending on graduation (1)	-2.763 (.411)** .063	-2.783 (.411)** .062	-2.848 (.443)** .058
Offending on negative interaction (15)	.751 (.379)* 2.119	--	--
Offending on commitment (17)	--	-.745 (.411) <sup>#</sup> .475	--
Offending on importance (19)	--	--	-.869 (.411)* .419
Negative interaction on graduation (14)	-.012 (.063)	--	--
Commitment on graduation (16)	--	-.057 (.032) <sup>#</sup> .945	--
Importance on graduation (18)	--	--	-.099 (.032)** .906
LL (df)	-405140.635 (6)	-551762.732 (6)	-695839.242 (6)

<sup>1</sup>Effects presented in logit coefficients (std. errors) and odds ratio for binary dependent variables (i.e. offending, commitment, and importance), and coefficients (std. errors) for continuous dependent variables (i.e. negative interaction).

\* Significant at a .05 level

<sup>#</sup> Borderline significant at a .05 level

\*\* Significant at a .01 level

**Table 5.10: Percentage of adult offending by graduation status and attending college for males (n=361)**

	Total	Number of Adult Offenders (%)
Graduates who went to college	77	0 (0%)
Graduates who did not go to college	143	8 (5.6%)
Dropouts	141	51 (36%)

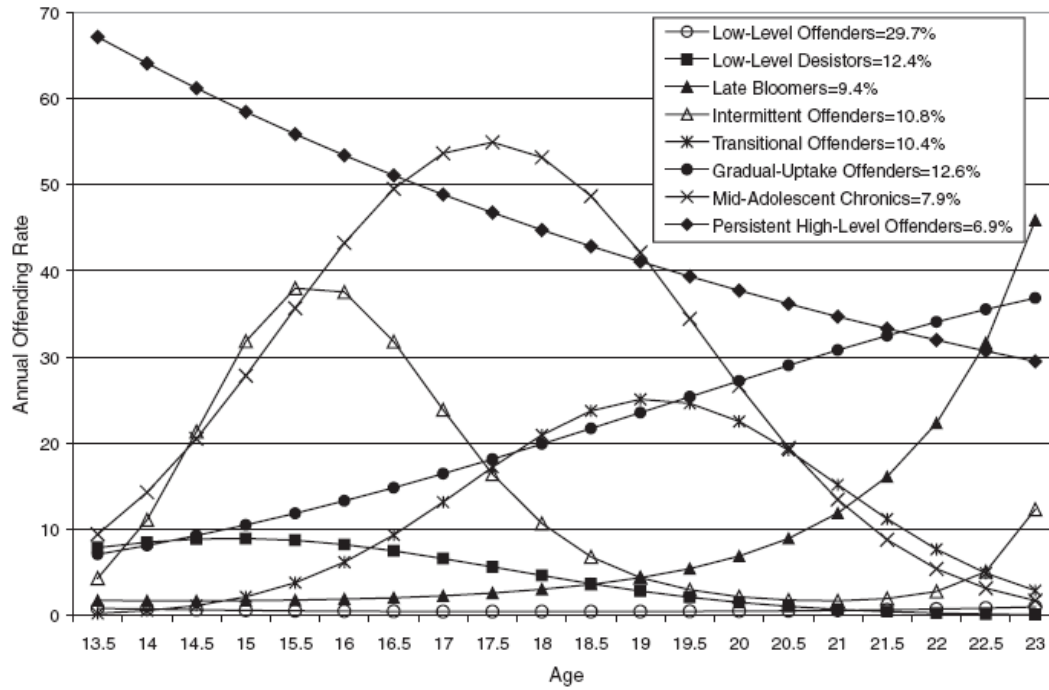
**Table 5.11: Comparison of college attendance and employment between matched and unmatched graduates for males (n=361)**

	Total	Attending college**	Working
Matched graduates	220	77 (35.0%)	163 (74.1%)
Unmatched graduates	99	66 (66.7%)	81 (81.8%)

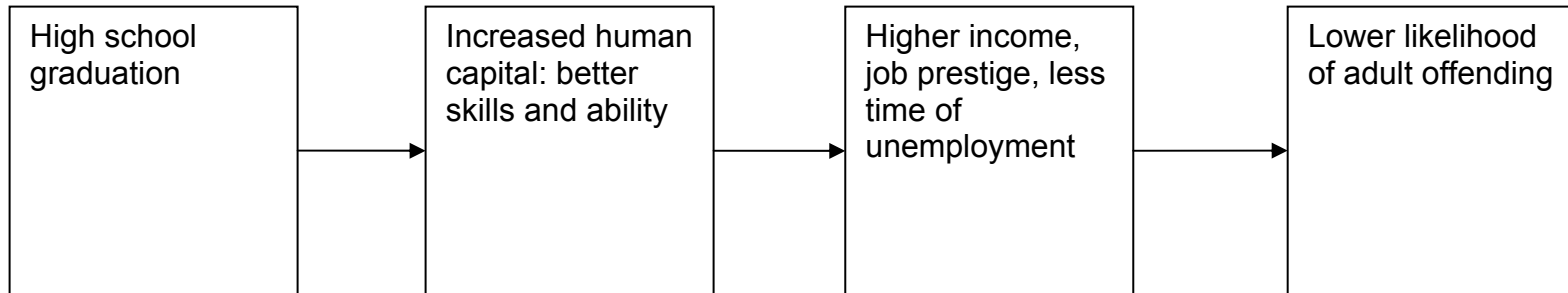
\*\* Chi-square test for differences is significant at a .01 level.



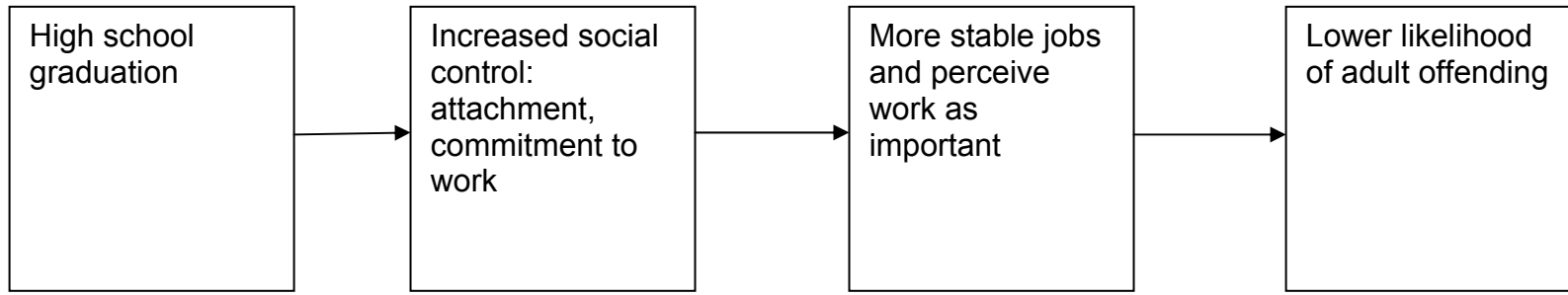
**Figure 2.1: Trajectories of criminal offending in the Rochester Youth Development Study for males (N=647) (Thornberry 2005, 164)**



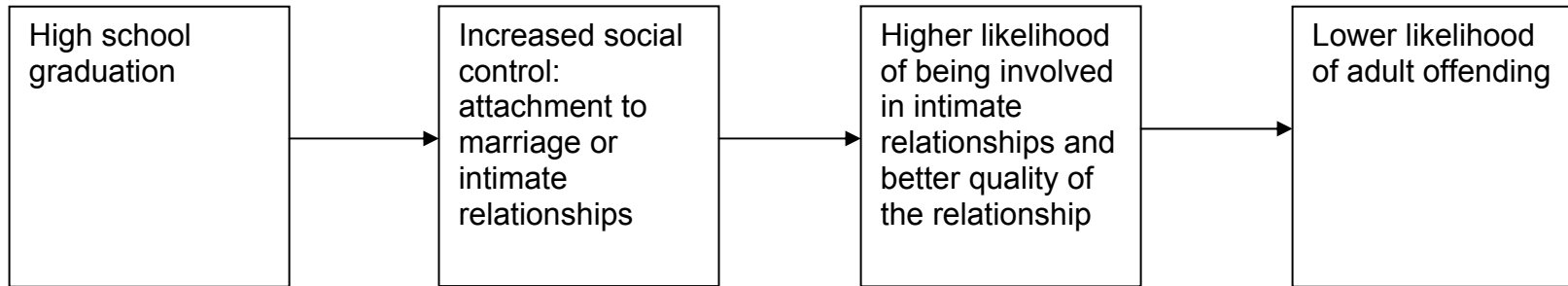
**Figure 2.2: The human capital model of education, work and crime**



**Figure 2.3: The social control model of education, work, and crime**



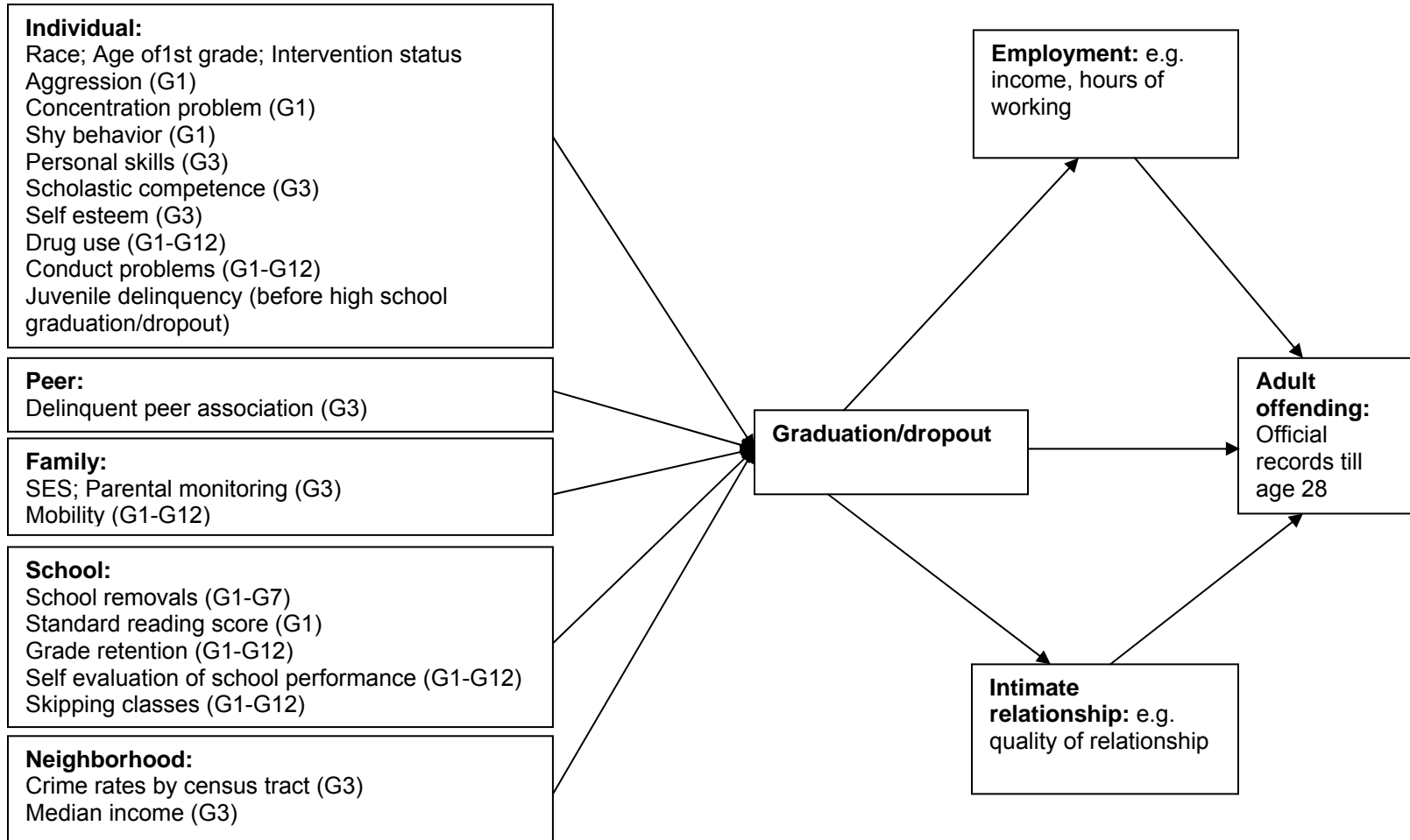
**Figure 2.4: The social control model of education, intimate relationships, and crime**



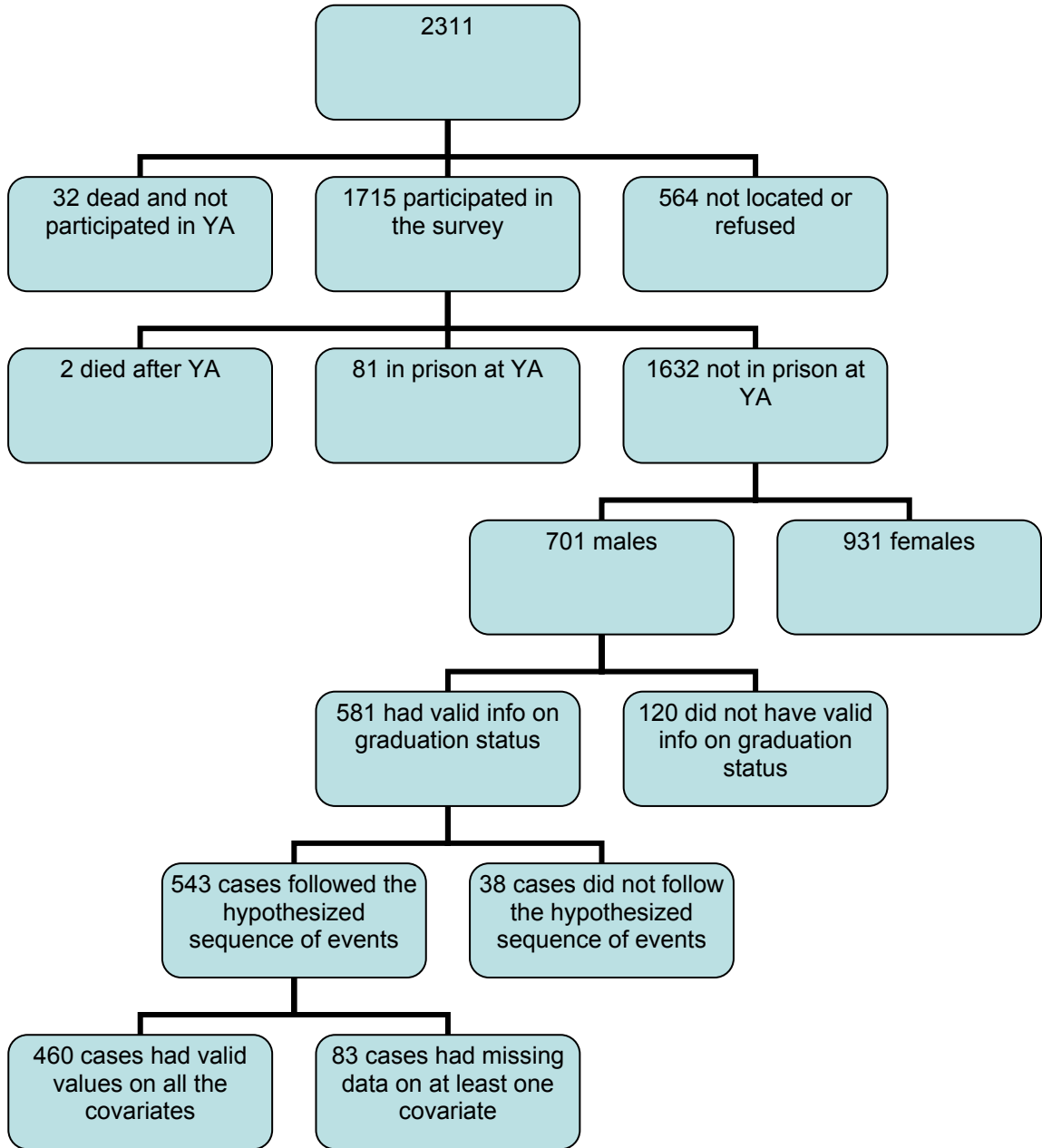
**Figure 3.1: The Conceptual Model**

Elementary, middle, and high school

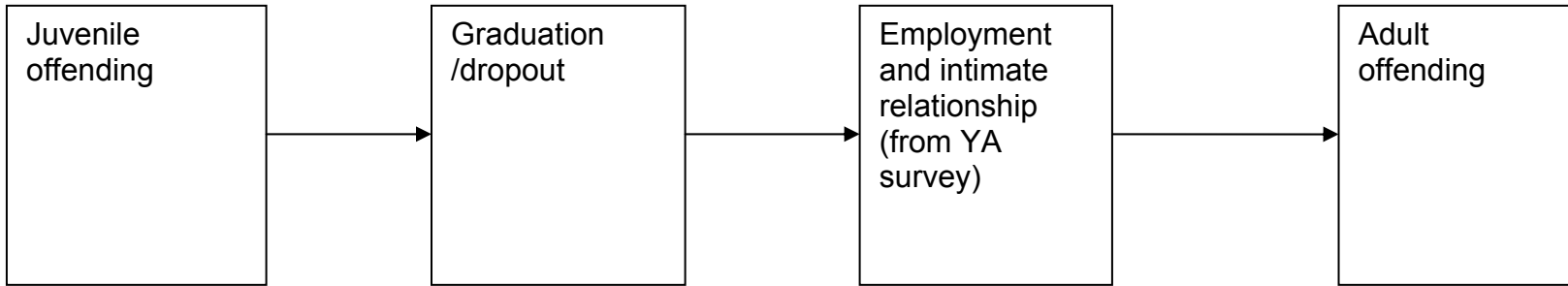
Early Adulthood



**Figure 4.1: Flow chart for sample selection**



**Figure 4.2: Time sequence of event occurrence**



**Figure 4.3: Observed and Latent Tables for Sensitivity Analysis (Harding 2003)**

**Observed Table:**

	Y=0	Y=1
X=0	A+E	B+F
X=1	C+G	D+H

**Latent Table:**

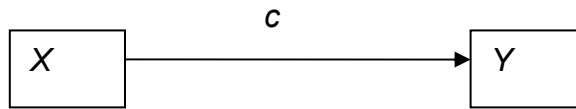
	Y=0	Y=1
U=0	A	B
X=1	C	D

	Y=0	Y=1
X=0	E	F
X=1	G	H

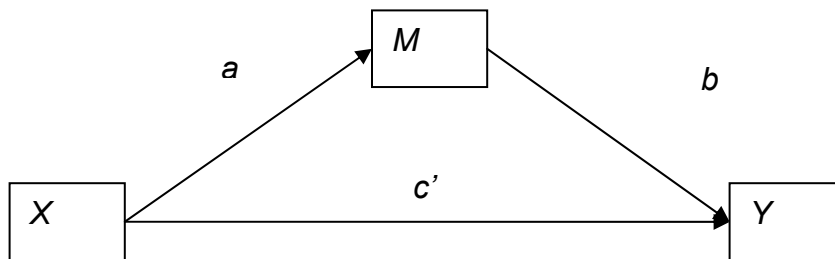
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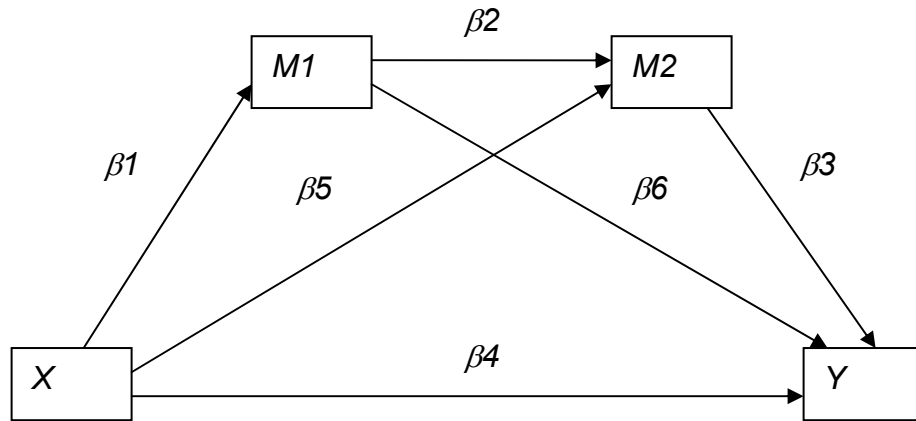
**Figure 4.4: The relationship between the independent and the dependent variable**



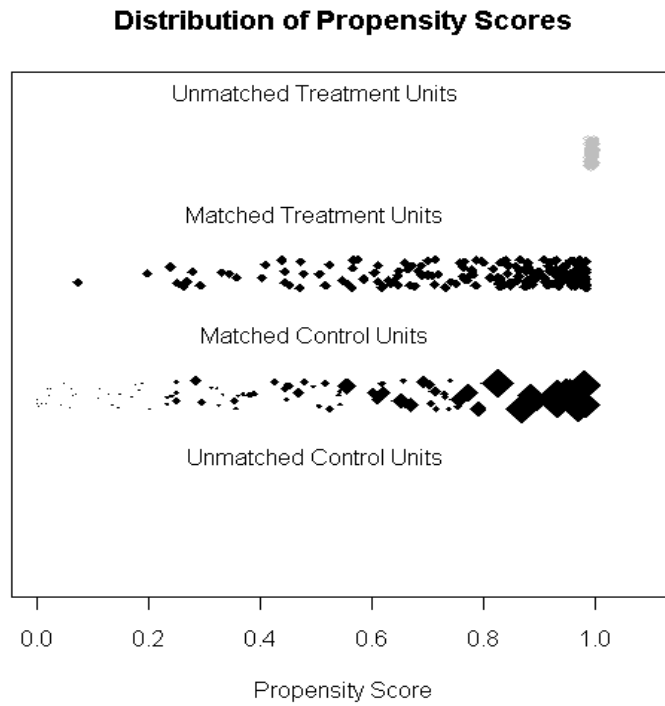
**Figure 4.5: The relationship between the independent variable, the mediator and the dependent variable**



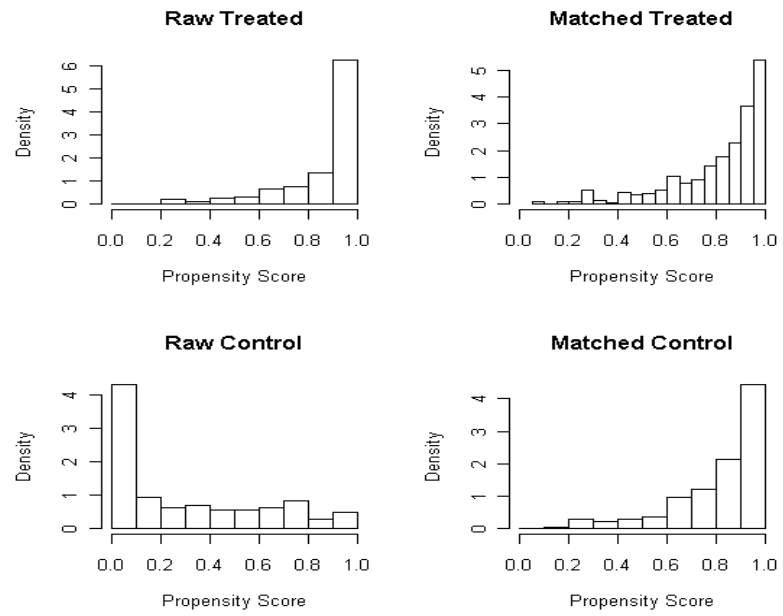
**Figure 4.6: The relationship between the independent variable, the mediators and the dependent variable in a three path mediation model**



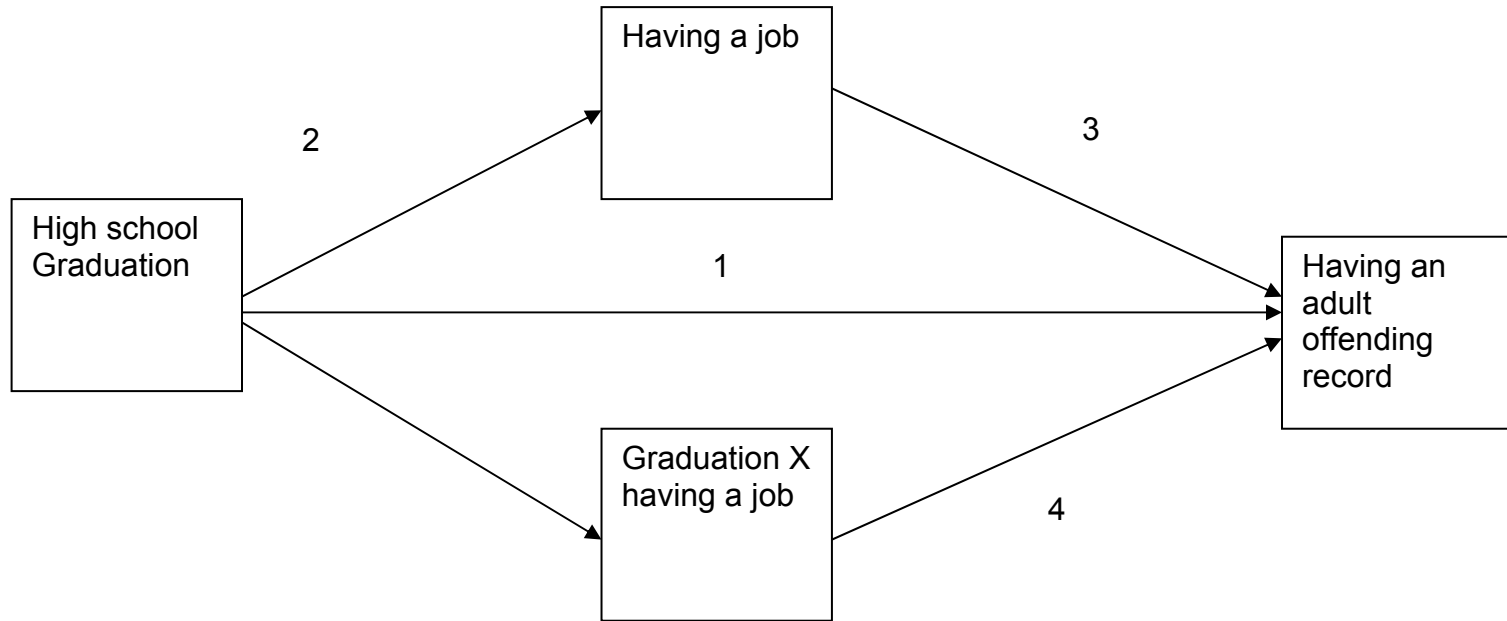
**Figure 5.1a: Distribution of propensity scores for males (jitter plot)**



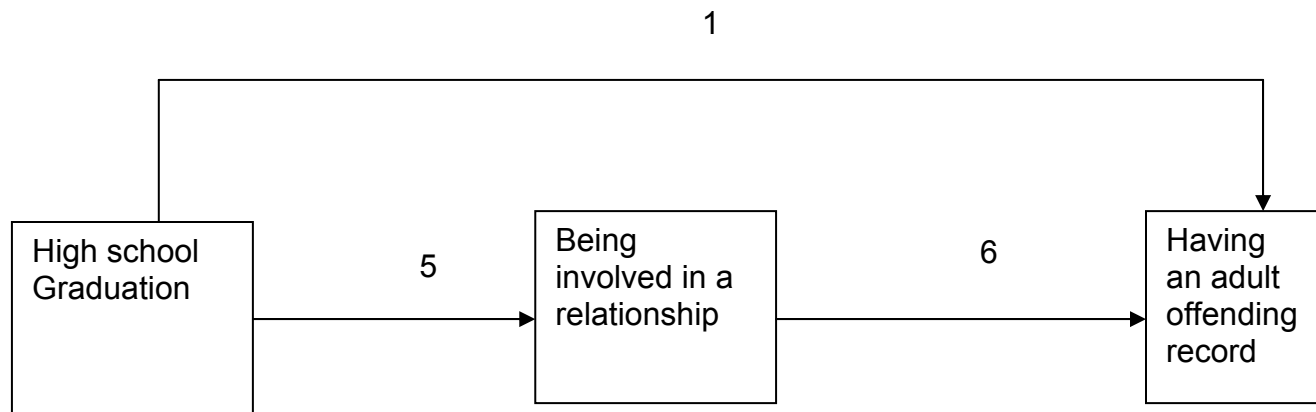
**Figure 5.1b: Distribution of propensity scores for males (histograms)**



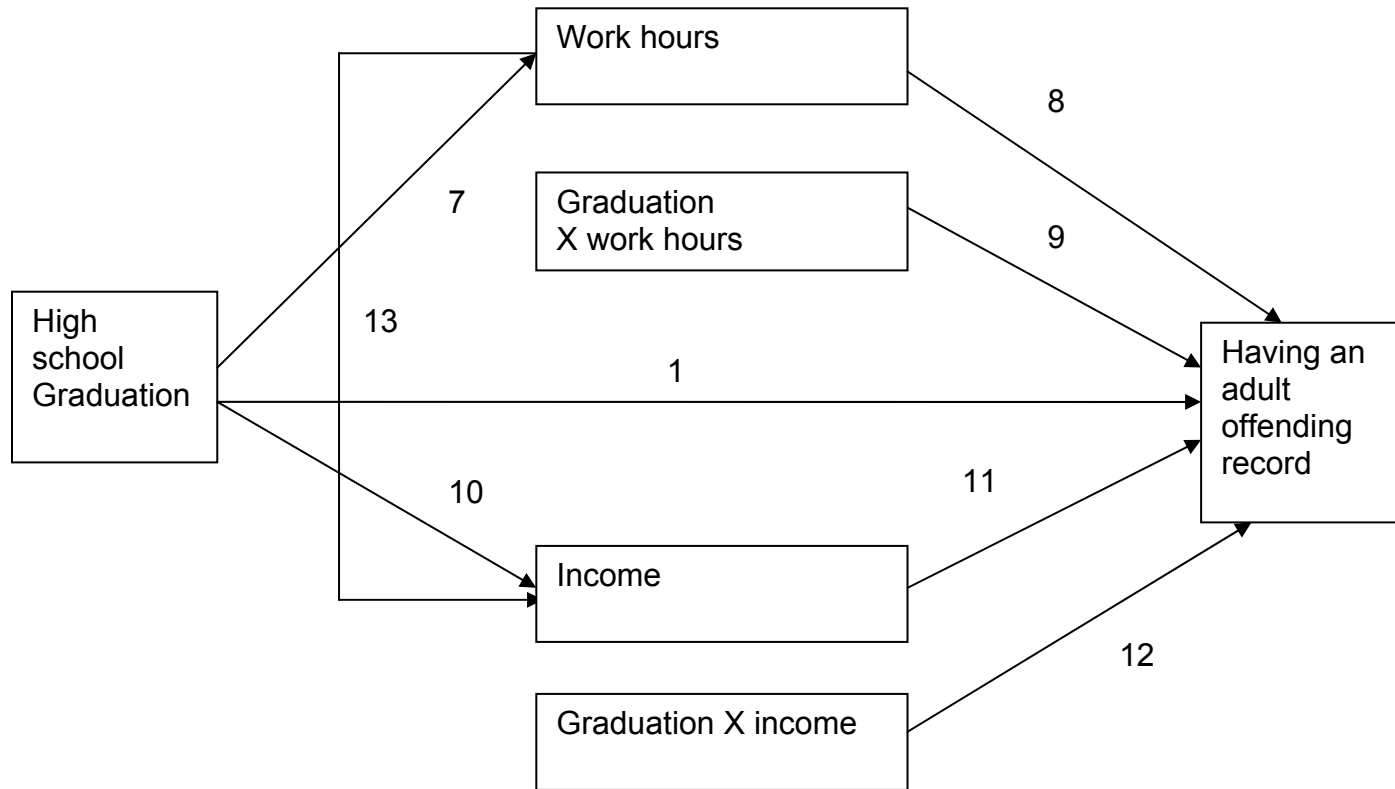
**Figure 5.2 a: The mediation effect of having a job**



**Figure 5.2 b: The mediation effect of aspects of being involved in a relationship**

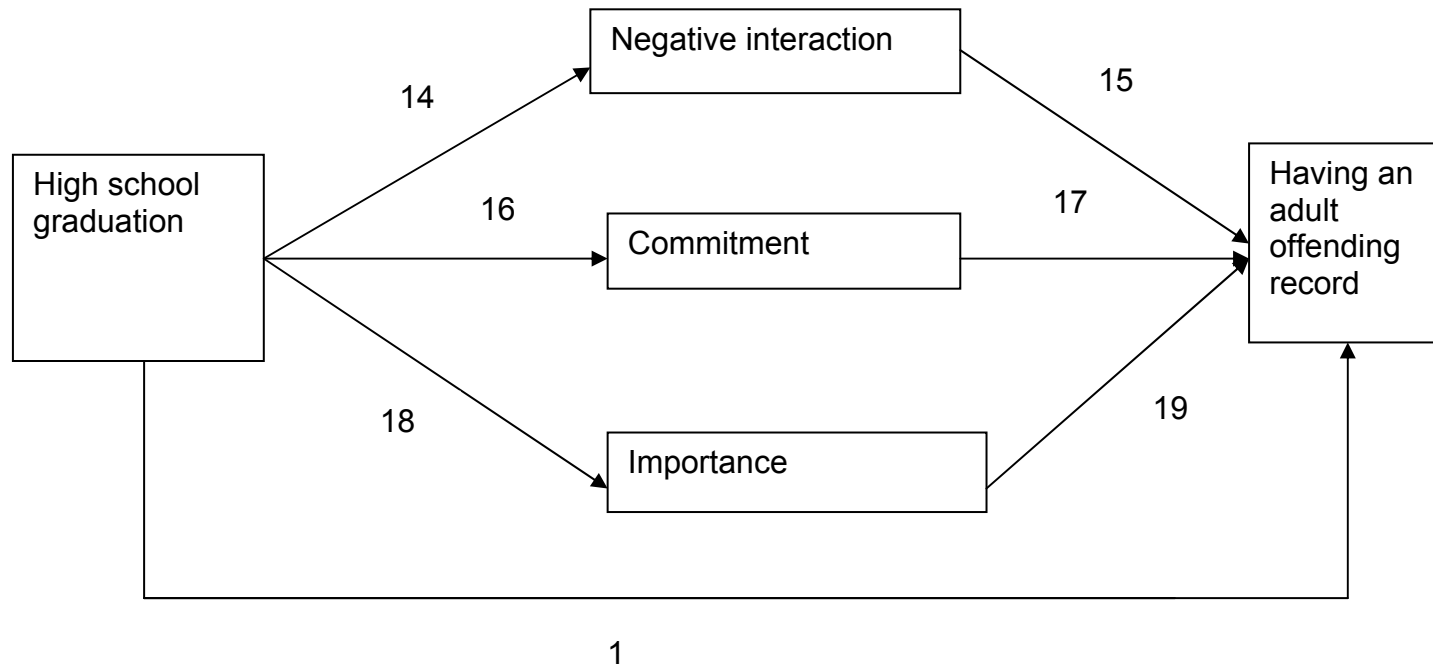


**Figure 5.2 c: The mediation effect of aspects of employment**

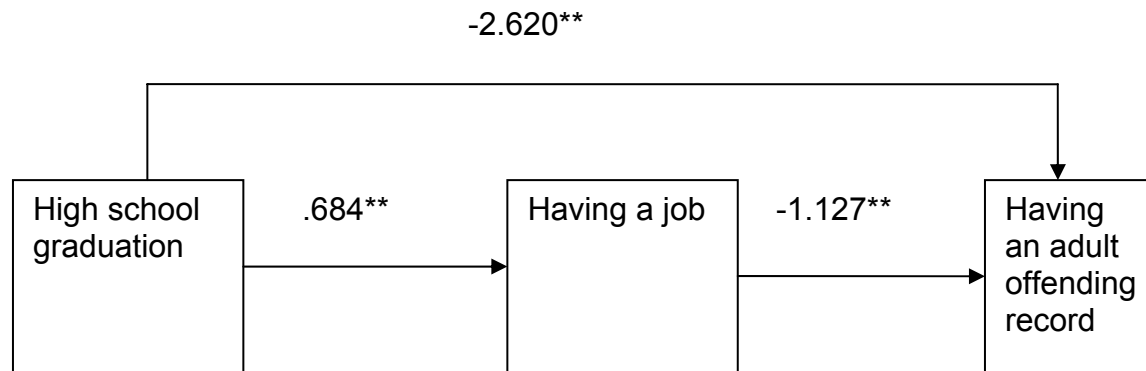




**Figure 5.2 d: The mediation effect of aspects of intimate relationships**

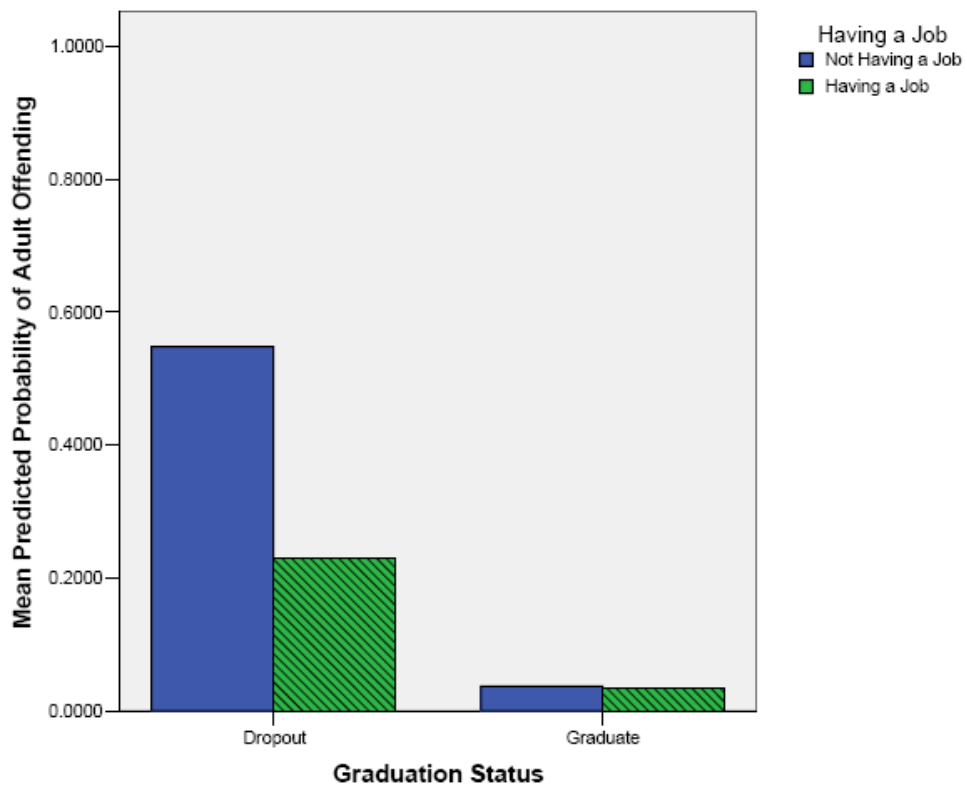


**Figure 5.3: The Mediation effect of employment status for males (in Logit coefficients)**

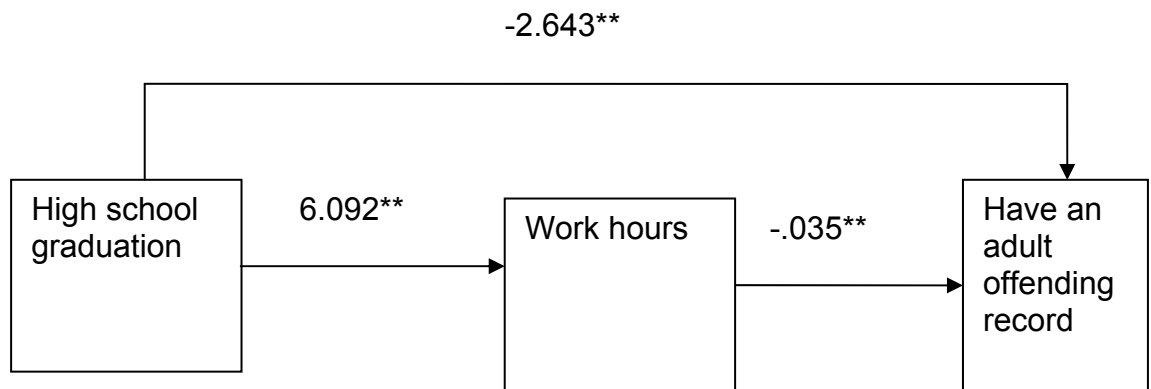


\*\* Significant at a .01 level

**Figure 5.4: Predicted probability of the four groups for males**

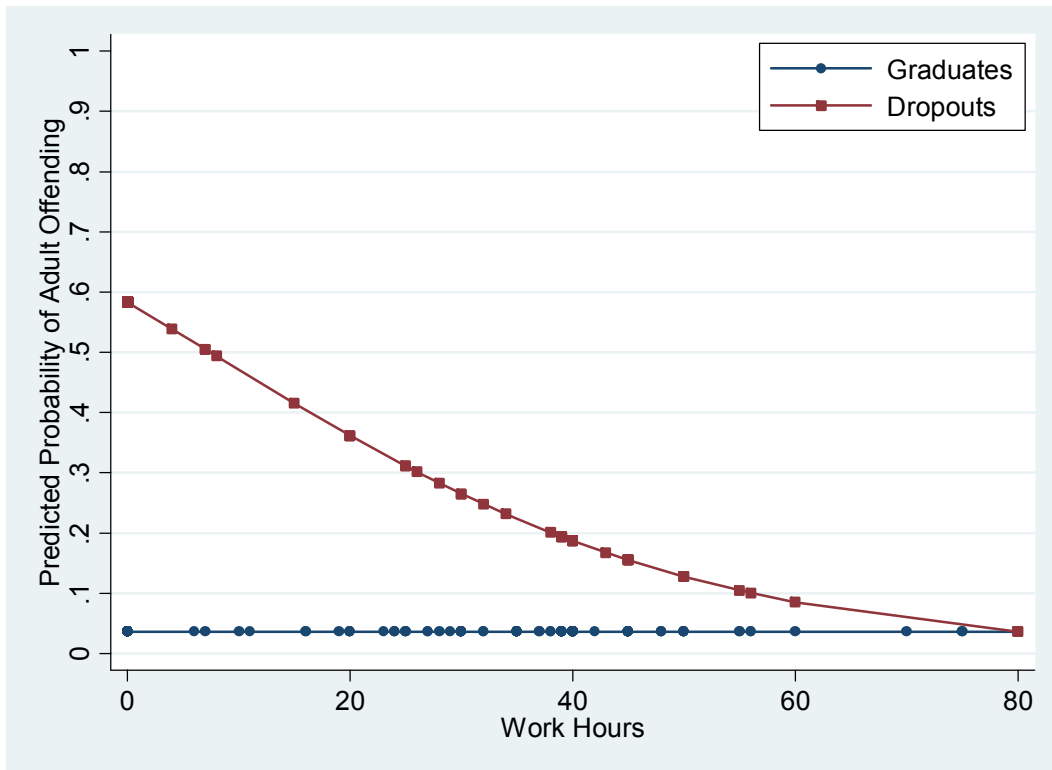


**Figure 5.5: The mediation effect of work hours for males (in Logit coefficients)**

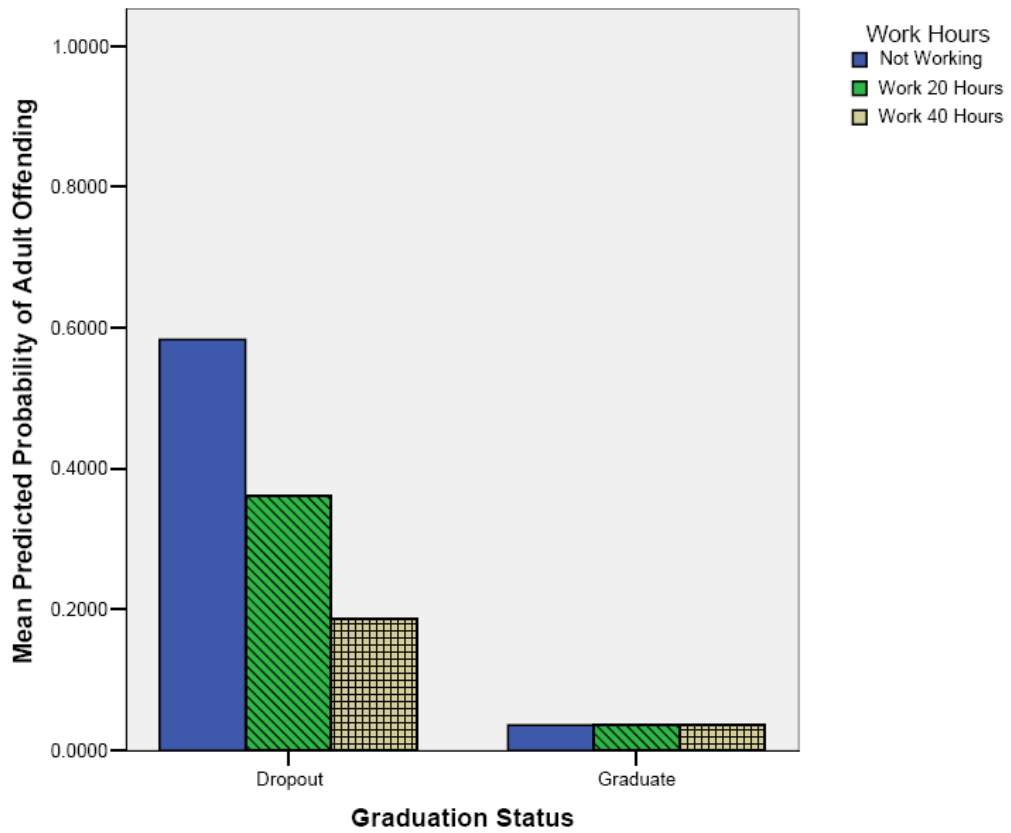


\*\* Significant at a .01 level

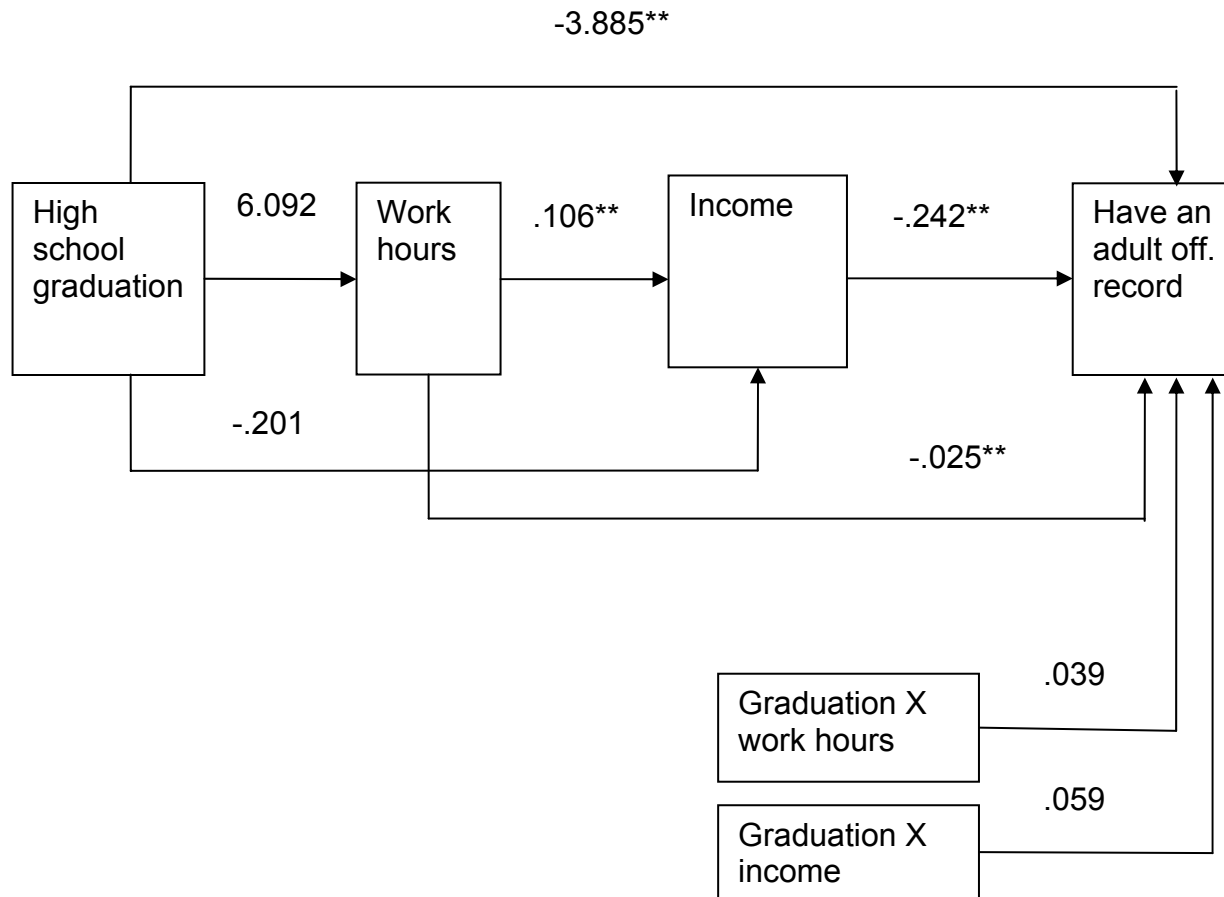
**Figure 5.6: The relationship between work hours and predicted probabilities of adult offending for males**



**Figure 5.7: Predicted probabilities of adult offending for the six groups for males**



**Figure 5.8: The Mediating effect of work hours and Income for males (in logit coefficients)**



\*\* Significant at a .01 level

#### **Appendix 4.1 The construction of graduation status**

Among the 701 respondents who participated in the YA survey, 588 answered the questions in both surveys, 111 only answered the questions in the YA survey, and two only answered the questions in the NIDA survey. A new variable “graduation status” was created with five categories: 1 as clear graduated cases, 2 as clear non-graduated cases, 3 as assigned graduated cases, 4 as assigned non-graduated cases, and 5 as unclear cases. I assigned each case into one of the five categories in the following fashion (also see the flow chart for determining graduation status):

##### *For those who answered the question in both surveys*

I compared the dates of the two surveys. When the YA survey occurred before the NIDA survey and both surveys indicated that the respondent had a high school diploma, then the case was assigned as category 1 (clear graduate). When the YA survey occurred before the NIDA survey and both surveys indicated that the respondent did not have a high school diploma, then the case was assigned as category 2 (clear non graduate). Among the 535 cases for whom the YA survey occurred before the NIDA survey, 263 cases were assigned to either category 1 or category 2.

I assigned the rest of the 272 cases into category 3, 4, or 5 in the following fashion.

In the following situations, I assign the case as category 3 (assigned graduate):



*Situation 1.* They reported finishing the twelfth grade in the YA survey and a high school diploma in NIDA survey, and they are expected to graduate before the NIDA survey. For example, the respondent with PRC ID 19860 reported that he finished the twelfth grade in the YA survey at age 19.84, his expected graduation age is 17.83 (refer to Appendix 4.4 for computation), and he reported a high school diploma in the NIDA survey at age 21.64. I assigned this person as category 3 (assigned graduate).

*Situation 2.* They reported finishing the eleventh grade in the YA survey and receiving a high school diploma in NIDA survey, and the expected graduation age is between YA and NIDA. For example, the respondent with PRC ID 188750 reported that he finished the eleventh grade in the YA survey at age 18.84, his expected graduation age is 19.46, and he reported a high school diploma in the NIDA survey at age 19.62. Since the person finished the twelfth grade and graduated after the YA survey and before the NIDA survey, I assigned the person as category 3 (assigned graduate).

In the following situations I assign the case as category 4 (assigned non-graduate):

*Situation 1.* They reported finishing less than the twelfth grade in the YA survey and completing a GED in the NIDA survey. For example, the respondent with PRC ID 80819 reported that he finished the tenth grade in the YA survey at age 21.59, and reported a GED in the NIDA survey at age 22.53. I assigned the person as category 4 (assigned non-graduate).

*Situation 2.* They reported finishing less than the twelfth grade in the YA survey and as a non-graduate in the NIDA survey. For example, the respondent with PRC ID 630 reported that he finished eleventh grade in the YA survey at age 19.60, and reported non-graduate in the NIDA at age 20.19. Since the person finished the eleventh grade and dropped out before NIDA, I assigned the person as 4 (assigned non-graduate).

Among the 272 cases, a total of 78 cases were assigned into category 3 (assigned graduate), a total of 152 were assigned into category 4 (assigned non-graduate), and the rest (42 cases) were assigned into category 5 (unclear cases).

Among the 53 cases who answered the questions in both YA and NIDA, with NIDA following YA, and both surveys indicate a high school graduate, the case is assigned as category 1 (clear graduate). When both surveys indicate a GED, the case is assigned as category 2 (clear non-graduate). A total of 23 cases were assigned into either of the two categories.

With the rest of the cases for whom the NIDA happened before the YA (30 cases), I assigned the case as category 3 (assigned graduate). They reported a high school diploma in NIDA and reported finishing the twelfth grade in YA.

In the following situations, I assigned the case as category 4 (assigned non-graduate):

*Situation 1.* They reported a GED in NIDA but finishing the twelfth grade or less in YA.

*Situation 2.* They reported as non-graduates in NIDA but finishing the twelfth grade or less in YA.

Among the 30 males, a total of four cases were assigned into category 3 (assigned graduate), a total of 23 were assigned into category 4 (assigned non-graduate), and the rest (three cases) were assigned into category 5 (unclear cases).

*For those who answered the question only in the YA survey*

When respondents report a high school diploma, they are assigned as category 1 (clear graduates). When they report a GED, they are assigned as category 2 (clear non-graduates). A total of 53 cases (out of the 111 who only answered the question in YA) were assigned to either of the two categories.

A total of 58 cases reported finishing less than twelfth grade in YA. I use another question in YA: "How would you characterize the course of study you are in now?" If they answer "not in school" or "GED program," then they are counted as non-graduates (category 4). A total of 36 cases were assigned into category 4 (assigned non-graduate), and the rest (22 cases) were assigned into 5 (unclear cases).

*For those who answered the question only in the NIDA survey*

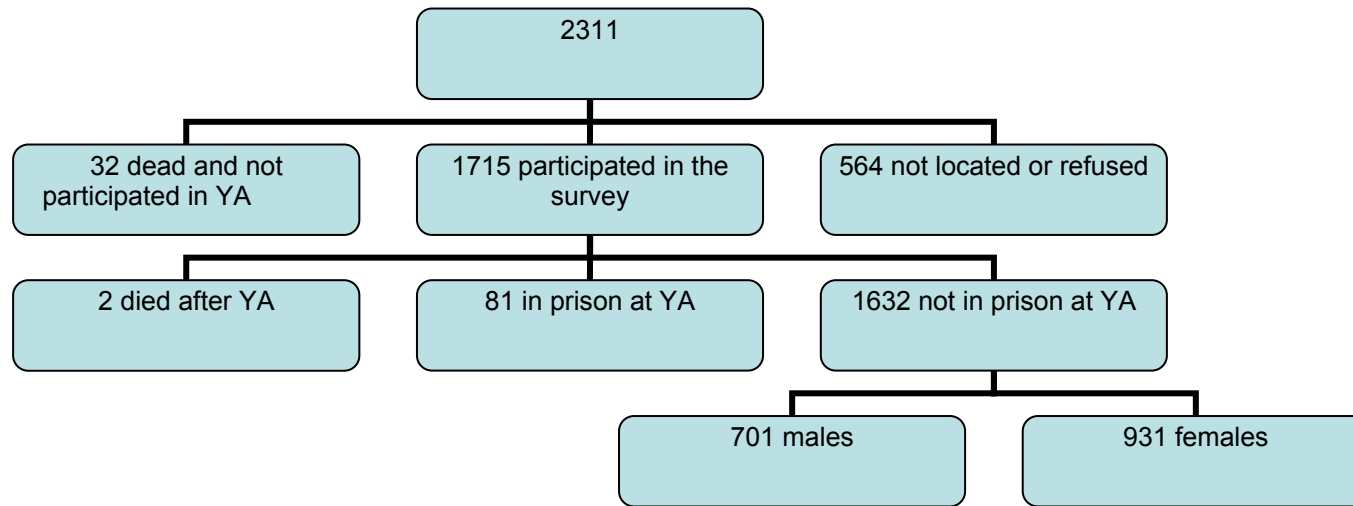
Among these five cases, one was assigned to category 4 (assigned non-graduate) and one into category 5 (unclear cases).

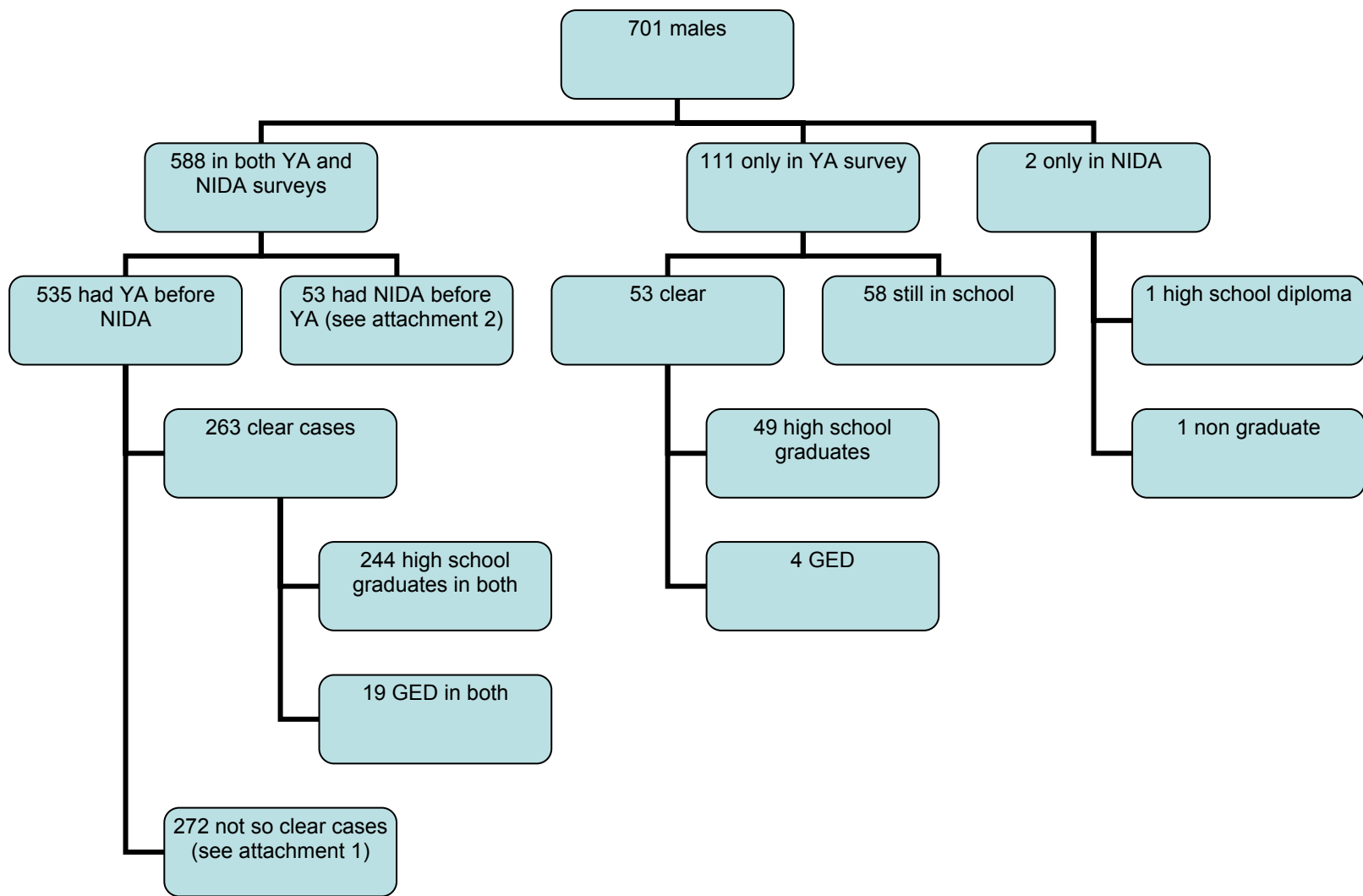
### *Graduation status*

Among the 701 cases who participated in the YA survey, the final variable has five categories: a total of 314 cases were clear graduates, 25 were clear non-graduates, 82 were assigned graduates, 212 were assigned non-graduates, and 68 were unclear cases. After rechecking every case in the assigned graduate and assigned non-graduate categories (a total of 294 cases), I further recoded 27 ambiguous cases (including seven from category 3 and 20 from category 4) into category 5 (See Appendix 4.3). For example, the respondent with a PRC ID of 82630 answered that he finished tenth grade in the YA survey (he was not in school at the time), but answered high school diploma in the NIDA survey. Given that his expected graduation age (20.74) is only shortly after the YA survey (19.66), the time difference is not enough for him to finish another two grades in order to graduate. Therefore, I took the conservative approach and recoded this case into category 5 (unclear).

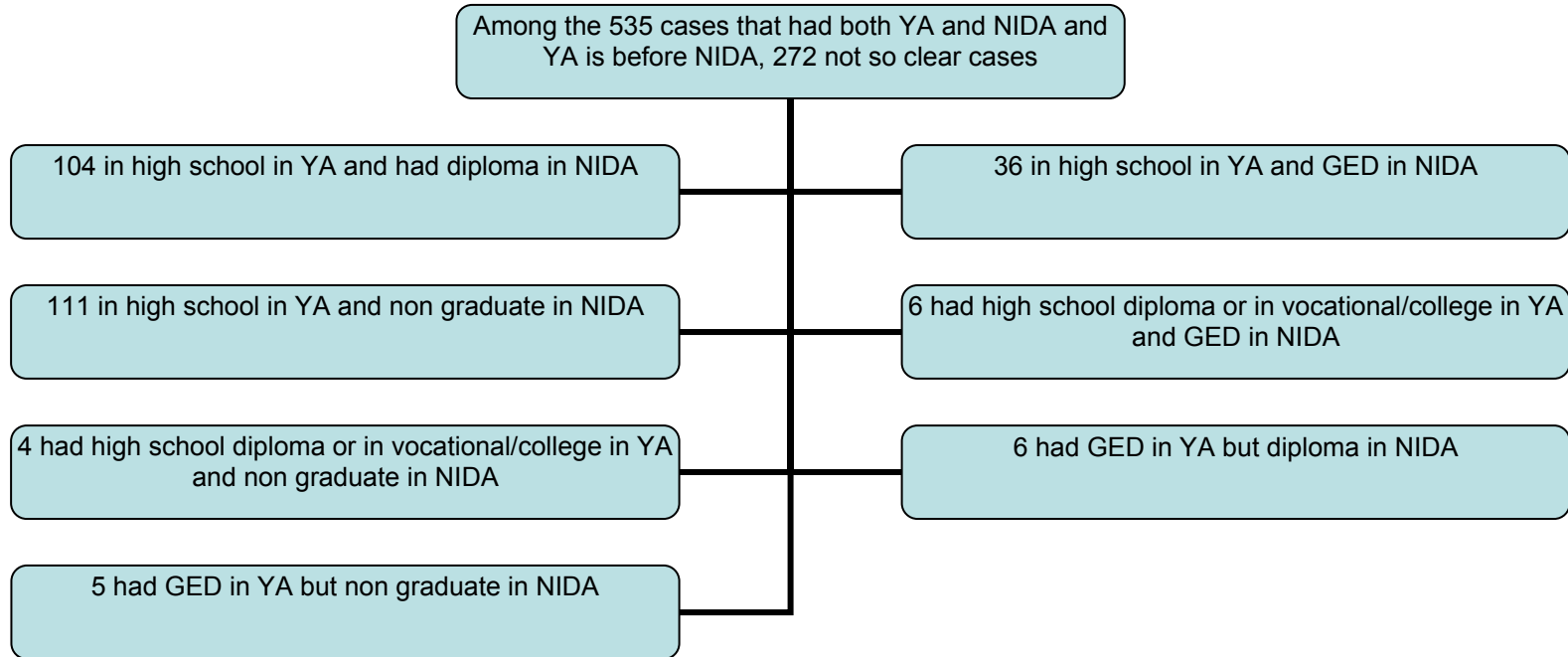
For the purpose of the analyses, I recoded this variable into a binary variable where I combined category 1 and 3 into graduates. I excluded those cases in category 5 and category 2 (since there is no information on what grade they dropped out, the dropout age for these 25 cases cannot be computed). The binary graduation status has two categories: a total of 389 were graduates and 192 were non-graduates. Out of 701 males, a total of 581 have valid information on graduation status. Among the 581 males, 389 males graduated from high school and 192 cases did not.

**Appendix 4.2 Flow chart for determining graduation status**

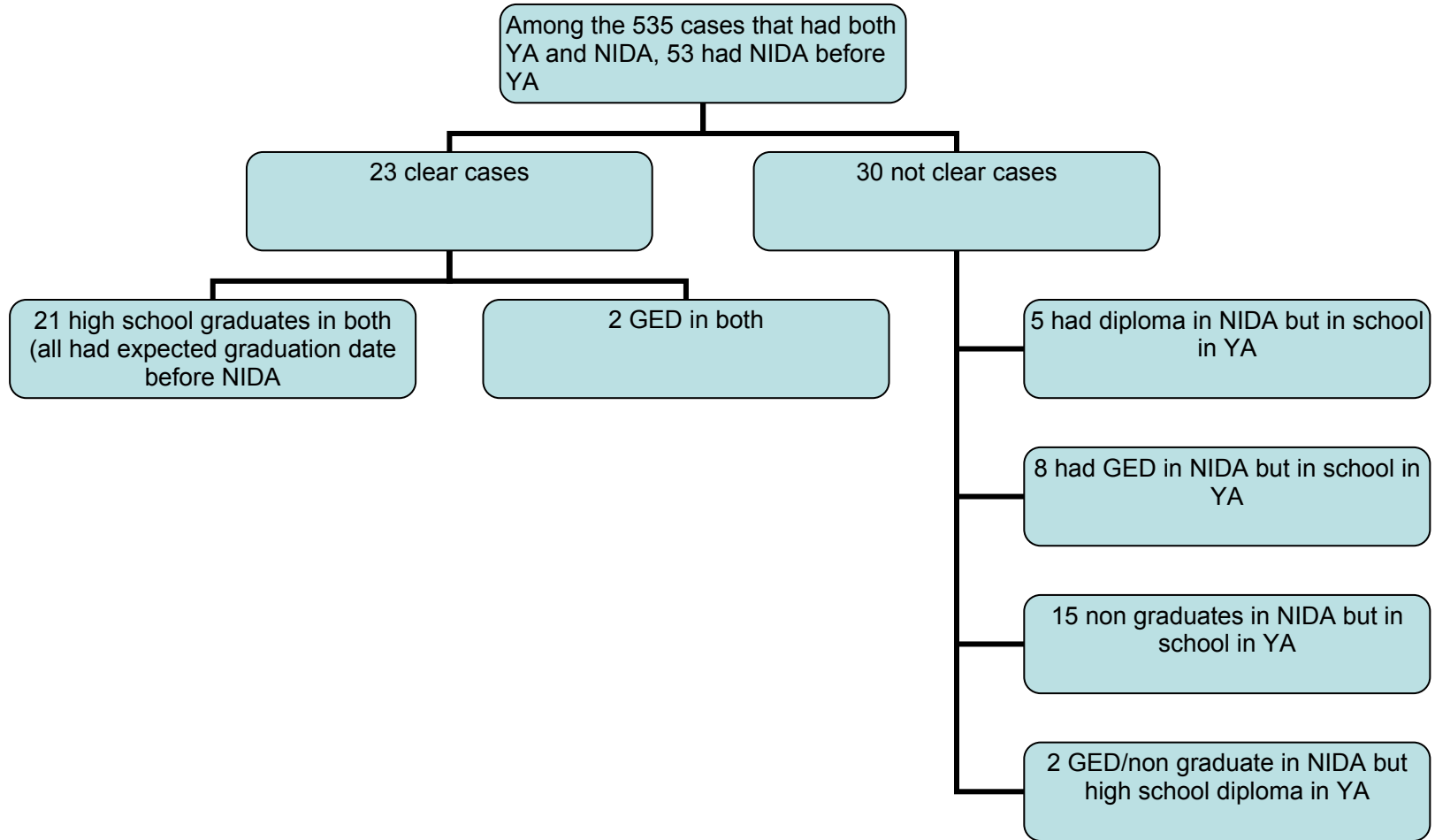




Attachment 1



Attachment 2





### Appendix 4.3 Double checking ambiguous cases

	PRC ID NUMBE R	What is the last year of schooling that you have completed YA age 19- 20	How would you characterize the course of study you are in now YA age 19- 20	high school grad status - Jim Anthony NIDA YA survey	expected graduation age	agesurv ey	agenida
1	82630	TENTH GRADE	NOT IN SCHOOL	diploma	20.74	19.66	22.40
2	234020	ELEVENTH GRADE	NOT IN SCHOOL	diploma	19.55	18.87	20.74
3	302720	TWELFTH GRADE	COMMUNIT Y COLLEGE, 2 YEAR PROGRAM	diploma	21.33	20.78	23.30
4	306250	ELEVENTH GRADE	NOT IN SCHOOL	diploma	19.71	19.08	19.88
5	420020	TWELFTH GRADE	NOT IN SCHOOL	diploma	20.27	20.25	21.22
6	582740	TWELFTH GRADE	HIGH SCHOOL	diploma	18.83	19.95	21.42
7	931630	TWELFTH GRADE	NOT IN SCHOOL	diploma	20.49	19.62	22.00
Total N	7	7	7	7	7	7	7

	PRC ID NUMBE R	What is the last year of schooling that you have completed YA age 19- 20	How would you characterize the course of study you are in now YA age 19- 20	high school grad status - Jim Anthony NIDA YA survey	expected graduation age	agesurv ey	agenida
1	34799	GED	VOCATION AL/TECHNI CAL/BUSIN ESS PROGRAM	non grad	19.97	21.56	22.07
2	65450	ELEVENTH GRADE	GED PROGRAM	GED	18.99	21.11	21.09
3	127020	ELEVENTH GRADE	COMMUNIT Y COLLEGE, 2 YEAR PROGRAM	non grad	19.81	19.16	19.92
4	172360	GED	NOT IN SCHOOL	non grad	18.37	19.53	22.33
5	206240	EIGHTH GRADE	NOT IN SCHOOL	GED	18.94	20.75	20.68
6	233419	GED	GED PROGRAM	non grad	20.27	20.95	23.55

7	276350	NINTH GRADE	NOT IN SCHOOL	GED	18.92	20.70	20.53
8	324040	GED	NOT IN SCHOOL	non grad	20.23	19.41	20.13
9	329750	ELEVENTH GRADE	NOT IN SCHOOL	GED	18.10	21.07	21.02
10	471409	ELEVENTH GRADE	NOT IN SCHOOL	GED	22.17	24.04	24.00
11	476030	TENTH GRADE	NOT IN SCHOOL	GED	18.85	20.87	20.65
12	567720	9999	HIGH SCHOOL	non grad	19.43	19.45	22.28
13	577630	ELEVENTH GRADE	NOT IN SCHOOL	GED	19.30	22.05	21.89
14	723419	ELEVENTH GRADE	VOCATION AL/TECHNICAL/BUSINESS	GED	21.48	19.55	21.67
15	778940	ELEVENTH GRADE	PROGRAM VOCATION AL/TECHNICAL/BUSINESS	9999	19.57	18.81	.
16	815999	ELEVENTH GRADE	PROGRAM COMMUNITY COLLEGE, 2 YEAR PROGRAM	non grad	20.17	20.23	23.46
17	835420	ELEVENTH GRADE	NOT IN SCHOOL	GED	20.16	22.46	22.31
18	857030	ELEVENTH GRADE	VOCATION AL/TECHNICAL/BUSINESS	non grad	20.07	21.19	21.53
19	868930	ELEVENTH GRADE	PROGRAM VOCATION AL/TECHNICAL/BUSINESS	9999	19.00	19.33	.
20	924640	GED	GED PROGRAM	non grad	21.32	19.50	20.33
Total	N	20	20	20	20	20	18

#### **Appendix 4.4 The computation of graduation/dropout age**

Using both self-reported and official information on number of grades repeated and official information of age at first grade, graduation/attrition age was computed in the following fashion.

The official record of age at the first grade and the self-reported measure of number of grades repeated is used to compute graduation/dropout age.<sup>51</sup> In the YA survey, respondents were asked, “Which grades (and how many times) have you repeated or been held back?” I computed the expected graduation age by adding together the age at the first grade, the total years the respondent repeated, and 12 years of total schooling upon high school graduation. Since students usually join the first grade in the fall and graduate in the summer, I subtracted 0.25 years (three months) from the expected graduation age. For example, a high school graduate started the first grade at age six, and he/she repeated tenth grade once. Then the expected graduation age is  $1+6+12-.25=18.75$ . The person is expected to have graduated from high school at age 18.75.

In order to compute the expected dropout age, I added together the total years the respondent repeated, their age at the first grade, and the number of years it normally takes to finish the last grade completed (from the YA survey).

For example, if the last grade a high school dropout finished is tenth grade, the

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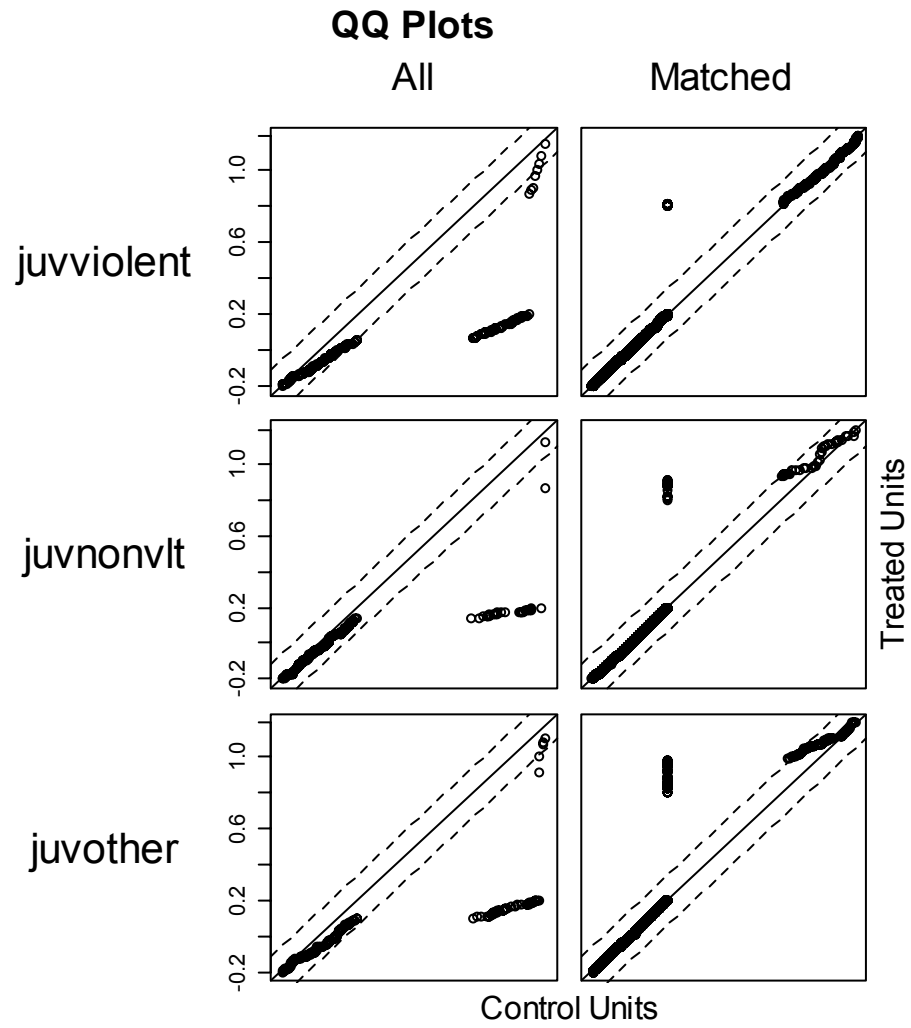
<sup>51</sup> The reason that I rely on self-reported repeating grade information is because the sample in this study is highly mobile in the city of Baltimore, where students often move in and out of the public school system. Therefore, the official repeating grade information is less accurate, and there is a lot of information especially during middle and high school. That said, I did compare self-reported with official information on grade repeating. There is a fairly high level of agreement between the two, and this is particularly true during elementary school where there is more valid information in the official records.

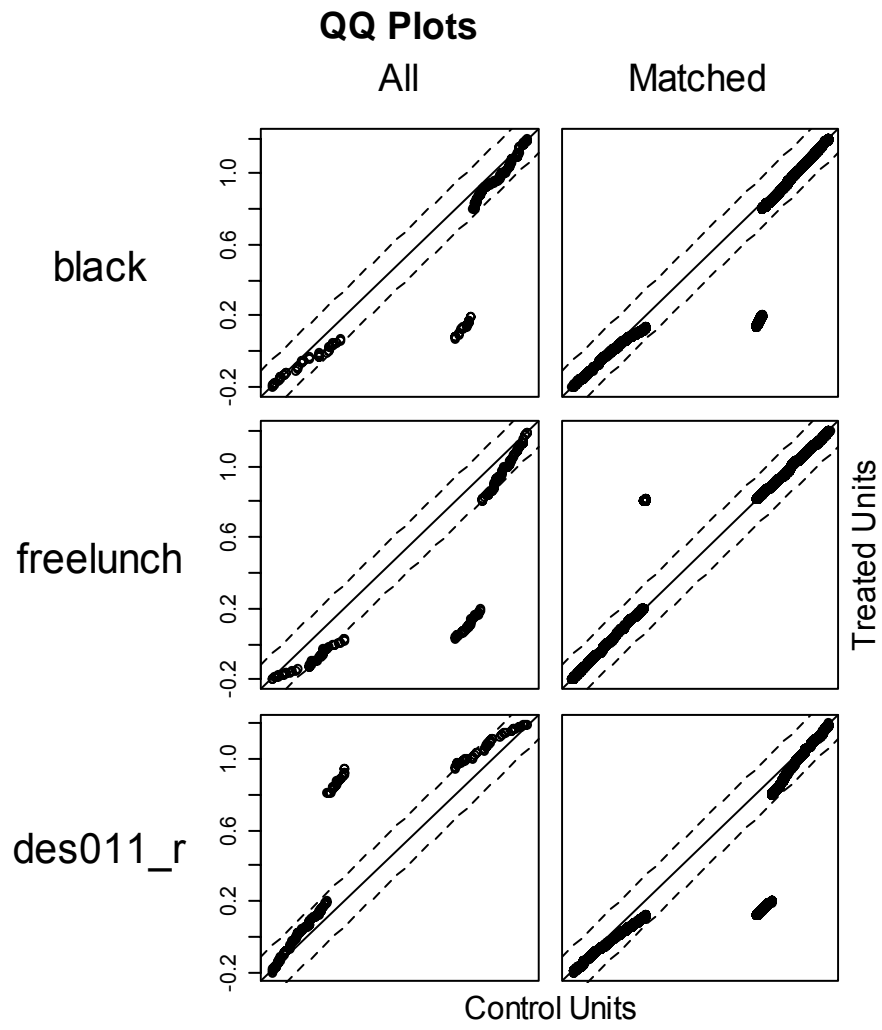
person started the first grade at age 6, and the person repeated the fifth grade twice. Then the expected dropout age is  $10+6+2=18$ . The person dropped out of school at age 18. Since the minimum age for dropping out in the state of Maryland is 16, for the 14 males (out of 581 males) whose computed dropout age is less than 16, I use the official grade repeating information to supplement the self-reported grade repeating information whenever the dropout age is younger than 16.<sup>52</sup> After this operation, there are still six males whose dropout age is less than 16. Since there is no further information I could utilize, I excluded these six males from the analyses. After this exclusion, 575 males were left in the sample.

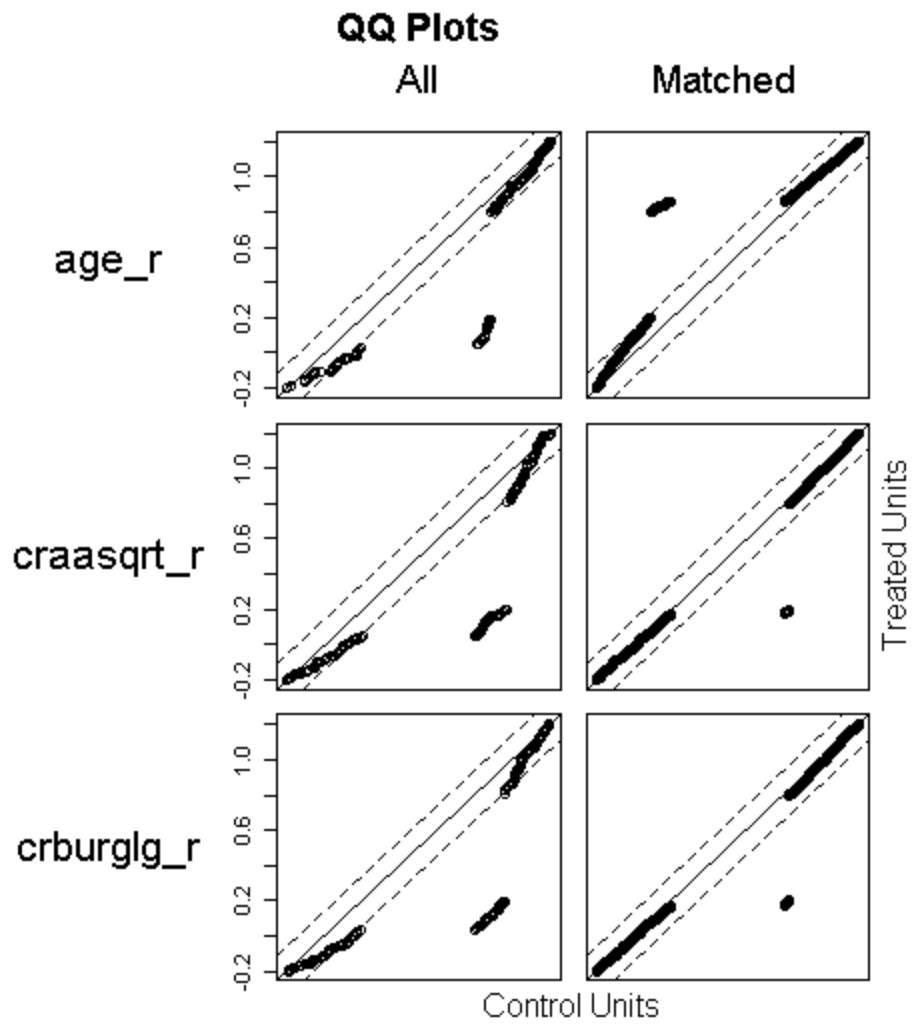
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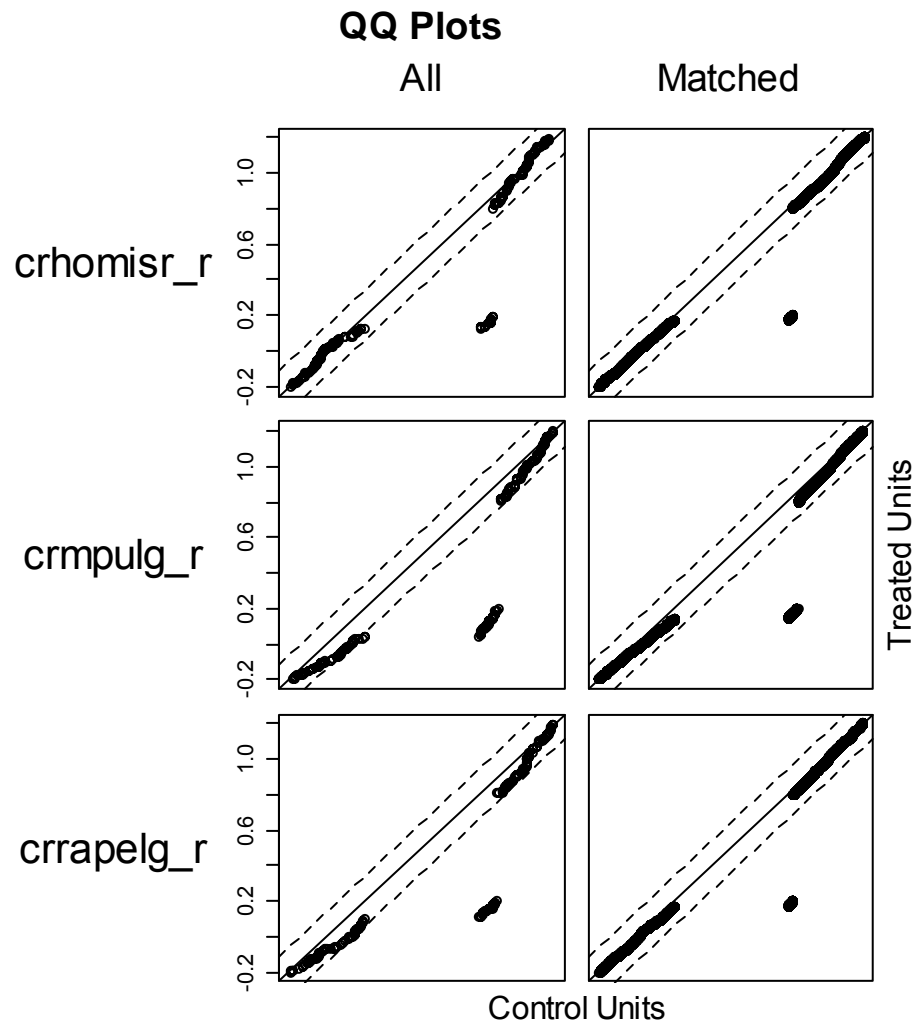
<sup>52</sup> It is possible that the respondents forget one or two grades they have repeated, especially for those who have repeated many grades and dropped out fairly early.

Appendix 5.1 QQ plots for covariate balance

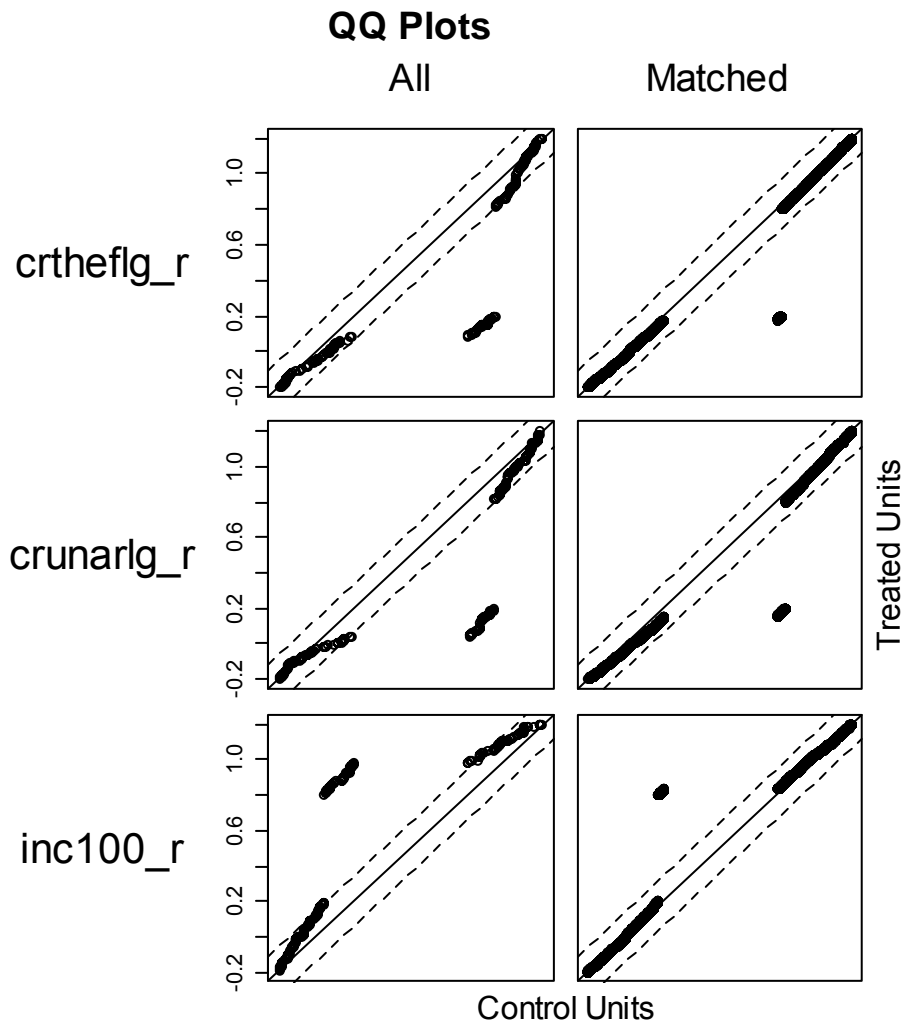










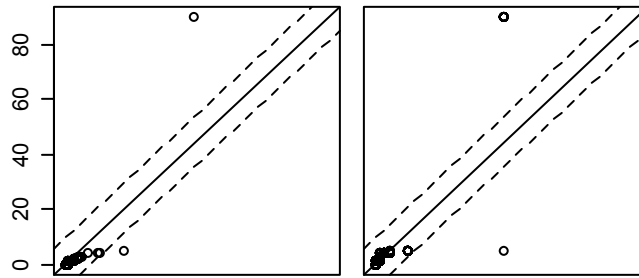


# QQ Plots

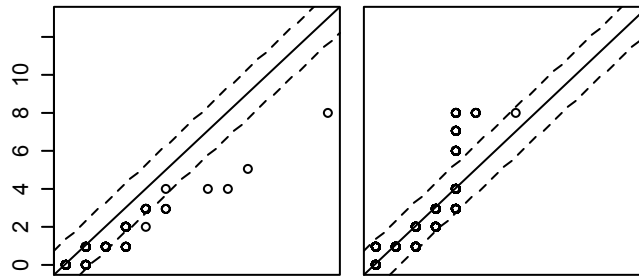
All

Matched

n2

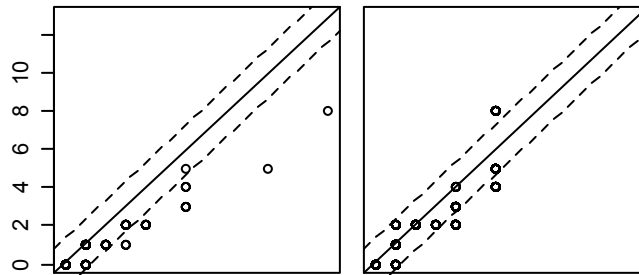


n3



Treated Units

n4



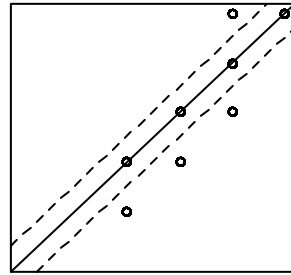
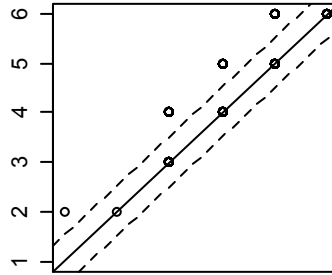
Control Units

# QQ Plots

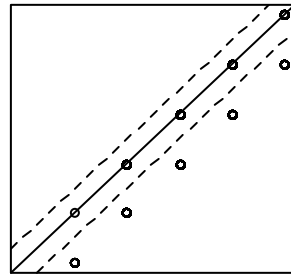
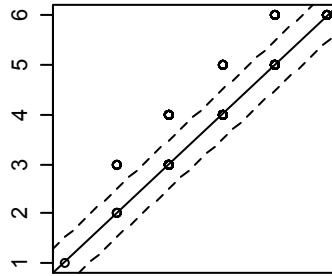
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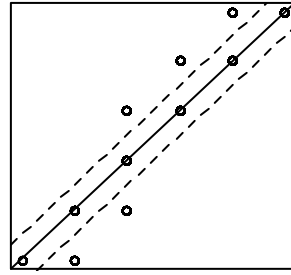
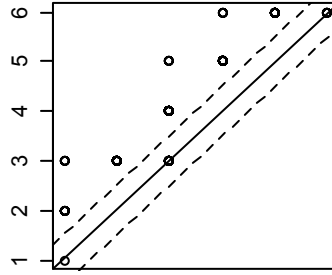
s10a



s10b



s10c



Treated Units

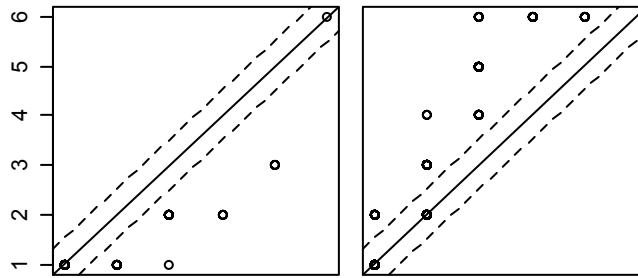
Control Units

# QQ Plots

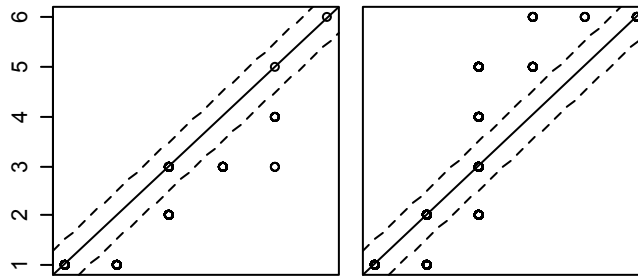
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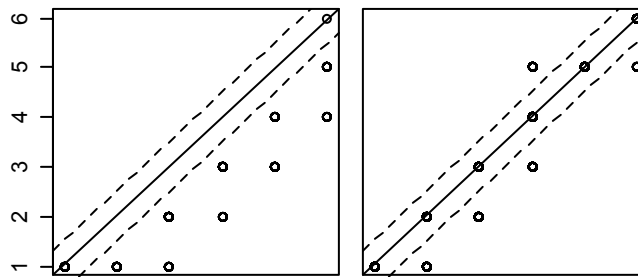
s13a



s13b

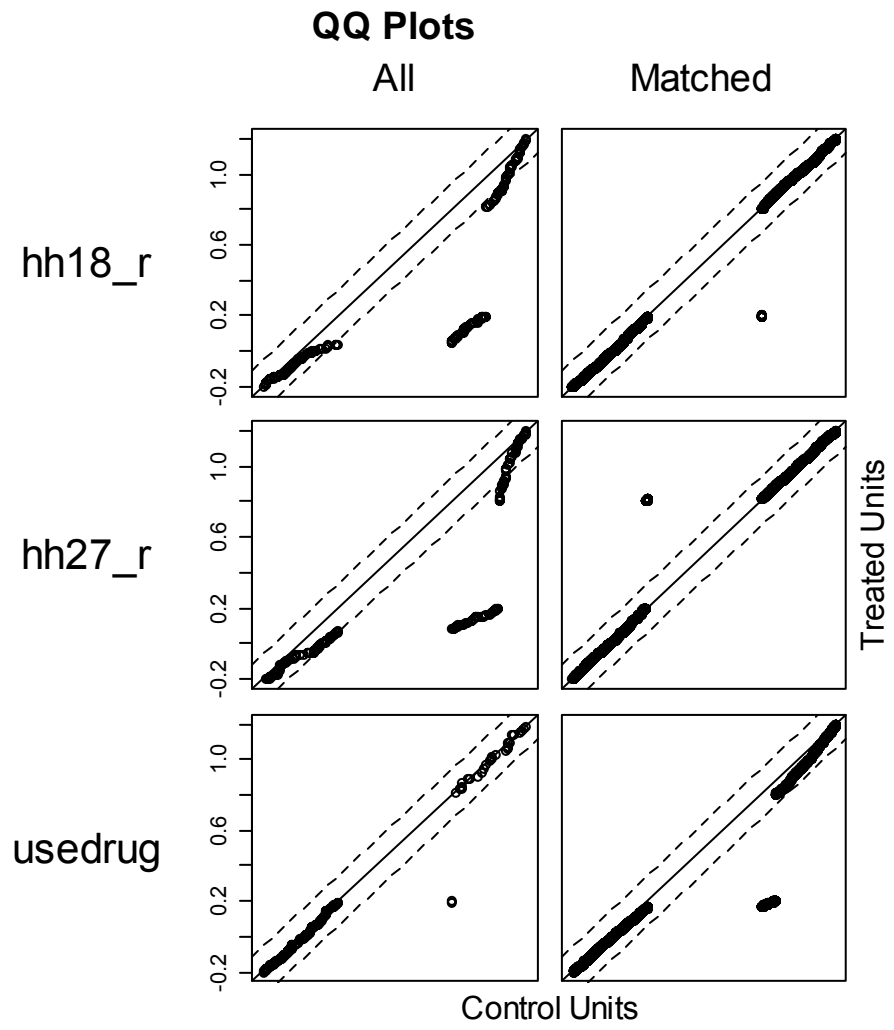


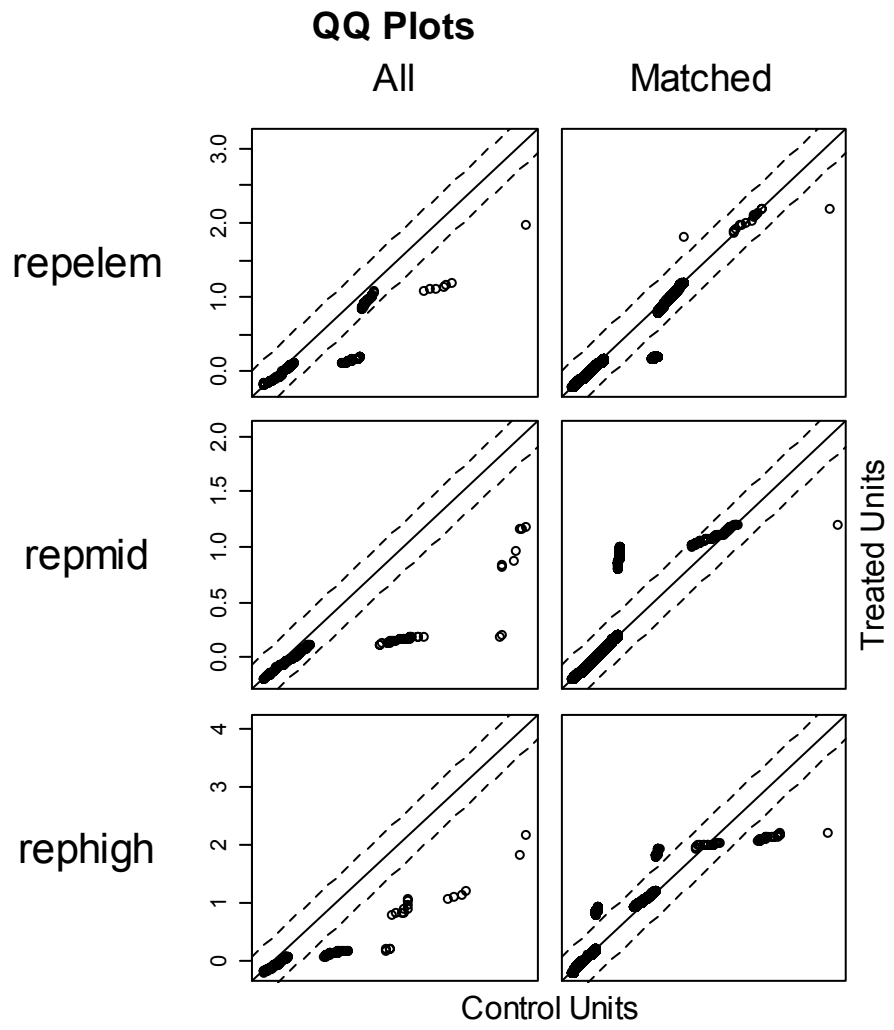
s13c



Treated Units

Control Units



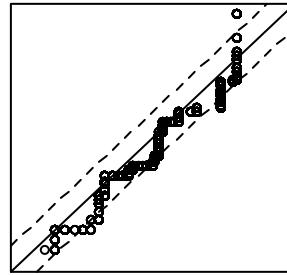
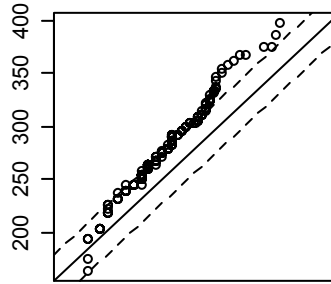


# QQ Plots

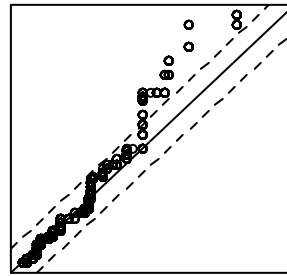
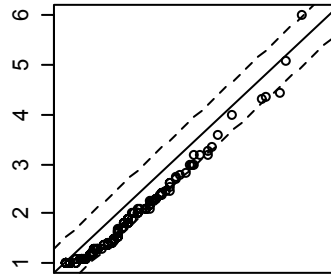
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Matched

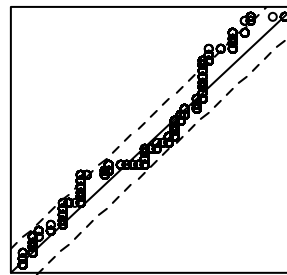
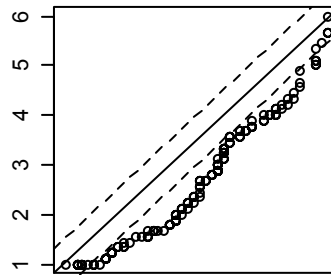
scsr011



sctag011



sctcp011



Treated Units

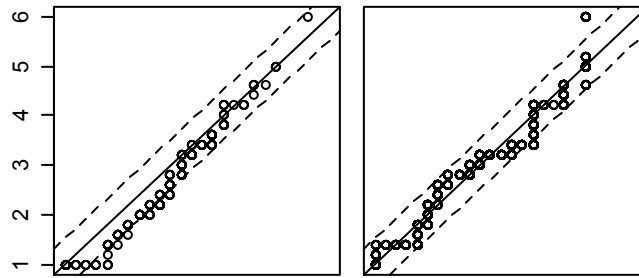
Control Units

### QQ Plots

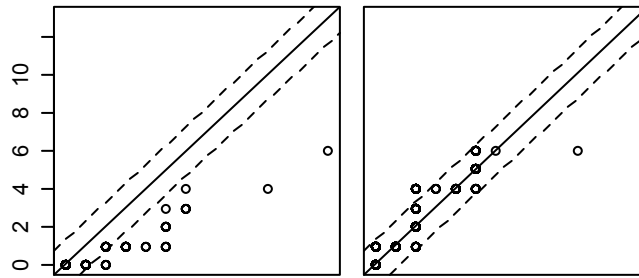
All

Matched

sctsb011



totalsr



Treated Units

Control Units



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